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electronic engineers master catalog

VOLUME **B**

electromechanical, electro-optical, and military components

36th EDITION

2440 Military Components & Equipment
2450 Displays, Readouts, & CRTs
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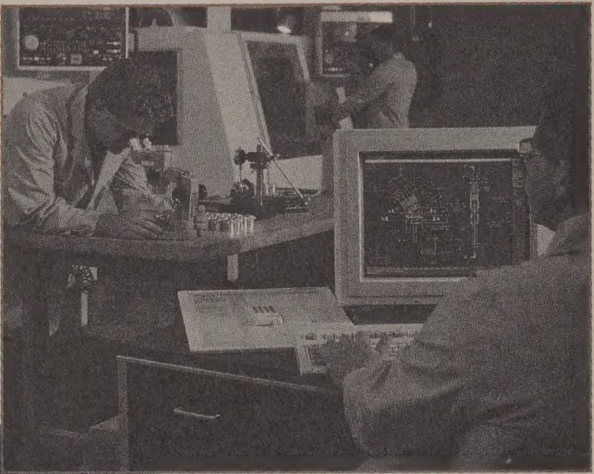

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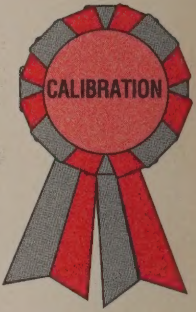

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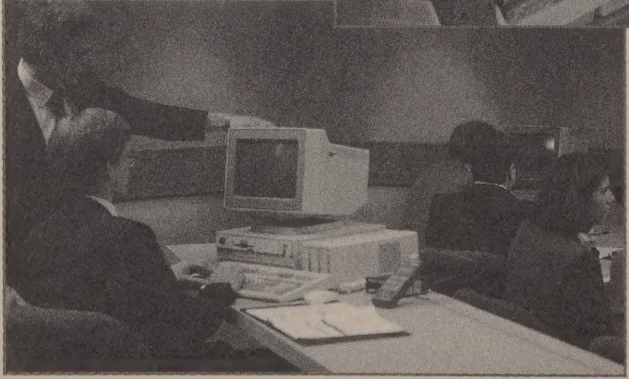

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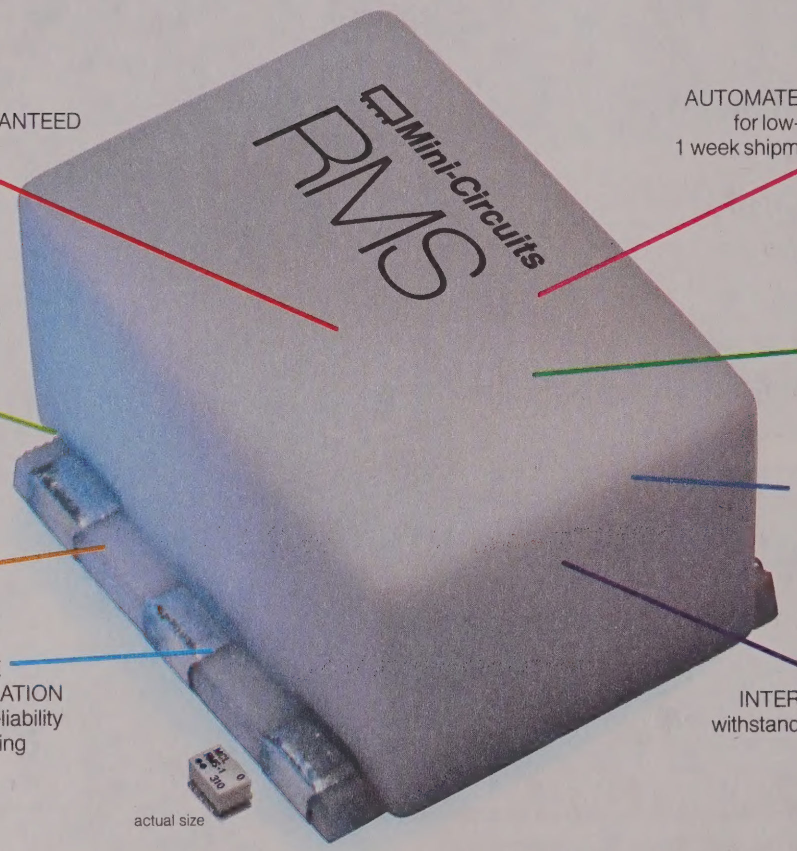

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5500 Transducers & Encoders .... B•1911

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how to use eem

The 36th edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product Index and Directory (green pages) and its own Manufacturers and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other that that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in boldface type and page numbers are shown. Manufacturers appearing in lightface type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 37 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

product selection index

Product Section Guide	**Vol. A**	**Vol. B**	**Vol. C**	**Vol. D**
1100 Amplifier Assemblies, Instrumentation				D•1002
1200 Antennas & Accessories				D•1022
1300 Audio Equipment & Accessories				D•1026
1400* Cabinets, Enclosures, Racks, & Chassis			C•1002	
1500* Capacitors	A•1002			
1600 Chemical Compounds (Adhesives, Cleaners, Coatings)			C•1134	
1700 Circuit Boards (Printed), Materials, & Accessories			C•1135	
1800* Coils, Chokes, & Inductors	A•1178			
1850 Cores, Magnets, & Ferrites	A•1316			
1900 Communications & Telemetry Equipment				D•1073
2000 Computer Peripheral Equipment				D•1078
2025 Computers (Mini/Micro/Boards)				D•1116
2050 Computer Software				D•1147
2100* Connectors, Terminals, & Sockets			C•1138	
2200 Control Systems & Components				D•1149
2300* Crystals, Oscillators, Crystal & Piezoelectric Filters	A•1324			
2325 Data Acquisition/Handling Systems & Accessories				D•1170
2350* Delay Lines	A•1512			
2400* Panel Hardware (Bezels, Dials, Knobs, etc.)			C•1522	
2440* Military Components and Equipment		B•1002		
2450* Displays, Readouts, & CRTs		B•1019		
2460* Lamps, Lights, & Indicators		B•1130		
2475* Fiber Optic Equipment & Accessories		B•1200		
2500 Hardware & Mechanical Components			C•1537	
2550 Environmental Test Equipment				D•1211
2600* Fans, Blowers, Cooling Equipment, & Heat Exchangers			C•1556	
2700* Filters, Power	A•1584			
2750* Filters, Signal	A•1616			
2900* Instruments, Test & Measuring				D•1214
2950* Panel Meters (Analog & Digital)				D•1336
2975* Instruments, Oscilloscopes				D•1402
3000 Instruments, Graphic Recording				D•1410
3100 Insulators & Insulating Materials			C•1654	
3130* Integrated Circuits, Hybrid Circuits, & Function Modules	A•1688			
3200* Interconnection Systems (Backpanels, Card Holders, & Packaging Systems)			C•1670	
3450* Microwave Components, Systems, & Equipment	A•1719			
3500* Motors, Drives, & Rotating Equipment		B•1230		
3700 Electro-optical Equipment		B•1312		
3900* Batteries				D•1418
4000* Power Supplies, DC				D•1486
4025* DC-DC Converters				D•2048
4050* Power Supplies, AC				D•2221
4100 Production Equipment & Manufacturing Services				D•2310
4200 Prototype Boards, Kits, & Design Aids			C•1677	
4300* Protective Components (Fuses, Circuit Breakers, etc.)		B•1340		
4500* Relays		B•1400		
4525 Shields & Shielding			C•1682	
4550* Solenoids		B•1626		
4700* Resistors	A•1858			
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4900 Servomechanisms & Robotic Equipment				D•2314
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5150* Keyboards & Keypads		B•1818		
5300* Thermal Components		B•1856		
5400 Tools (Manual & Power)			C•1700	
5500* Transducers & Encoders		B•1911		
5600* Transformers	A•2228			
6000* Wire & Cable			C•1701	

* A Product Selection Guide precedes these Product Sections.

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advertisers' index

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manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section. In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.

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ASCII Code	**D**•1296
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Conductors, Maximum Current Capacity	**C**•1255
Connectors	**C**•1146
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93 94 Alphabetical Index of Manufacturers Catalog Pages

This index provides an alphabetical listing of manufacturers pages and where to find them

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† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1936-1939,1945**
† Humphrey, Inc., San Diego, CA 92123, 619-565-6631	**B•1957-1958**
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Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA	**B•2015**
§† Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-U-SENS-IT	**B•2024**
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A. L. Design, Inc., Buffalo, NY 14217	716-875-6240
Alpha-M Corp., Dallas, TX 75229	214-406-0424
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Bently Nevada Corp., Minden, NV 89423	800-227-5514·702-782-3611
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Cal-Scope, Exceltron Inc., Sunnyvale, CA 94086	408-730-4573; 1-800-828-3547
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
† Cole Instrument Corp., Santa Ana, CA 92704	714-556-3100
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
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† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342	818 362 7151
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§ IC Sensors, Inc., Milpitas, CA 95035	800-767-1888
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
§Φ Instrumented Sensor Technology, Inc., Okemos, MI 48864	517-349-8487
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† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065	805-581-3985
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† Pind Testers Inc., Irvine, CA 92718	714-457-1090
PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
Sensotec, Inc., Columbus, OH 43212	614-486-7723
† Sensym, Inc., Sunnyvale, CA 94089	408-744-1500
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
† Sundstrand Data Control, Redmond, WA 98073-9701	206-885-3711
§† Systron-Donner Inertial Div., A BEI Electronics Company, Concord, CA 94518	510-671-6400
§ Terra Tecnnlg. Corp., Redmond, WA 98052	206-883-7300
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
Unholtz-Dickie Corp., Wallingford, CT 06492	203 265-3929
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322

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§ Solid State Relays, Oak Brook, IL 60521	708-932-1660
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000

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IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-0473;800-221-4767
Applied Fiberoptics, Inc., Southbridge, MA 01550	508-765-9121;800-225-7486
AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223 Ext 1027
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§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
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# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ EXFO, E.O. Engineering, Inc., Vanier, QC, CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
W.L. Gore & Assocs., Newark, DE 19714	302-738-4880

§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Light Control Systems Inc., M/A COM Inc., Hudson, NH 03051	603-883-8300
§† Lightwave Communications, Inc., Milford, CT 06460	203-878-9838
MACOM, Inc., Lowell, MA 01851	617-272-3000
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
3M Telecom Markets Division, Austin, TX 78726	512-984-3400;800-426-8626
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
# Olympic Wire & Cable, Fairfield, NJ 07004	201-227-7996
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444
Rifocs Corp., Camarillo, CA 93012	805-389-9800
SBE, Inc., San Ramon, CA 94583-1389	510-355-2000;800-925-2666
Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298

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§ ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103	**C•1287**
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# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
§† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
§ AVA Electronics Corporation, Drexel Hill, PA 19026	215-284-2500
§ Coax Connection, Peekskill, NY 10566	914-736-1010
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
§ E-Z Hook, Tektest Inc., Arcadia, CA 91006	818-446-6175
§ Inmet Corporation, Ann Arbor, MI 48103	313-426-5553
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101	617-890-4750
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666; 800-724-3911
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408 730-0300;800-PENSTOCK
RF Industries Ltd. (Nuelink), San Diego, CA 92126	619-549-6340;800-233-1728
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801	617-935-8610
† Tru-Connector Corp., Peabody, MA 01960	508-532-0775;1-800-262-9787; 1-800-COAXTRU
§ Wiltron, Morgan Hill, CA 95037-2809	408-778-2000

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§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1324-1325**
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1364**
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AES Corp., Peabody, MA 01960	508-535-7310
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Cascor, Inc., RJB Industries, Inc., Naples, FL 33942	813-643-6616
Enerco, Inc., Seattle, WA 98108	206-762-1422
§ Hughey & Phillips, Inc., Simi Valley, CA 93062	805-581-5591
Lark Electronics, Inc., New York, NY 10040	212-569-0430
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
PULNiX America, Inc., Sunnyvale, CA 94086	408-733-1560
§ Rodann Electronics Mfg. Co., Costa Mesa, CA 92626	714-662-3232;800-366-7010
Scanning Devices, Inc., Waltham, MA 02154	617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717

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Intronics, Inc., Canton, MA 02021, 800-367-0004	**B•1081**
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000

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† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778

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† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
JEMA, Wilmette, IL 60091	708-251-3600
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007

Antenna Switching Matrices-1200 — *See Vol. D*

Antenna Towers-1200 — *See Vol. D*

Antennas, Airborne-1200 — *See Vol. D*

Antennas, Citizens Band — See Antennas, Whip & Accessories (Incl. Marine & Mobile Types) (Vol. D)

Antennas, Direction Finding-1200 — *See Vol. D*

Antennas, Ground Plane-1200 — *See Vol. D*

Antennas, Helical-1200 — *See Vol. D*

Antennas, Log Periodic-1200 — *See Vol. D*

Antennas, Loop-1200 — *See Vol. D*

Antennas, Microwave-1200 — *See Vol. D*

Antennas, Multiband, UHF/VHF-1200 — *See Vol. D*

Antennas, Phased Array-1200 — *See Vol. D*

Antennas, Rhombic-1200 — *See Vol. D*

Antennas, Satellite-1200 — *See Vol. D*

Antennas, Spiral-1200 — *See Vol. D*

Antennas, Telescopic-1200 — *See Vol. D*

Antennas, Whip & Accessories (Incl. Marine & Mobile Types-1200 — *See Vol. D*

Antennas (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§† Centurion International, Inc., Lincoln, NE 68504	800-228-4563
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
† Eastern Microwave, Winchester, MA 01890	617-721-9800
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010	518-843-2600
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
JEMA, Wilmette, IL 60091	708-251-3600
§† M/A-Com, Inc., Antenna & Cable Division, Amesbury, MA 01913	508-388-5210
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
† Microwave Applications Group, Santa Maria, CA 93455	805-928-5711
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810	508-475-7831
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Antenna Systems (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§ Antenna Research Associates, Beltsville, MD 20705	301-937-8888
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
† Electronic Space Systems Corp., Concord, MA 01742	508-369-7200
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† MDM, Inc., Chatsworth, CA 91311	818-700-8400
† Microwave Applications Group, Santa Maria, CA 93455	805-928-5711
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
Precision Specialties, Inc., Northridge, CA 91324	818-349-9774
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
† Sabre Communications Corp., Sioux City, IA 51102	712-258-6690
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810	508-475-7831
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
§ Winegard Co., Burlington, IA 52601-2000	319-754-0600

Antistatic Devices, Blowers, Guns, etc.-4100 — *See Vol. D*

Antitheft Devices — See Alarms & Alarm Systems (Vol. D)

Armatures — See Motor & Generator Armatures, Rotors, Stators (Vol. B)

Arms & Manipulators, Robotic-4900 — *See Vol. D*

Array Processors-2025 — *See Vol. D*

Array Sockets — See Sockets, Array (Vol. C)

Arresters, Electrical Surge — See Suppressors, Transient Voltage (Vol. B)

Arresters, Electrical Surge/Lightning (MIL)-2440

§† MCG Elctrns., Deer Park, NY 11729, 516-586-5125	**B•1368**
§† Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488	**A•1139,1598-1599**
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170	**B•1379**
§ World Products Inc., Sonoma, CA 95476, 707-996-5201	**A•2224**
Amber Inds., Inc., Carrollton, TX 75006	214-490-9801
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180	605-665-9301
Edal Industries, East Haven, CT 06512	203-467-2591
§† EFI Electronics Corp., Salt Lake City, UT 84119	801-977-9009;800-877-1174
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
JEMA, Wilmette, IL 60091	708-251-3600
§† Joslyn Electronic Systems Corp., Goleta, CA 93116	800-752-8068; 805-968-3551
Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
Optrex/Satori, Torrance, CA 90503	310-214-1791
§† Power Integrity Corp., Greensboro, NC 27408	910-379-9773;800-237-6260
§† ProTek Devices, Tempe, AZ 85281	602-968-6060
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
§ TII Industries Inc., Copiague, NY 11726	516-789-5000
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201

Artificial Loads — See Dummy Loads (Vol. D)

Assemblers/Disassemblers, Network-1900 — *See Vol. D*

Assembly & Fabrication Services (Incl. R & D) — See Services, Assembly & Fabrication (Vol. D)

Attenuators, Audio-1300 — *See Vol. D*

Attenuators, Audio (T, L, LL Pads)-4750 — *See Vol. A*

Attenuators, Coaxial-3450 — *See Vol. A*

Attenuators, Decade-3450 — *See Vol. A*

Attenuators, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1209**
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1332**
T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227	**B•1814**
ADC Telecommunications, Inc., Minneapolis, MN 55435	612-938-8080
AOFR, Inc., Richardson, TX 75081	214-644-1394
Aster, a Porta Systems Company, Hopkinton, MA 01748	508-435-0101
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
§ Contact East, N. Andover, MA 01845	508-682-2000
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
Hewlett-Packard Company Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Laser Precision Corp., Utica, NY 13502	315-797-4449
† Light Control Systems Inc., M/A COM Inc., Hudson, NH 03051	603-883-8300
MACOM, Inc., Lowell, MA 01851	617-272-3000
† 3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800 426-8626
3M Telecom Markets Division, Austin, TX 78726	512-984-3400;800-426-8626
Optics for Research, Inc., Caldwell, NJ 07006	201-228-4480
Rifocs Corp., Camarillo, CA 93012	805-389-9800

Attenuators, Fixed-3450 — *See Vol. A*

Attenuators, IF-1900 — *See Vol. D*

Attenuators, Impedance Matching-3450 — *See Vol. A*

Attenuators, Logarithmic-3450 — *See Vol. A*

Attenuators, Microwave-3450 — *See Vol. A*

Attenuators, Programmable-3450 — *See Vol. A*

Attenuators, RF-1900 — *See Vol. D*

Attenuators, Switchable-3450 — *See Vol. A*

Attenuators, Turret-3450 — *See Vol. A*

Attenuators, Variable-3450 — *See Vol. A*

Attenuators, Voltage Controlled-3450 — *See Vol. A*

Attenuators (MIL)-2440

EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	**D•1671**
† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340	**A•1722**
Advanced Technical Materials, Inc., Patchogue, NY 11772	516-363-9018; 516-289-0363
† Alan Industries Inc., Columbus, IN 47202	812-372-8869
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
† Elcom Systems, Inc., Boca Raton, FL 33487	407-994-1774
† EMC Technology Inc, Cherry Hill, NJ 08034	609-429-7800
† General Microwave Corporation, Amityville, NY 11701	516-226-8900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† KDI/Triangle Electronics, Whippany, NJ 07981	201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
§† Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Magnetic Component Engineering, Inc., Inglewood, CA 90301	310-677-6600
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
§† Midwest Microwave, Saline, MI 48176-9569	313-429-4773;800-521-4410
Phoenix Microwave, Telford, PA 18969	215-723-6011
Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697	407-848-4311
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221

Attenuators (MIL), Fiber Optic-2440

§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
MACOM, Inc., Lowell, MA 01851	617-272-3000
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626

Attenuators (MIL), Inductive-2440

† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340	**A•1722**
† Magnetic Component Engineering, Inc., Inglewood, CA 90301	310-677-6600

Audible Alarms & Transducers-Also see Piezoelectric Ceramics; Transducers, Audio-1300 — *See Vol. D*

Autoclaves-2550 — *See Vol. D*

Automated Wafer Fabrication Systems — See Machines, Accessories, Semiconductor Machine (Vol. D)

Awls-5400 — *See Vol. C*

Backlight Panels, Electroluminescent-2450

Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300	**B•1050-1060**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442	**B•1156**
# Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1837**
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448	**B•1843**
Lumitex, Inc., Strongsville, OH 44136, 800-969-5483	**B•1173**
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770	**B•1113**
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757	800-874-9063
Precision Lamp, Inc., Cotati, CA 94931	707-792-0333
§ Sanyo Semiconductor Corp., Allendale, NJ 07401	201-825-8080
§ Three-Five Sys., Inc., Phoenix, AZ 85044	602-496-0035

Backpanel Interconnect Systems-3200 — *See Vol. C*

Backplane Wiring Services — See Services, Backplane Wiring (Vol. D)

Baffles, Speaker-1300 — *See Vol. D*

Ballasts — See Resistors, Ballast (Vol. A)

Ballasts, Lighting, Electronic-2460

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1965**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1965**
TMP Inc., Santa Ana, CA 92705, 714-558-8028	**B•1195**
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0	613-836-3511
Holt Inc., Irvine, CA 92718	714-859-8800
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5	416-630-8108
Universal Semiconductor Inc., San Jose, CA 95112	408-436-1906
WPI Group, Inc., Warner, NH 03278	603-456-3111

Ballasts, Lighting, Magnetic-1850 — *See Vol. A*

Baluns — See Transformers, Matching (Vol. A)

Bargraphs — See Meters, Bargraph (Vol. D)

Barrier Blocks & Strips — See Terminal Blocks (Vol. C), Terminal Strips (Vol. C)

Barriers, Intrinsic Safety-2100 — *See Vol. C*

Bars, Shorting-3200 — *See Vol. C*

Baths, Controlled Temperature (Air & Liquid)-4100 — *See Vol. D*

Baths, Ultrasonic — See Cleaners, Ultrasonic (Vol. D)

Batteries, Alkaline Manganese-3900 — *See Vol. D*

Batteries, Carbon Zinc-3900 — *See Vol. D*

Batteries, Lead-Acid — See Batteries, Lead Acid, Valve Regulated (Vol. D), Batteries, Lead acid, Flooded

Batteries, Lead-Acid, Valve Regulated-3900 — *See Vol. D*

Batteries, Lead-Acid, Flooded-3900 — *See Vol. D*

Batteries, Lead Dioxide-3900 — *See Vol. D*

Batteries, Lithium-3900 — *See Vol. D*

Batteries, Lithium Manganese Dioxide-3900 — *See Vol. D*

Batteries, Lithium Thionyl Chloride-3900 — *See Vol. D*

Batteries, Mercury-3900 — *See Vol. D*

Batteries, Mercury Oxide-3900 — *See Vol. D*

Batteries, Nickel Cadmium-3900 — *See Vol. D*

Batteries, Nickel Metal Hydride-3900 — *See Vol. D*

Batteries, Rechargeable-3900 — *See Vol. D*

Batteries, Silver Cadmium-3900 — *See Vol. D*

Batteries, Silver Oxide-3900 — *See Vol. D*

Batteries, Silver Zinc-3900 — *See Vol. D*

Batteries, Solar — See Cells, Photovoltaic (Vol. B)

Batteries, Standard Cell-3900 — *See Vol. D*

Batteries, Thermal-3900 — *See Vol. D*

Batteries, Thin Format-3900 — *See Vol. D*

Batteries, Zinc Air-3900 — *See Vol. D*

Batteries, Zinc Carbon-3900 — *See Vol. D*

Batteries, Zinc Chloride-3900 — *See Vol. D*

Batteries, Zinc Oxide-3900 — *See Vol. D*

Batteries (MIL)-2440

Battery Engineering, Inc., Hyde Park, MA 02136, 617-361-7555	**D•1426**
Duracell Inc., OEM Sales & Marketing, Bethel, CT 06801, 203-791-3274	**D•1436**
†# Eagle-Picher, Joplin, MO 64801, 417-623-8000	**D•1443-1445**
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608, 201-288-4477;800-447-5639	**D•1448**
§† Power Conversion, Inc., BTR, Elmwood Park, NJ 07407, 201-796-4800	**D•1462-1463**
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331	**D•1467-1468**
Tadiran Electronic Industries, Inc., Port Washington, NY 11050, 516-621-4980	**D•1477**
T.D.I. Batteries, Downers Grove, IL 60515, 800-323-7307	**D•1483**
# Alexander Batteries, New Product/OEM Divison, San Diego, CA 92198	619-480-4445
# Battery Specialties, Costa Mesa, CA 92626	714-755-0888;1-800-352-3706 (Toll free in CA)
Catalyst Research, Mine Safety Appliances Co., Inc., Owings Mills, MD 21117	410-356-2400
East Penn Manufacturing, Lyon Station, PA 19536	215-682-6361
Gates Energy Products, Portable Battery Division, Gainesville, FL 32614-7114	904-462-3911
# House of Batteries, Huntington Beach, CA 92647	1-800-432-3385;714 375 0222
Lyntronics, Inc., Deer Park, NY 11729	516-245-6397
Nickel Metal Hydride, Downers Grove, IL 60515	800-323-7307
Power-Pak, Inc., Morton Grove, IL 60053	708-966-6000
Pro Battery, Inc., Atlanta, GA 30340	800-451-7171
# Yardney Technical Products, Inc., Pawcatuck, CT 06379	203-599-1100

Battery Chargers — See Chargers, Battery (Vol. D), Power Supplies, Plug-in (Vol. D)

Battery Holders — See Connectors, Battery (Vol. C), Retainers, Battery (Vol. C)

Battery Plugs — See Connectors, Battery (Vol. C)

Beads, Shielding, Ferrite — See Shielding, Beads, Ferrite (Vol. C)

Beam Splitters-3700

Barr Associates, Inc., Westford, MA 01886	508-692-7513
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343 4912
Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
§ Optics for Research, Inc., Caldwell, NJ 07006	201-228-4480
† Oxley Inc., Branford, CT 06405	203-488-1033
† Plummer Precision Optics, Pennsburg, PA 18073	215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199	818-915-5707 5717
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† UCE, Inc., Norwalk, CT 06854	203-838-7509

Bearings-2500 — *See Vol. C*

Beepers — See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices (Vol. D)

Bells, Buzzers, Gongs, Sirens & Aural Warning Devices-2200 — *See Vol. D*

Belts, Dial Drive — See Cords & Cable, Dial Drive (Vol. C)

Belts, Drive-2500 — *See Vol. C*

Benches, Consoles, Tables (Work Stations, Lab & Shop)-Also See Enclosures, Equipment and Panel Mounting-1400 — *See Vol. C*

Bends & Twists, Microwave-3450 — *See Vol. A*

Bezels & Escutcheons, Shielded & Unshielded-2400 — *See Vol. C*

Bimetals, Thermostatic-5300

Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500	**B•1389,1903**
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450	**B•1905-1906**
Chace Precision Metals, Inc., Reidsville, NC 27320	919-342-2381
Hold-Heet Products Corp., Chicago, IL 60640	312-728-4454;312-728-4455
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800

Blackbody Radiation Sources-2900 — *See Vol. D*

Blowers, Centrifugal-2600 — *See Vol. C*

Blowers, Tangential-2600 — *See Vol. C*

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Board Computers & Subassemblies, PC Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, Q Bus/Unibus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, S100 Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, STD Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, VXI Bus Compatible-2025 — *See Vol. D*

Board Computers & Subassemblies, VME Bus Compatible-2025 — *See Vol. D*

Boards, Adapter, IBM PC-2000 — *See Vol. D*

Boards, Circuit, Clad-1700 – *See Vol. C*

Boards, Circuit, Molded-1700 – *See Vol. C*

Boards, Circuit, Unclad-1700 – *See Vol. C*

Boards, Display, Graphic-2450

Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690 ... B•1020
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .. B•1036,1038
Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300 ..... D•1095
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
§ AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
§ Ampro Computers,Inc., Sunnyvale, CA 94086 408-522-2100
Applied Data Systems, Inc., Baltimore, MD 21202 ..... 800-541-2003;410-576-0335
§ ATI Technologies Inc., Scarborough, Ont., CANADA M1W 3S2 416-756-0718
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Avelem, Gargilesse, FRANCE 36190 33-54478672
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Colorgraphic Communications Corp., Atlanta, GA 30341 404-455-3921
§ Diversified Technlg., Ridgeland, MS 39157 601-856-4121
† DY 4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108 ..... 203 528-9821
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Enterprise Systems Corp., Dover, NH 03820 603-742-7363
General Digital Corp., Enfield, CT 06082 203-741-7171
§ ilCon Corporation, Morgan Hill, CA 95037 408-779-7466
Industrial Computer Source, San Diego, CA 92131 619-271-9340
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 ..... 508-927 6575
§ Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4 514-685-2630
Mauell Corp., Dillsburg, PA 17019-0339 717-432-8686
§ Metra Corporation, San Jose, CA 95131 408-432-1110
Micro Industries, Westerville, OH 43081-9486 614-548-7878
Parsytec Inc., West Chicago, IL 60185 708-293-9500
PERX,Inc., Corte Madera, CA 94925 415-927-0155
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
Raster Graphics, Inc., Bend, OR 97701 503-388-2584
Redlake Corp., Morgan Hill, CA 95037 408-779-6464
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Vicom Systems, Inc., Fremont, CA 94538 415-498-3200
§ Visual Information Technologies, Inc.(UITEC), Plano, TX 75075 ..... 214-596-5600; 800-325-6467
§ Western Digital Corp., Irvine, CA 92718 714-932-6000
XYZ Electronics, McCordsville, IN 46055 317-335-2128

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Boards, Plug-in-3200 – *See Vol. C*

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Boards, Plug-in, Interface-3200 – *See Vol. C*

Boards, Plug-in, Memory-3200 – *See Vol. C*

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Boards, Programming-3200 – *See Vol. C*

Bobbins, Winding, Coil & Transformer-Also See Coil Assemblies & Forms-2500 – *See Vol. C*

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Brakes, Clutches, Electromechanical-3500

Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO ..... B•1271
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1295, D•2316
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171 ... 617-328-3300;1-800-225-5280
† Caribbean Assemblies, Inc., Wintersprings, FL 32708 407-327-0602
† Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
† Island Components Group, Bohemia, NY 11716 516-563-4224
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
Magnet Schultz of America, Westmont, IL 60559 708-789-0600
Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11042-5416 516-328-3300
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
§† Purolator Products, Inc., Formerly Facet Enterprises, Elmira, NY 14902 .. 607-737-8011
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Brakes, Magnetic-3500

†# Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1294, D•2316
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1300
§ Ambi-Tech Inds., Hillsdale, NJ 07642 201-666-0504
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 ..... 908-819-7070; 908-572-0500
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141 ..... 414-656-4011; 800-356-5077
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
Infranor, Naugatuck, CT 06770 ..... 203-729-8258;800-BE-SERVO
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
Magnet Schultz of America, Westmont, IL 60559 708-789-0600
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 619-662-2235
§† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11042-5416 516-328-3300
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
§† Purolator Products, Inc., Formerly Facet Enterprises, Elmira, NY 14902 .. 607-737-8011
Sandman Electric Co., Inc., Braintree, MA 02184 617-848-2111
§ Square D Co., Palatine, IL 60067 708-397-2600
§† Sterling Instruments, a DSG Company, New Hyde Pk., NY 11042-5416 516-328-3300

Brakes, Mechanical-3500

Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1294, D•2316
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1300
† Electronic Hardware Corp, Formerly Jan Hardware Mfg. Co., Farmingdale, NY 11735 516-752-1950
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
§† Purolator Products, Inc., Formerly Facet Enterprises, Elmira, NY 14902 .. 607-737-8011
§† Sterling Instruments, a DSG Company, New Hyde Pk., NY 11042-5416 516-328-3300
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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Brushes & Brush Assemblies-3500

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 .... B•1234-1238
† Electro Miniatures Corp., Moonachie, NJ 07074, 201-460-0510 .... B•1251-1252
† Fabricast, S. El Monte, CA 91733, 818-443-3247 .... B•1254-1255,1257,1259
† Graphite Metallizing Corp., Yonkers, NY 10702, 914-968-8400 .... B•1265
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1279,1281-1284,1289
† Danmar Inds., Moorpark, CA 93021 1-805-529-3788
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
§† Eraser Co., Syracuse, NY 13221 315-454-3237
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
† Gordon Brush Mfg. Co., Inc., Los Angeles, CA 90021-1786 213-627-6889
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
† Kirkwood Industries Inc., Cleveland, OH 44135 216-267-6200
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
§† Purolator Products, Inc., Formerly Facet Enterprises, Elmira, NY 14902 607-737-8011
§† Superior Carbon Products, Inc., Walnut Grove, MS 39189 601-253-2442
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ Tech Spray, Inc., Amarillo, TX 79105 806-372-8523
† Unit Industries, Fullerton, CA 92631 714-871-4161

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Cable, Fiber Optic/Cable Assemblies-2475

§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... B•1206, C•1163
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1325
† National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611 .... C•1788
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454 .... C•1805
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 .... B•1229
# Accu-Tech Corporation, Roswell, GA 30076-3890 .... 404-751-9473;800-221-4767
ADC Telecommunications, Inc., Minneapolis, MN 55435 612-938-8080
§ Alcatel Canada Wire Inc., Manassas, VA 22024 703-369-0440
Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
Andrew Corp., Orland Pk., IL 60462 800-255-1479
Applied Fiberoptics, Inc., Southbridge, MA 01550 .... 508-765-9121;800-225-7486
§ AT&T Microelectronics, Allentown, PA 18103 .... 1-800-372-2447;In Can.:1-800-553-2448
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 .... 1-800-344-0223, Ext. 1027
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§† Berk-Tek Inc., New Holland, PA 17557-9722 717-354-6200
§† BIW Cable Systems, Inc., N. Dighton, MA 02764 508-520-1200
§ Brand-Rex Company, BICC Cables Corporation, Willimantic, CT 06226-1128 203-456-8000
† Cable Systems, Inc., The HVT Group, Everett, MA 02149 617-389-7080
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
Carlon, A Div. of Lamson & Sessions, Cleveland, OH 44122 216-831-4000
CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
# Clifford of Vermont, Inc., Bethel, VT 05032 .... 802-234-9921;800-451-4381
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
# Computer System Products, Minneapolis, MN 55447 .... 612-476-6866;800-422-2537
Connect-Air International, Inc., Auburn, WA 98002 206-939-4880
§† Cooper Industries/Belden Div., Richmond, IN 47375 .... 317-983-5200;800-BELDEN-1
§ CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069 .... 619-744-8182; 800-334-3815
§ Custom Cable Corp., Westbury, NY 11590 516-334-3600
§ Custom Computer Cable, Inc., Eden Prairie, MN 55344 .. 612-941-5651;1-800-343-5553
Data Set Cable Co., Inc., Ridgefield, CT 06877 .... 203-438-9684;800-344-9684
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
† Dymec Inc., Winchester, MA 01890 617-729-7870
Electronic Connectors, Inc., Reading, PA 19602 215-374-3796
† Electroweave, Inc., Worcester, MA 01604 508-752-8932
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
Fiberoptics Technology, Inc., Pomfret, CT 06258 .... 203-928-0443, 800-433-5248
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
W. L. Gore & Assocs., Inc., Phoenix, AZ 85044 602-431-0077
W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
GTE Control Devices, Inc., Standish, ME 04084 207-642-4535
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
Henricks Technologies, Inc., Forsyth, GA 31029 .... 912-993-1060;800-241-0806
§† Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
ICS Electronics Corp., Milpitas, CA 95035-5545 .... 408-263-5500;1-800-952-4499
Interoptics, Purdy Group, Burlingame, CA 94010 415-347-7727
Lextel, Inc., Wakefield, MA 01880 617-245-5017
§† Light Control Systems Inc., M/A COM Inc., Hudson, NH 03051 603-883-8300
† Lightwave Communications, Inc., Milford, CT 06460 203-878-9838
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 .... 800-336-2112;703-953-4751
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
§ Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701 516-226-8950
3M-Electronic Products Division, Austin, TX 78726 ... 1-800-225-5373 Sls. & Prod. Info.
† 3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
Micro-Coax, Collegeville, PA 19426 215-489-3700
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 215-699-5373
Minnesota Wire & Cable Co., St. Paul, MN 55108-2721 .... 612-642-1800 ; 1-800-258-6922(MWCC)
Mohawk/CDT, Leominster, MA 01453 .... 508-537-9961;800-422-9961
Montrose/CDT, Cable Design Technologies, Auburn, MA 01501 508-791-3161
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ OFTI, Westford, MA 01886 508-692-6606
§ Olympic Wire & Cable, Fairfield, NJ 07004 201-227-7996
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Optical Cable Corp., Roanoke, VA 24022-1967 1-800-622-7711
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Pan International (USA), Inc., Rancho Cucamonga, CA 91730 909-945-1365
Parlex Corporation, Methuen, MA 01844 508-685-4341
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
§† Remee Products Corp., Florida, NY 10921 914-651-4431
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2261
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220 .... 310-609-1811; 800-326-0006
§ Storm Products Co., Hinsdale, IL 60521 708-323-9121
Swan Associates, New Haven, CT 06534 203-387-3917
# Technical Services for Electronics, Inc., Arlington, MN 55307 612-964-2237
Teledyne Thermatics, Teledyne Inds., Inc., Elm City, NC 27822 919-236-4311
§# TELTEC, Inc., Minneapolis, MN 55425 612-854-9177
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401 803-676-2900
Trionics, Inc., St. Charles, IL 60174 708-365-6570
† United Wire & Cable Corp., Worcester, MA 01604 508-757-3872
Volpi-MFG-USA, Auburn, NY 13021-1289 315-255-1737
# V-Tron Electronics Corp., S. Attleboro, MA 02703 508-761-9100
§† Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 512-388-2522
§† Western Electronic Products Co., San Clemente, CA 92673 714-492-4677
§† Whitmor Wire & Cable Corp., Valencia, CA 91355 805-257-2400
† Woven Electronics, Woven Electronics Corporation, Simpsonville, SC 29681 803-963-5131

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Cable & Assemblies (MIL)-2440

§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886	**C•1712,1718**
Caton Connector Corp., Kingston, MA 02364, 617-585-4315	**C•1275,1725**
Connectronics Corp., Toledo, OH 43607, 419-537-0020	**C•1293**
§ Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412, 708-455-8830	**C•1726**
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473	**C•1672**
† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571	**C•1358-1359**
JH America, Inc., JBT International, Inc., Torrance, CA 90501, 310-328-0051	**C•1754-1755**
§† Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357;800-545-5833	**C•1756**
† National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611	**C•1768,1771-1776,1781**
† Product Technology, Inc., Irvine, CA 92714, 714-474-8998	**C•1673**
† Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761	**C•1807**
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**C•1458,1809**
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020	**C•1499-1500**
Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970	**C•1835-1838**
§ ABL Electronics Supply, Inc., Peekskill, NY 10566	914-736-1010; 1-800-431-2103
† Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Adirondack Wire & Cable, ACS Industries Inc., Woonsocket, RI 02895	1-401-769-1600
Advanced Technical Materials, Inc., Patchogue, NY 11772	516-363-9018; 516-289-0363
† Advance Wire & Cable Assembly, Electrical Insulation Suppliers, Belmont, CA 94002	415-592-4550
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
American Assembly Inc., Florida, NY 10921	914-651-3433
† American Insulated Wire Corp., Leviton Mfg. Co., Pawtucket, RI 02862	401-726-0700
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
§ Amphenol Interconnect Products, LPL Technologies, Endicott, NY 13760	607-754-4444
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
† Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311	818-998-5124
§ AVA Electronics Corporation, Drexel Hill, PA 19026	215-284-2500
§† Brand-Rex Company, BICC Cables Corporation, Willimantic, CT 06226-1128	203-456-8000
§ Burton Electrical Engineering, Wyle Laboratories, El Segundo, CA 90245	310-322-0615
CableStar, Incorporated, Glasgow, KY 42141	800-338-8223
† Cable Systems, Inc., The HVT Group, Everett, MA 02149	617-389-7080
† Cabletest Products Co., Malden, MA 02148	617-665-2932
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
C & C Jetronic, Inc., Allentown, NJ 08501	609-259-8855
† Cardinal Control Co., Kensington, CT 06037	203-828-6379
Cat Wire and Cable Corp., Miami, FL 33150	305-836-3600
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226	602-940-0740
† CICOIL CORP., Valencia, CA 91355-3428	805-295-1295
# Clifford of Vermont, Inc., Bethel, VT 05032	802-234-9921;800-451-4381
Comm/Scope, Inc., Network Cable Div., Claremont, NC 28610	704-324-2200; 800-982-1708
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379	508-580-0111
# Computer System Products, Minneapolis, MN 55447	612-476-6866;800-422-2537
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ Cooner Wire Co., Chatsworth, CA 91311	818-882-8311
Cooper Industries/Belden Div., Richmond, IN 47375	317-983-5200;800-BELDEN-1
† CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069	619-744-8182; 800-334-3815
† dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
† De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089	408-734-2020
§† Dearborn Wire & Cable, L.P., Wheeling, IL 60090	708-459-1000; 800-323-0198
† Dielectric Sciences, Inc., HVT Group, Chelmsford, MA 01824	508-250-1507
† Dilwol Wire & Cable Inc., Burlington, Ont., CANADA L7T 2X5	416-681-2343
† Electro Miniatures Corp., Moonachie, NJ 07074	201-460-0510
Electronic Connectors, Inc., Reading, PA 19602	215-374-3796
† Electro-Prep, Inc., Wareham, MA, MA 02571	508-291-2880
† Electro-Support Systems, Temecula, CA 92590	909-676-2751
†# ELMEC, Inc., Technautic Corp., Chandler, AZ 85226	602-961-7100
† Escod Industries, Insilco, S. Hadley, MA 01075	413-536-1800
† Excel Specialty Corp., Chicago, IL 60660	312-262-4781
† The First Electronics Corp., Boston, MA 02125	617-288-2430
† Gavitt Wire & Cable, Brookfield, MA 01506	508-867-6476
† General Technology Corp., Albuquerque, NM 87109	505-345-5591
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85044	602-431-0077
† W.L. Gore & Assocs., Newark, DE 19714	302-738-4880
† GSI Corp., Timonium, MD 21093	410-252-1768
Henricks Technologies, Inc., Forsyth, GA 31029	912-993-1060;800-241-0806
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
§† Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
† Judd Wire Inc., San Marcos, CA 92069	619-744-7720;800-344-5251
† Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
† Lynn Electronics, Feasterville, PA 19053	215-355-8200;800-523-6075
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
MACOM, Inc., Lowell, MA 01851	617-272-3000
§ Markel Corp., Norristown, PA 19404	215-272-8960
§† 3M-Electronic Products Division, Austin, TX 78726	1-800-225-5373 Sls. & Prod. Info.
§† Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
Minnesota Wire & Cable Co., St. Paul, MN 55108-2721	612-642-1800 ; 1-800-258-6922(MWCC)
Mohawk/CDT, Leominster, MA 01453	508-537-9961;800-422-9961
MOLDCON Div. of Contex Electronics, W. Springfield, MA 01089	413-736-0371
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
National Telephone & Electronics Inc., Miami, FL 33172	305-592-0551
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757
† Olympic Wire & Cable, Fairfield, NJ 07004	201-227-7996
Pan International (USA), Inc., Rancho Cucamonga, CA 91730	909-945-1365
Parlex Corporation, Methuen, MA 01844	508-685-4341
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
§† Precision Tube, N. Wales, PA 19454	215-699-5801
† Precision Tube Co., Coaxitube Div., Salisbury, MD 21801	410-546-3911
§† Quality Microwave Interconnects, Inc., Wilmington, MA 01887	508-988-9090
† Reactel, Inc., Rockville, MD 20850	301-279-5535
§ Samtec, Inc., New Albany, IN 47151-1147	1-800-672-6832
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
§† Storm Products Co., Hinsdale, IL 60521	708-323-9121
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
TELCO Intercontinental Corp., TECO, Houston, TX 77095	713-855-2218
† Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584	309-693-3300
† Tru-Connector Corp., Peabody, MA 01960	508-532-0775;1-800-262-9787; 1-800-COAXTRU
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
† Veam, Litton Systems, Watertown, CT 06795	203-274-9681
† Victor Elec. Wire & Cable, W. Warwick, RI 02893	401-821-1700;SALES 401-821-7800
† Waters Instruments Inc., Rochester, MN 55903	507-252-3700
§† Western Electronic Products Co., San Clemente, CA 92673	714-492-4677
† Western Reserve Electronics, Twinsburg, OH 44087	216-425-4951
Whitmor Wire & Cable Corp., Valencia, CA 91355	805-257-2400
§† Wilco Wire & Cable Co., Inc., San Jose, CA 95133	408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079	609-935-7601;609-935-7651
† Zippertubing Co., Los Angeles, CA 90061	310-527-0488

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Cable Assemblies, Microwave-3450 – *See Vol. A*

Cable Fault Locators-2900 — *See Vol. D*

Cable (MIL), Fiber Optic-2440

# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§† AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Berk-Tek Inc., New Holland, PA 17557-9722	717-354-6200
CICOIL CORP., Valencia, CA 91355-3428	805-295-1295
# Clifford of Vermont, Inc., Bethel, VT 05032	802-234-9921;800-451-4381
† Daburn Electronics & Cable Corp., Northvale, NJ 07647	201-768-5400
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
MACOM, Inc., Lowell, MA 01851	617-272-3000
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
Mohawk/CDT, Leominster, MA 01453	508-537-9961;800-422-9961
Montrose/CDT, Cable Design Technologies, Auburn, MA 01501	508-791-3161
† Optical Cable Corp., Roanoke, VA 24022-1967	1-800-622-7711
Parlex Corporation, Methuen, MA 01844	508-685-4341
K.L. Tannehill Inc., Bloomington, MN 55431	612-881-6700

Cable (MIL), Flat-2440

§ **ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103**	**C•1706**
§† **Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886**	**C•1712,1718**
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855	**C•1274**
§† **Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400**	**C•1743**
† **GSI Corp., Timonium, MD 21093, 410-252-1768**	**C•1749-1751**
† **Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970**	**C•1832,1844**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† Advanced Circuit Technology, Nashua, NH 03062	603-880-6000
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
† Berk-Tek Inc., New Holland, PA 17557-9722	717-354-6200
§† Brand-Rex Company, BICC Cables Corporation, Willimantic, CT 06226-1128	203-456-8000
† CICOIL CORP., Valencia, CA 91355-3428	805-295-1295
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
Dearborn Wire & Cable, L.P., Wheeling, IL 60090	708-459-1000; 800-323-0198
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Flex-Link Products, Inc., San Fernando, CA 91340	818-898-1451
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85044	602-431-0077
† W.L. Gore & Assocs., Newark, DE 19714	302-738-4880
§ 3M-Electronic Products Division, Austin, TX 78726	1-800-225-5373 Sls. & Prod. Info.
Omega Engineering, Stamford, CT 06907	800-826-6342
§† Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
§ Samtec, Inc., New Albany, IN 47151-1147	1-800-672-6832
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
† Temp-Flex Cable, Inc., S. Grafton, MA 01560	508-839-5987
§ Wilco Wire & Cable Co., Inc., San Jose, CA 95133	408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079	609-935-7601;609-935-7651

Cable (MIL), RF-2440

§ **ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103**	**C•1706-1708**
§† **Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886**	**C•1712-1713,1715-1716,1718**
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412, 708-455-8830	**C•1734-1735**
§† **Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400**	**C•1744**
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	**C•1748**
† **GSI Corp., Timonium, MD 21093, 410-252-1768**	**C•1749,1751**
§† **Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357;800-545-5833**	**C•1756**
† **National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611**	**C•1768-1773,1777**
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740	**A•2441**
† **Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761**	**C•1807**
† **Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970**	**C•1832-1833,1837-1838,1844**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§† Brand-Rex Company, BICC Cables Corporation, Willimantic, CT 06226-1128	203-456-8000
† Cable Systems, Inc., The HVT Group, Everett, MA 02149	617-389-7080
Carol Cable Co., Highland Heights, KY 41076	606-572-8303,606-572-8000
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226	602-940-0740
CICOIL CORP., Valencia, CA 91355-3428	805-295-1295
§† Comm/Scope, Inc., Network Cable Div., Claremont, NC 28610	704-324-2200; 800-982-1708
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
† Danmar Inds., Moorpark, CA 93021	1-805-529-3788
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
Dearborn Wire & Cable, L.P., Wheeling, IL 60090	708-459-1000; 800-323-0198
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85044	602-431-0077
† W.L. Gore & Assocs., Newark, DE 19714	302-738-4880
§† JSC Wire & Cable, Wayne, NJ 07474-0248	201-694-6200;1-800-572-9473
Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
MACOM, Inc., Lowell, MA 01851	617-272-3000
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
Mohawk/CDT, Leominster, MA 01453	508-537-9961;800-422-9961
Parlex Corporation, Methuen, MA 01844	508-685-4341
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
†# Quality Microwave Interconnects, Inc., Wilmington, MA 01887	508-988-9090
§† Remee Products Corp., Florida, NY 10921	914-651-4431
§† Specialty Cable Corporation, Wallingford, CT 06492	800-456-SPEC
† Storm Products Co., Hinsdale, IL 60521	708-323-9121
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
§† Teledyne Thermatics, Teledyne Inds., Inc., Elm City, NC 27822	919-236-4311
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584	309-693-3300
§† Western Electronic Products Co., San Clemente, CA 92673	714-492-4677
§ Wilco Wire & Cable Co., Inc., San Jose, CA 95133	408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079	609-935-7601;609-935-7651

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§† ASC Capacitors, Ogallala, NE 69153, 308-284-3611 ..... A•1016,1018,1020,1023
† AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... **A•1024**
§† Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... A•1029
§† Component Research Co. Inc., Santa Monica, CA 90404, 310-829-3615 ..... A•1030
§† Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 ..... A•1062-1064
CSI Capacitors, CSI Technologies, San Marcos, CA 92069-3009, 619-747-4000 ..... A•1066
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1157
Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 ..... A•1068-1073
† Johanson Dielectrics, Inc., Sylmar, CA 91342, 818-364-9800 ..... A•1089
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 ..... A•1090
† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 ..... A•1092-1093
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1106,1108-1111,1113-1114
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1119
† North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 ..... A•1132-1135
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1136-1138
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1015
Reliable Capacitors/Hi-Rel Capacitors, Sante Fe Springs, CA 90690, 310-946-8577 ..... A•1156
† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1678
Sprague, Concord, NH 03301, 603-224-1961 ..... A•1166-1167
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231, 207-324-4140 ..... A•1166-1167
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987, 413-664-4431 ..... **A•1166-1167**
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1169
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1174-1175
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
AVX Filters Corp. Sun Valley, CA 91352 818-767-6770
† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
§† Electron Products, Irwindale, CA 91706 818-960-2299
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§† Johanson Manufacturing Corporation, Boonton, NJ 07005 201-334-2676
† KD Components, Inc., Carson City, NV 89706 702-883-8003
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Micro-Ceramx Technology, A MicroSemi Company, Escondido, CA 92029 619-480-1906
§ MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
Multi Products International, West Paterson, NJ 07424 201-890-1344
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
Presidio Components, Inc., San Diego, CA 92121 619-578-9390
† Rogers Corp., Rogers, CT 06263 203-774-9605
SFE Technologies, San Fernando, CA 91340 818-365-9411
Southern Electronic, F-Dyne, Burbank, CA 91502 818-845-2458
† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
§† Tansitor Electronics, Bennington, VT 05201 802-442-5473

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Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... A•1029
Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1088
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 ..... A•1090
Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 ..... A•1093
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1119
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1015
§† Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164-1165
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1169
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
MACOM, Inc., Lowell, MA 01851 617-272-3000
Metuchen Capacitors, Inc., Old Bridge, NJ 08857 908-679-3366
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-975-2711
S & El Manufacturing, Northridge, CA 91324 818-349-4111
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
† Voltronics Corporation, Denville, NJ 07834 201-586-8585

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§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442:800-421-6815 ..... B•1136
§† Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1146
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1166
Osram Sylvania, Hillsboro, NH 03244, 603-464-5533;603-464-5538 ..... B•1190-1194
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1182,1184-1185
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1196
ACI Components, Inc., Laguna Hills, CA 92653 714-588-9611
§† Atlantic Optical Moulding, Webster, MA 01570 508-943-1746
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
Display Devices, Inc., Encinitas, CA 92023 619-753-0113
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
§† Electrical Industries Corp., Murray Hill, NJ 07974 908-464-3200
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
§† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
George Risk Industries, Inc., Kimball, NE 69145 308-235-4645
GTE Products Corporation, Miniature Lighting Products, Hillsboro, NH 03244 ..... 603-464-5533;603-464-5538
§ Inter-Market, Glenview, IL 60025 708-729-5330
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
§ Lamb Industries, Inc., Portland, OR 97225 503-297-8878,800-824-9374
Ledtronics, Inc., Torrance, CA 90505 310-534-1505
§† Littelfuse Inc., Des Plaines, IL 60016 ..... 708-824-1188:708-824-0400
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
† Oxley Inc., Branford, CT 06405 203-488-1033
Schott Electronics, Seymour, CT 06483 203-881-0102
§ Schurter, Inc., Petaluma, CA 94954 ..... 800-848-2600 ext.62
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-275-7089
§ Sylvania Automotive and Miniature Lighting, Osram Sylvania, Hillsboro, NH 03244 603-464-5533
Topflight, York, PA 17404 ..... 717-843-9901:800-233-9386

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§† Amphenol RF Operations; Amphenol Corporation, Danbury, CT 06810 ..... 203-743-9272; 800-627-7100
† Cole-Flex Corporation, West Babylon, NY 11704 516-249-6150
† Presidio Components, Inc., San Diego, CA 92121 619-578-9390
† Tru-Connector Corp., Peabody, MA 01960 ..... 508-532-0775;1-800-262-9787; 1-800-COAXTRU

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† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 .... B•1936-1937,1942-1943
Advanced Process Controls, Woburn, MA 01801 617-932-9262
† A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302 614-387-8827
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
§ Data Instruments, Inc., Acton, MA 01720 800-332-3282
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
§ DCT Instruments, Columbus, OH 43212 1-800-328-1028
§† Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
DJ Instruments, Inc., N. Billerca, MA 01862 508-667-5301
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§† Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
Omega Engineering, Stamford, CT 06907 800-826-6342
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
Sensor Developments Inc., Lake Orion, MI 48361 313-391-3000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721

Cells, Photoconductive-3700

Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 .... B•1210
† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 .... B•1312
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 .... B•1339
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
† Graseby Infrared, Graseby PLC, Orlando, FL 32826 407-282-7700
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref. JAPAN 053-452-2141
† OptoElectronics Textron, Petaluma, CA 94975-0039 707-763-5900
§ Raytheon Company, Quincy Operation, Quincy, MA 02269 617-479-5300
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

Cells, Photoemissive-3700

Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 .... B•1210
Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
EG & G Vactec, St. Louis, MO 63132 314-423-4900
GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref. JAPAN 053-452-2141
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586

Cells, Photovoltaic-3700

Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 .... B•1210
† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 .... B•1312
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 .... B•1339
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
AES Corp., Peabody, MA 01960 508-535-7310
East Penn Manufacturing, Lyon Station, PA 19536 215-682-6361
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
Energy, Ltd., Bladensburg, MD 20710 301-699-1144
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref. JAPAN 053-452-2141
Hoppecke Battery Systems, Inc., Bulter, NJ 07405 201-492-0045
§ Johnson Controls Battery Group, Inc., Milwaukee, WI 53212 414-961-6500
§ Panasonic Industrial Co., Battery Sales GP, Secaucus, NJ 07096-1511 201-348-5266
§ SANYO Energy (U.S.A.) Corporation, San Diego, CA 92173 619-661-6620
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Xenotronix Inc., Valencia, CA 91355 805-257-4793

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Chambers, Anechoic-2550 — *See Vol. D*

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Chambers, RFI/EMI-2550 — *See Vol. D*

Chambers, Shock-2550 — *See Vol. D*

Chambers, Space Simulation-2440

† Bemco, Simi Valley, CA 93065 805-583-4970
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
Cooke Vacuum Prods., Inc., S. Norwalk, CT 06854 203-853-9500
§† Despatch Industries, Minneapolis, MN 55418 612-781-5363
Nordion International, Kanata, Ontario, CANADA K2K 1X8 613-592-2790
Ransco Industries, Oxnard, CA 93033 805-487-7777
† Tenney Engineering, Union, NJ 07083 908-686-7870

Chambers, Temperature-2550 — *See Vol. D*

Chambers, Vacuum-2550 — *See Vol. D*

Chambers, Vibration-2550 — *See Vol. D*

Chambers (MIL)-2440

Sigma Systems Corp., San Diego, CA 92116, 619-283-3193 .... D•1211
† Bemco, Simi Valley, CA 93065 805-583-4970
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
† Ransco Industries, Oxnard, CA 93033 805-487-7777
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309 305-739-7004
† Tenney Engineering, Union, NJ 07083 908-686-7870
† Thermotron Inds., Holland, MI 49423 616-392-1491

Character Recognition Equip., Magnetic Ink-2000 — *See Vol. D*

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Chargers, Battery-4000 — *See Vol. D*

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Chassis (MIL), Electrical-2440

- **Ango Electronics Corp., North Arlington, NJ 07031, 201-955-0800 ...... C•1014**
- **† Optima Electronic Packaging Systems, Tucker, GA 30084-5088, 404-496-4000 .... C•1061**
- **Zero Cabinets (Stantron), Pacoima, CA 91331-2226, 818-890-3445 .. C•1118-1119**
- **†# Zero East, Zero Corporation, Monson, MA 01057-0128, 413-267-5561 ... C•1124**
- §† Abalon Precision Mfg., Bronx, NY 10459 .... 718-589-5682;1-800-888-ABALON
- BICC-VERO Electronics, Inc., Hamden, CT 06514 .... 203-288-8001;1-800-242-2863
- §† Boston Gear, IMO Industries Inc., Quincy, MA 02171 .... 617-328-3300;1-800-225-5280
- † DY 4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
- † General Technology Corp., Albuquerque, NM 87109 505-345-5591
- Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
- # Project Pro, Twinsburg, OH 44087 216-425-8888
- Prototek, Inc., Hamilton, OH 45015 513-874-5094
- † STRONGBOX, Culver City, CA 90231-2726 310-305-8288

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Chokes, Swinging-1800 — *See Vol. A*

Chokes, Waveguide-3450 — *See Vol. A*

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- **† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... A•2234**
- **Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 .... A•1198-1199,1201-1202,1204,1209-1211**
- **§† Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 .... A•1226,1229,1232**
- **Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1240-1241**
- **§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 .... A•2411**
- **† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 .... D•1851**
- **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 .... A•1259**
- **† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 .... A•1263**
- **§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1282,2019**
- **Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 .... A•1286-1287**
- † Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
- † Automatic Coil Corp., Miami, FL 33147 305-696-6660
- §† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
- §† Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 310-515-1720
- Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
- † Bicron Electronics, Canaan, CT 06018 203-824-5125
- §† Capcon, Inc., New York, NY 10001 212-243-6275
- † Communication Coil Inc., Chicago, IL 60634 312-637-1333
- † Del Electronics Corp., Valhalla, NY 10595 914-686-3600
- §† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 .. 716-652-3600
- Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
- † Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
- # Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
- † Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
- † Gavagan Electronics, Danbury, CT 06810 203-748-5248
- §† Jeffers Electronics, Nogales, AZ 85621 602-281-4925
- † Keytronics Inc., Endicott, NY 13760 607-754-5405
- † Magnecomp, Inc., Pickens, SC 29671 803-878-4700
- † Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
- † Magnetico Inc., Holtsville, NY 11742 516-654-1166
- † Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
- † PTC Transformers, Bordentown, NJ 08505 609-298-8200
- Schott Corp., Wayzata, MN 55391 612-475-1173
- † Trans American Transformer, E. Setauket, NY 11733 516-928-0762
- †# United States Electronics, Springfield, NJ 07081 201-912-0111
- † Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
- † Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Choppers-Also See Light Choppers-4050 — *See Vol. D*

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- † DARE Electronics, Inc., Troy, OH 45373 513-335-0031
- † Duplicon, Inc., S. Boston, MA 02127 617-269-5859
- † Solid State Electronics Corp., Northridge, CA 91324 818-993-8257

Circuit Analyzers — See Testers, Signal Tracing (Vol. D)

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Circuit Breakers-4300

- **§ Altech Corp., Flemington, NJ 08822-6000, 908-806-9400 .... B•1342**
- **§ Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556 .... B•1350-1351**
- **† E-T-A Circuit Breakers, Niles, IL 60714, 708-647-8303 .... B•1353-1357,1721**
- **§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 .... D•1732**
- **§† Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800, 609-896-0009 .... B•1360-1363**
- **§ Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400 .... B•1366**
- **§† Mechanical Products Inc., Jackson, MI 49204, 517-782-0391 .... B•1369-1373**
- **† Philips Technologies, Airpax Protector Group, Cambridge, MD 21613, 410-228-4600 .... B•1378**
- **§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1380-1381,1590**
- **§ Raychem Corporation, Menlo Park, CA 94025, 415-361-3863;800-2-RAYCHEM/ext. 6900 ... B•1384-1385,1894-1895, D•1466**
- **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1593**
- **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 .... B•1386**
- **Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181, C•1460**
- **Weber Protection, inc., Malvern, PA 19355, 610-651-0770;800-WEBERPA .... B•1391-1393**
- § Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
- Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
- § Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
- § Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101 718-937-8000
- § Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
- § Entrelec Inc., Irving, TX 75038 214-550-9025
- Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
- § IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
- International Microelectronics, Arlington, TX 76003 817-473-1730
- Joemex Electrics, Irvine, CA 92718 714-855-4472
- § Klockner Moeller, Franklin, MA 02038 508-520-7080
- Mouser Electronics, Santee, CA 92071 800-346-6873
- Mouser Electronics, Mansfield, TX 76063 800-346-6873
- Mouser Electronics, Gilroy, CA 95020 800-346-6873
- § Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
- § Philips Technologies, North American Philips Corporation, Cheshire, CT 06410 203-271-6525
- § Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
- PoCo Sls., Porter Co., Chatsworth, CA 91311 818-700-8727
- † Pyle-National, Chicago, IL 60651 .... 312-342-6300 x210
- RDI Elctrns., Inc., Mamaroneck, NY 10543 914-777-7000
- § Relay Specialties, Oakland, NJ 07436 201-337-1000
- Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
- § SL Waber, Inc., Mt. Laurel, NJ 08054 .... 609-866-8888;800-257-8384
- § Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
- § Square D Co., Palatine, IL 60067 708-397-2600
- § Texas Instruments, Connector Systems, Attleboro, MA 02703 .... 508-699-5269; 508-699-3450
- § Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
- § USD Products , Div. of Bussmann, Chicago, IL 60656 708-867-4600

Circuit Breakers, Boxes, Panel Boards, Enclosures (MIL)-2440

- **Altech Corp., Flemington, NJ 08822-6000, 908-806-9400 .... B•1342**
- **Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556 .... B•1350-1351**
- **E-T-A Circuit Breakers, Niles, IL 60714, 708-647-8303 ... B•1353.1356-1357,1721**
- **Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800, 609-896-0009 .... B•1360,1362**
- **§ Mechanical Products Inc., Jackson, MI 49204, 517-782-0391 .. B•1369,1371-1374**
- **Philips Technologies, Airpax Protector Group, Cambridge, MD 21613, 410-228-4600 .... B•1378**
- **Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... C•1460**
- **Weber Protection, inc., Malvern, PA 19355, 610-651-0770;800-WEBERPA .... B•1391-1393**
- Elgin Electronics, Erie, PA 16509-3570 814-864-4921
- § Square D Co., Palatine, IL 60067 708-397-2600
- † Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548 904-243-3722

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Clamps (MIL), Cable-2440

§† All-States, Inc., Chicago, IL 60640	312-728-0525
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007	708-981-6000
§ DEK, Inc., St. Charles, IL 60174	708-377-2575
§† Heyco Molded Products, Inc., Kenilworth, NJ 07033	908-245-0033;800-526-4182
† NMC Fastening Systems, Nylon Molding Corp., Monrovia, CA 91016	818-357-0901
§† Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
† Tru-Connector Corp., Peabody, MA 01960	508-532-0775;1-800-262-9787; 1-800-COAXTRU
§† Tyton Corp., Milwaukee, WI 53223	414-355-1130;800-535-5552
† Veam, Litton Systems, Watertown, CT 06795	203-274-9681

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Clips (MIL), Electrical-2440

§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594	**B•1359**
Atlee Inc., North Andover, MA 01845	508-681-1003
Autosplice, Inc., San Diego, CA 92121	619-535-0077
§ Bussmann Division, Cooper Industries, St. Louis, MO 63178	314-394-2877
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
§ DEK, Inc., St. Charles, IL 60174	708-377-2575
EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268	818-442-2572
† Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
§† Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
Wire Graphics, Inc., Farmingdale, NY 11735	516-293-1525

Clocks, Time Keeping - Also See Oscillators, Clock-2200 — *See Vol. D*

Clocks & Controllers, Thermal-2200 — *See Vol. D*

Clutches, Friction, Magnetic, Positive-3500

Motor Technology, Inc., Dayton, OH 45429, 513-294-1041	**B•1300**
§† Berg, W. M., Inc., East Rockaway, NY 11518	516-599-5010
§ Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081	201-467-8100
† Globe Motors, Dayton, OH 45404	513-228-3171
† Island Components Group, Bohemia, NY 11716	516-563-4224
Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11042-5416	516-328-3300
† Precision Mechanisms, Westbury, NY 11590	516-ED3-5955
§† Purolator Products, Inc., Formerly Facet Enterprises, Elmira, NY 14902	607-737-8011
§† Sterling Instruments, a DSG Company, New Hyde Pk, NY 11042-5416	516-328-3300
† Vernitech:Vernitron Corp., Deer Pk, NY 11729	516-586-5100

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Coils, Hybrid & Repeater-1800 — *See Vol. A*

Coils, IF-1800 — *See Vol. A*

Coils, Molded-1800 — *See Vol. A*

Coils, pi Winding-1800 — *See Vol. A*

Coils, Relay-1800 — *See Vol. A*

Coils, RF-1800 — *See Vol. A*

Coils, Saturable Reactor-1800 — *See Vol. A*

Coils, Shielded-1800 — *See Vol. A*

Coils, Solenoid-1800 — *See Vol. A*

Coils, Switching, Power-1800 — *See Vol. A*

Coils, Telephone-1800 — *See Vol. A*

Coils, Telephone Pickup (Recording) — See Pickups, Telephone (Vol. D)

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Coils, Transducer-1800 — *See Vol. A*

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Coils, TV (All Types)-1800 — *See Vol. A*

Coils, Variable-1800 — *See Vol. A*

Coils (MIL), Non-RF-2440

American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052, 716-652-3600	**A•1189**
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720	**A•1192**

Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310	**A•1198,1201,1203,1212**
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301	**A•1227,1229,1232**
EWC, Inc., Englishtown, NJ 07726, 908-446-3110	**A•1235**
§ Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234	**A•1241**
† Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600	**A•1251**
Magnetico Inc., Holtsville, NY 11742, 516-654-1166	**A•2390**
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050	**A•1254,2411**
Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180, 605-665-9301	**A•1231**
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**A•1263**
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501	**A•1274**
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211	**A•2508**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054	**A•1282**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828	**A•1284,1289**
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777	**A•1292**
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	**A•2572**
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314	**A•1307,2594**
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181	**A•1308**
Abbott Technologies, Inc., Sun Valley, CA 91352	818-504-0644;1-800-367-8200
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410	718-441-5207
† Automatic Coil Corp., Miami, FL 33147	305-696-6660
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
† Communication Coil Inc., Chicago, IL 60634	312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719	909-735-7558
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449	716-652-3600
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
† ESC Electronics Corp., Palisades Pk., NJ 07650	201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823	908-475-3207
Hisonic, Inc., Olathe, KS 66051	913-782-0012
JB Electronic Transformers Inc., Chicago, IL 60647	312-342-0080
Keytronics, Inc., Endicott, NY 13760	607-754-5405
† Magnecomp, Inc., Pickens, SC 29671	803-878-4700
† Neshaminy Transformer Corp., Furlong, PA 18925	215-794-7411
† Newport Manufacturing Co., Santa Ana, CA 92704	800-726-0715
† North Hills Signal Processing, Syosset, NY 11791	516-682-7740
† NWL Transformers, Bordentown, NJ 08505	609-298-7300
† OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
† Raytheon Co., Electronic Components Division, Waltham, MA 02254	617-899-8400
Schott Corp., Wayzata, MN 55391	612-475-1173
† Sigma Electronics Inc., Houston, TX 77099	713-933-4700;800-874-7121
† Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5671
† Trans American Transformer, E. Setauket, NY 11733	516-928-0762
†# United States Electronics, Springfield, NJ 07081	201-912-0111
Vanguard Electronics Co., Gardena, CA 90248	310-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824	602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043	415-968-9176

Coils (MIL), RF-2440

Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292	**A•1182**
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052, 716-652-3600	**A•1186-1189**
§† Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720	**A•1190-1194**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310	**A•1198,1201,1212**
Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019	**A•1213**
Coil-Q Corp., Bronxville, NY 10708, 914-337-4775	**A•1222-1223**
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333	**A•1224**
§† Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301	**A•1226-1229,1232**
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200	**A•1258**
El & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721	**B•1482**
EWC, Inc., Englishtown, NJ 07726, 908-446-3110	**A•1235**
Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234	**A•1241**
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012	**A•2360**
† Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600	**A•1251,1321**
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166	**A•2390**
§ Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180, 605-665-9301	**A•1231**
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**A•1263**
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501	**A•1274**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054	**A•1282**
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777	**A•1292**
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314	**A•1305,1307,2594**
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181	**A•1308**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300	**A•1312**
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410	718-441-5207
§† Associated Spring, Barnes Grp., Bristol, CT 06010	203-583-1331
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069	305-979-7920
† Automatic Coil Corp., Miami, FL 33147	305-696-6660
Bey Electric, Inc., Lincoln Park, NJ 07035	201-694-5000
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
† Corona Magnetics, Inc., Corona, CA 91719	909-735-7558
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449	716-652-3600
† Electro Assemblies Corp., Northbrook, IL 60062-2319	708-498-6520
† ESC Electronics Corp., Palisades Pk., NJ 07650	201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823	908-475-3207
Lenox-Fugle Electronics, S. Plainfield, NJ 07080	908-756-1164
Microtran Co. Inc., Valley Stream, NY 11582-0236	516-561-6050
† Newport Manufacturing Co., Santa Ana, CA 92704	800-726-0715
† North Hills Signal Processing, Syosset, NY 11791	516-682-7740
† OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
Schott Corp., Wayzata, MN 55391	612-475-1173
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
† Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5671
§† Toko America, Inc., Mt. Prospect, IL 60056	708-297-0070
† Trans American Transformer, E. Setauket, NY 11733	516-928-0762
Vanguard Electronics Co., Gardena, CA 90248	310-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824	602-861-1856

Cold-Cathode Readout Tubes — See Tubes, Readout (Vol. A)

Cold Plates — See Thermal Platforms (Vol. D)

Collection Systems (MIL)-2440

Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
§ Testone Inc., Skippack, PA 19474-1589	215-584-9658

Collector Rings — See Slip Rings (Vol. B)

Collimators-2900 — *See Vol. D*

Combiners, Microwave — See Couplers, Microwave (Vol. A)

Communications Intelligence (Comint) Systems (MIL)-2440

† Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220	**D•1074**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
† Locus, Inc., State College, PA 16804	814-466-6275
† Locus, Kaman, State College, PA 16804	814-466-6275
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
New Wave Instruments, Provo, UT 84604	801-373-4909
†# Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Communications Systems, FM-1900 — *See Vol. D*

Communications Systems, Laser-1900 — *See Vol. D*

Communications Module, Power Line LANs-1900 — *See Vol. D*

Communication Systems, Megalinks-1900 — *See Vol. D*

Communication Systems, Megaplex-1900 — *See Vol. D*

Communications Systems, Microwave-3450 — *See Vol. A*

Communications Systems, Multiplex-1900 — *See Vol. D*

Communications Systems, Telemetering-1900 — *See Vol. D*

Communications Systems, Telephone-1900 — *See Vol. D*

Communicators, Digital-1900 — *See Vol. D*

Commutators-3500

† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1219**
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100	**B•1306**
Airflyte Elctrns. Co., Bayonne, NJ 07002	201-436-2230
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Danmar Inds., Moorpark, CA 93021	1-805-529-3788
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060	703-552-2111
Kaut & Bux Manufacturing Co., Mundelein, IL 60060	708-949-8505
† Kirkwood Industries Inc., Cleveland, OH 44135	216-267-6200
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278	310-379-2000

Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221

Comparators, Analog – See Comparators, Voltage (Vol. D)

Comparators, Attenuation-3450 – *See Vol. A*

Comparators, Capacitance – See Bridges, Capacitance (Vol. D)

Comparators, Digital-2900 – *See Vol. D*

Comparators, Dimension Calibrators-4100 – *See Vol. D*

Comparators, Frequency-2900 – *See Vol. D*

Comparators, Impedance – See Bridges, Impedance (Vol. D)

Comparators, Inductance – See Bridges, Inductance (Vol. D)

Comparators, Optical-2900 – *See Vol. D*

Comparators, Phase-2900 – *See Vol. D*

Comparators, Resistance – See Bridges, Resistance (Vol. D)

Comparators, Voltage-2900 – *See Vol. D*

Component Handling Equipment, Surface Mount-4100 – *See Vol. D*

Compounds, Encapsulating, Molding, Potting-Also See Plastic Raw Materials-1600 – *See Vol. C*

Compounds, Insulating-3100 – *See Vol. C*

Compression Systems, Image-2000 – *See Vol. D*

Computer-Aided Design Services – See Computers, CAD, CAM, & CAD/CAM (Vol. D), Services, Computer-Aided Design (Vol. D)

Computer Interfaces – See Interfaces, Computer

Computer Logic Circuits – See Cards, Logic (Vol. D), Circuits, Hybrid (Vol. A), Integrated Circuits (Vol. A), Modules, Logic (Vol. A)

Computer Systems, Ruggedized-2000 – *See Vol. D*

Computer Tape Recorders – See Recorders, Computer Data (Vol. D)

Computer Type Indicators – See Displays, Indicator Lights (Vol. B)

Computers, Analog & Hybrid-2025 – *See Vol. D*

Computers, CAD, CAM, & CAD/CAM-2025 – *See Vol. D*

Computers, Digital, Micro - Also See Board Computers and Subassemblies-2025 – *See Vol. D*

Computers, Micro-2025 – *See Vol. D*

Computers, Micro, Ruggedized, for Industrial Applications-2000 – *See Vol. D*

Computers, Mini-2025 – *See Vol. D*

Computers, Personal-2025 – *See Vol. D*

Computer Sets (MIL), Digital Data-2440

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
AMASCO, Torrance, CA 90501 310-781-9494
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
† Cable & Computer Technology Inc., Anaheim, CA 92806 714-937-1341
Dianachart Inc., Rockaway, NJ 07866 201-625-2299
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
† NAVAN Corporation, Media, PA 19063 215-352-8464
† Racal-Guardata, Inc., Herndon, VA 22070 703-471-0892

Computer Software – See Software (Vol. D)

Computer Systems (MIL)-2440

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1145
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1145
Allen Systems, Columbus, OH 43221 614-488-7122
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Cable & Computer Technology Inc., Anaheim, CA 92806 714-937-1341
† Codar Technology, Inc., Longmont, CO 80503 303-776-0472
§† Compucart, Versa Tec, Tampa, FL 33601-2095 .... 800-237-9024;813-251-2431
§ Cyber Sys., Inc., Anaheim, CA 92806 714-502-6950
Data Engineering, Inc., Margate, FL 33063-3206 305-971-0400
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† DY 4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215 617-267-8600
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
Industrial Computer Source, San Diego, CA 92131 619-271-9340

† Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
Innovative Electronics, Inc., Dynatech Corporation, Miramar, FL 33025 305-432-0300
† NAVAN Corporation, Media, PA 19063 215-352-8464
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
Parsytec Inc., West Chicago, IL 60185 708-293-9500
Zendex Corp., Dublin, CA 94568 510-828-3000

Computing Equipment, Peripheral – See Converters, Digital To Paper Tape (Vol. D), Printers (Vol. D), Terminals, Data Display (Vol. D), etc.

Concentrators, Communications-1900 – *See Vol. D*

Conditioners, Power Line – See Regulators & Stabilizers, Voltage (Vol. D), Line Conditioners (Vol. D)

Conductive Elastomers-4525 – *See Vol. C*

Conductive Fabrics, Films & Tapes – See Fabrics, Conductive (Vol. C)

Conductive Floor Coatings & Cleaners-1600 – *See Vol. C*

Conductive Plastic Materials & Parts-4525 – *See Vol. C*

Conduit, Electrical-6000 – *See Vol. C*

Connecting Blocks, Data-2100 – *See Vol. C*

Connecting Blocks, Modular Telephones-2100 – *See Vol. C*

Connector Adapters-2100 – *See Vol. C*

Connector Assemblies, IEEE 488-GPIB-2100 – *See Vol. C*

Connector Backshells-2100 – *See Vol. C*

Connector Blocks, Mother Board-2100 – *See Vol. C*

Connector Boxes & Strips, Power Outlet-2500 – *See Vol. C*

Connectors, AC Power-2100 – *See Vol. C*

Connectors, Antenna – See Connectors, RF, Coaxial & Triaxial (Vol. C)

Connectors, Audio-2100 – *See Vol. C*

Connectors, Back Panel – See Connectors, Wirewrap (Z-3 Level) (Vol. C)

Connectors, Battery-2100 – *See Vol. C*

Connectors, Cable-2100 – *See Vol. C*

Connectors, Card – See Connectors, Printed Circuit, Card Edge (Vol. C)

Connectors, Circular, Metal Shell-2100 – *See Vol. C*

Connectors, Circular, Plastic/Composite Shell-2100 – *See Vol. C*

Connectors, Data-2100 – *See Vol. C*

Connectors, DC Power-2100 – *See Vol. C*

Connectors, DIN-2100 – *See Vol. C*

Connectors, D Subminiature-2100 – *See Vol. C*

Connectors, Edgeboard – See Connectors, Printed Circuit, Card Edge (Vol. C)

Connectors, Elastomeric-2100 – *See Vol. C*

Connectors, Fiber Optic-2475

§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... B•1202,1204-1206
§ Harting Elektronik, Inc., Hoffman Estates, IL 60195, 708-519-7700, ext. 200 .... C•1345
§ Richard Hirschmann of America Inc., Riverdale, NJ 07457, 201-835-5002 .... C•1347
§ LEMO U.S.A., Inc., Santa Rosa, CA 95406, 707-578-8811, 800-444-LEMO (5366) .... C•1369
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1325
# Accu-Tech Corporation, Roswell, GA 30076-3890 .... 404-751-9473;800-221-4767
ADC Telecommunications, Inc., Minneapolis, MN 55435 612-938-8080
Air Electro Inc., Van Nuys, CA 91406 .... 213-873-6400;818-988-4400
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
§ Amphenol, Bendix Connector Operations, Sidney, NY 13838 607-563-5011
§ AT&T Microelectronics, Allentown, PA 18103 .... 1-800-372-2447;In Can.:1-800-553-2448
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 .... 1-800-344-0223, Ext. 1027
Berg Electronics, Camp Hill, PA 17011 800-237-2374
Braxton Mfg., Watertown, CT 06795 203-274-6781
Cabletron Systems, Inc., Rochester, NH 03867 603-332-9400
# Clifford of Vermont, Inc., Bethel, VT 05032 .... 802-234-9921;800-451-4381
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379 508-580-0111
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411

§ CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069	619-744-8182; 800-334-3815
§ Custom Computer Cable, Inc., Eden Prairie, MN 55344	612-941-5651;1-800-343-5553
§ Daitron, Inc., Tigard, OR 97223	503-620-2879
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
DDK Electronics, Inc., Markham, Ont., CANADA L3R 9T2	416-470-1346
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Dynacast Inc., Yorktown Heights, NY 10598	914-962-6300
§ Electronic Components & Materials, GTE Sylvania, Warren, PA 16365	814-726-6500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772	516-758-0700
§ ERNI Components, Richmond, VA 23236	804-794-6367
# Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
W.W. Fischer Electronic Connectors, Atlanta, GA 30338	1-800-551-0121
Foxconn International, Hon Hai, Sunnyvale, CA 94086	408-749-1228
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080	201-769-3200
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
§† Greenwich Instruments USA, Charlotte, NC 28205	704-376-1021
GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065	805-522-7958
§† Honeywell Microswitch Div., Richardson, TX 75081	214-470-4271
†# Hughes Aircraft Co., Interconnect Systems Div., Irvine, CA 92714	714-660-5772
§ Ideal Industries, Inc., Sycamore, IL 60178	815-895-5181
† Interoptics, Purdy Group, Burlingame, CA 94010	415-347-7727
ITT Cannon, Santa Ana, CA 92705-5684	714-557-4700
§ KEL Connectors, Inc., KEL Corp., Sunnyvale, CA 94086	408-720-9044
† Light Control Systems Inc., M/A COM Inc., Hudson, NH 03051	603-883-8300
§ LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
MACOM, Inc., Lowell, MA 01851	617-272-3000
§ Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701	516-226-8950
† 3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
3M Telecom Markets Division, Austin, TX 78726	512-984-3400;800-426-8626
§ Methode Electronics, Inc., Chicago, IL 60656	708-867-9600
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
§ MOLEX, Inc., Lisle, IL 60532	708-969-4550
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ OFTI, Westford, MA 01886	508-692-6606
# Olympic Wire & Cable, Fairfield, NJ 07004	201-227-7996
† Optelecom, Inc., Gaithersburg, MD 20877	301-840-2121
Oxley Inc., Branford, CT 06405	203-488-1033
§ Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
Radiall, Inc., Stratford, CT 06497	203-386-1030
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444
Rifocs Corp., Camarillo, CA 93012	805-389-9800
§ RMS, Electrical Connector Division, Minneapolis, MN 55433	612-786-1520
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
Sabritec, Irvine, CA 92714	714-250-1244
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505	310-517-7770
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Siltronics Ltd., Dover, MA 02030	617-329-4068
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
I I Stanley Co., Inc., Irvine, CA 92714	1-800-LED-LCD1
Swan Associates, New Haven, CT 06534	203-387-3917
Swiss Jewel Company, Philadelphia, PA 19106	215-925-2867
§ TELTEC, INC., Minneapolis, MN 55425	612-854-9632
§ TELTEC, Inc., Minneapolis, MN 55425	612-854-9177
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401	803-676-2900
† Veam, Litton Systems, Watertown, CT 06795	203-274-9681
# Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Connectors, Filtered, EMI/RFI-Also See Gaskets, Shielding, RF-2100 — *See Vol. C*

Connectors, Flat Cable (Incl. Flexible)-2100 — *See Vol. C*

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Connectors, Hermetically Sealed, Pressurized, or Waterproof-2100 — *See Vol. C*

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Connectors, Mini-DIN — See Connectors, DIN (Vol. C)

Connectors, Missile (Umbilicals, Interstage, Post Boost)-2440

Adam Technologies Inc., Roselle Park, NJ 07204	908-245-4000
† Alden Products Co., Brockton, MA 02403	508-583-0160
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
§† Amphenol, Bendix Connector Operations, Sidney, NY 13838	607-563-5011
# Array Connector Corporation, Miami, FL 33166-5598	305-591-7530
Burndy Corporation, An FCI Company, Norwalk,, CT 06856	203-838-4444
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428	612-537-1010
Connectronics Corp., Toledo, OH 43607	419-537-0020
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180	605-665-9301
† Detoronics Corporation, S. El Monte, CA 91733	818-579-7130
†# Hughes Aircraft Co., Interconnect Systems Div., Irvine, CA 92714	714-660-5772
§ Hugin Industries Inc., Los Altos, CA 94022	415-961-2950
Hypertronics Corp., Hudson, MA 01749	508-568-0451;800-225-9228
† ITT Cannon, Santa Ana, CA 92705-5684	714-557-4700
† Kemlon Products & Development Company, Houston, TX 77021	713-747-5020
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
§ PCD, Peabody, MA 01960	508-532-8800
† Pyle-National, Chicago, IL 60651	312-342-6300 x210
† Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
† Sabritec, Irvine, CA 92714	714-250-1244
† Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584	309-693-3300
† Veam, Litton Systems, Watertown, CT 06795	203-274-9681
§† Viking Electronics, Inc., Chatsworth, CA 91311	818-341-4330

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Connectors, Stripline-2100 — *See Vol. C*

Connectors, Surface Mount-2100 — *See Vol. C*

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Connectors, Zero & Low Insertion Force-2100 — *See Vol. C*

Connectors & Terminals, Push-on, Quick Disconnect-2100 — *See Vol. C*

Connectors (MIL), Fiber Optic-2440

† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
† BTC Electronic Components, Old Bridge, NJ 08857	908-679-9300
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† 3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
§ OFTI, Westford, MA 01886	508-692-6606
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200

Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
† Veam, Litton Systems, Watertown, CT 06795	203-274-9681

Connectors (MIL), Flat Cable-2440

AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200	**C•1147**
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Catamount Manufacturing, Inc., Orange, MA 01364, 1-800-222-5969	**C•1723**
§† CW Industries, Southhampton, PA 18966, 215-355-7080	**C•1304**
LMI Connectors Inc., Boca Raton, FL 33487-2710, 407-994-5896;800-247-0564	**C•1398**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
Amphenol Spectra-Strip/ITD, Hamden, CT 06514	203-281-3200
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
Autosplice, Inc., San Diego, CA 92121	619-535-0077
Autoswage Products, Shelton, CT 06484	203-929-1401
Beau Interconnect Systems, Vernitron Corp., Laconia, NH 03247	603-524-5102
† BTC Electronic Components, Old Bridge, NJ 08857	908-679-9300
Burndy Corporation, An FCI Company, Norwalk,, CT 06856	203-838-4444
§# Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
Data Set Cable Co., Inc., Ridgefield, CT 06877	203-438-9684;800-344-9684
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135	408-922-9000
§† 3M-Electronic Products Division, Austin, TX 78726	1-800-225-5373 Sls. & Prod. Info.
§ ODU-USA, Inc., ODU-Kontakt GmbH, Germany, Camarillo, CA 93012	805-484-0540
§† Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
§ Robinson Nugent, Inc., New Albany, IN 47150	812-948-0564
§ Samtec, Inc., New Albany, IN 47151-1147	1-800-672-6832
† Star-Tron Corporation, Providence, RI 02909	401-274-5090
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
§ TELTEC, INC., Minneapolis, MN 55425	612-854-9632
TELTEC, Inc., Minneapolis, MN 55425	612-854-9177
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401	803-676-2900

Connectors (MIL), Power-2440

Caton Connector Corp., Kingston, MA 02364, 617-585-4315	**C•1275,1277**
† Hypertronics Corp., Hudson, MA 01749, 508-568-0451;800-225-9228	**C•1350**
§ Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561	**C•1475**
§ Anderson Power Products, Div. of High Voltage Engineering, Boston, MA 02135	617-787-5880
† BTC Electronic Components, Old Bridge, NJ 08857	908-679-9300
† Burndy Corporation, An FCI Company, Norwalk,, CT 06856	203-838-4444
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007	708-981-6000
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428	612-537-1010
Connectronics Corp., Toledo, OH 43607	419-537-0020
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180	605-665-9301
† Dielectric Sciences, Inc., HVT Group, Chelmsford, MA 01824	508-250-1507
§ Ideal Industries, Inc., Sycamore, IL 60178	815-895-5181
§† ITT Cannon, Santa Ana, CA 92705-5684	714-557-4700
ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
§† 3M-Electronic Products Division, Austin, TX 78726	1-800-225-5373 Sls. & Prod. Info.
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
§† Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
§† Positronic Industries, Inc., Springfield, MO 65801	417-866-2322
† Pyle-National, Chicago, IL 60651	312-342-6300 x210
Sabritec, Irvine, CA 92714	714-250-1244
§ Schurter, Inc., Petaluma, CA 94954	800-848-2600 ext.62
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401	803-676-2900
U.S. Terminals Inc., Cincinnati, OH 45243	513-561-8145
† Veam, Litton Systems, Watertown, CT 06795	203-274-9681
† Walther Electric Corporation, WALTHER WERKE, Ferdinand Walther, E. Brunswick, NJ 08816	908-238-1166
§† Wire-Pro, Inc., Salem, NJ 08079	609-935-7601;609-935-7651

Connectors (MIL), Printed Circuit-2440

† AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200	**C•1147**
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Atlee Inc., North Andover, MA 01845, 508-681-1003	**C•1015,1671**
Beau Interconnect Systems, Vernitron Corp., Laconia, NH 03247, 603-524-5102	**C•1271**
§ Circuit Assembly Corp., Irvine, CA 92718-2703, 714-855-7887	**C•1281**
§† CW Industries, Southhampton, PA 18966, 215-355-7080	**C•1304**
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680, 714-669-9473	**C•1672**
† Hypertronics Corp., Hudson, MA 01749, 508-568-0451;800-225-9228	**C•1349**
§ Sullins Electronics Corp., San Marcos, CA 92079, 619-744-0125	**C•1473**
§† Texas Instruments, Connector Systems, Attleboro, MA 02703, 508-699-5269;508-699-3450	**C•1493-1494,1498**
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020	**C•1500,1502**
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
Autosplice, Inc., San Diego, CA 92121	619-535-0077
Autoswage Products, Shelton, CT 06484	203-929-1401
† Berg Electronics, Camp Hill, PA 17011	800-237-2374
† BTC Electronic Components, Old Bridge, NJ 08857	908-679-9300
Burndy Corporation, An FCI Company, Norwalk,, CT 06856	203-838-4444
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007	708-981-6000
Components Corp., Denville, NJ 07834	201-627-0290
Crane Electronics, Inc., Cincinnati, OH 45212	800-676-7644
† CTS Corporation, Elkhart, IN 46514	219-293-7511
† CTS Corp., Connector Products, New Hope, MN 55428	612-533-3533
§† Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180	605-665-9301
† EBY Company, Philadelphia, PA 19124	215-537-4700
EDA Inc., Div. of Connector, La Habra, CA 90631	213-697-7151
§† Elco Corp., Electronic Connector Div., Huntingdon, PA 16652	814-643-0700
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§† ERNI Components, Richmond, VA 23236	804-794-6367
§† IEH Corp., Bay Ridge, NY 11220	718-492-4440
§† ITT Cannon, Santa Ana, CA 92705-5684	714-557-4700
§† 3M-Electronic Products Division, Austin, TX 78726	1-800-225-5373 Sls. & Prod. Info.
§† Methode Electronics, Inc., Chicago, IL 60656	708-867-9600
† Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
† Milton Ross Co., Warrington, PA 18976	215-491-0600
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
Nanonics Corporation, Phoenix, AZ 85027	602-581-6188
Oxley Inc., Branford, CT 06405	203-488-1033
§† Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
† PCD Peabody, MA 01960	508 532-6800
§† Positronic Industries, Inc., Springfield, MO 65801	417-866-2322
† Pyle-National, Chicago, IL 60651	312-342-6300 x210
§ Schurter, Inc., Petaluma, CA 94954	800-848-2600 ext.62
Siltronics Ltd., Dover, MA 02030	617-329-4068
† Star-Tron Corporation, Providence, RI 02909	401-274-5090
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
TELTEC, INC., Minneapolis, MN 55425	612-854-9632
§ TELTEC, Inc., Minneapolis, MN 55425	612-854-9177
† Teradyne Connection Sys., Teradyne, Inc., Nashua, NH 03060	603-889-5156
§† Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401	803-676-2900
§† Wire-Pro, Inc., Salem, NJ 08079	609-935-7601,609-935-7651

Connectors (MIL), RF-2440

§† ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103	**C•1287**
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Caton Connector Corp., Kingston, MA 02364, 617-585-4315	**C•1275**
Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571	**C•1291**
Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616	**C•1309**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366	**C•1416,1419**
† North Hills Signal Processing, Syosset, NY 11791, 516-682-7740	**A•2440**
Spectrum Control, Inc., Erie, PA 16506, 814-835-4000	**A•1678, C•1468**
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020	**C•1499-1505**
† Tru-Connector Corp., Peabody, MA 01960, 508-532-0775;1-800-262-9787;1-800-COAXTRU	C•1507
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
§† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
§ AVA Electronics Corporation, Drexel Hill, PA 19026	215-284-2500
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226	602-940-0740
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428	612-537-1010
§ Coax Connection, Peekskill, NY 10566	914-736-1010
† Compac, Holbrook, NY 11741	516-585-3400
§ Compar, D.G.W. Electronics Corporation, Markham, Ontario, CANADA L3R 4Z4	416-475-6500
§# Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
§† Delta Electronics Mfg. Corp., Beverly, MA 01915	508-927-1060
§† ITT Cannon/Sealectro, New Britian, CT 06051	203-223-2700
§ ITT Pomona Electronics, Pomona, CA 91766	909-469-2900
§† Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
Lucas Weinschel, Gaithersburg, MD 20884-6001	301-948-3434
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101	617-890-4750
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936	215-699-5373
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
Pacific Microtronics Corp., New York, NY 10021	212-517-5622
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018	408-730-0300;800-PENSTOCK
† Pyle-National, Chicago, IL 60651	312-342-6300 x210
Rowe Industries, Inc., Toledo, OH 43612	419-729-9761
† Sabritec, Irvine, CA 92714	714-250-1244
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584	309-693-3300

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Consoles (MIL), ECCM-2440

Electrorack Products Co., Anaheim, CA 92806, 714-776-5420	**C•1097**
Alusett U.S.A., Inc., Peekskill, NY 10566	914-737-0120

† Amco Engineering, Schiller Pk, IL 60176 ... 708-671-6670;800-833-3156
† BTC Electronic Components, Old Bridge, NJ 08857 ... 908-679-9300
Electronic Packaging System, Marion, IA 52302 ... 319-377-3423
ELMA Electronic Inc., Fremont, CA 94538 ... 510-656-3400

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† American Aerospace Controls, Farmingdale, NY 11735 ... 516-694-5100
Arrow Hart Controls, Products Unlimited Corp., Sterling, IL 61081 ... 815-626-0300
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 ... 414-449-7326
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 ... 408-292-4025
The J. M. Ney Company, Bloomfield, CT 06002 ... 203-242-2281
† PCD, Peabody, MA 01960 ... 508-532-8800
† Ross Engineering Corp., Campbell, CA 95008 ... 408-377-4621

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Contacts (MIL), Assemblies & Holders-2440

† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... C•1163
† Electro Miniatures Corp., Moonachie, NJ 07074, 201-460-0510 ... B•1251
† Fabricast, S. El Monte, CA 91733, 818-443-3247 ... B•1255
AMI-DDC, Cedar Knolls, NJ 07927 ... 201-267-2000
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 ... 203-265-8910
§† Amphenol, Bendix Connector Operations, Sidney, NY 13838 ... 607-563-5011
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 ... 203-743-9272; 800-627-7100
Autosplice, Inc., San Diego, CA 92121 ... 619-535-0077
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 ... 612-537-1010
§ Compar, D.G.W. Electronics Corporation, Markham, Ontario, CANADA L3R 4Z4 ... 416-475-8500
† Danmar Inds., Moorpark, CA 93021 ... 1-805-529-3788
Delbert Blinn Co., Inc., Pomona, CA 91769 ... 909-629-3900
Deringer Mfg. Co., Mundelein, IL 60060 ... 708-566-4100
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
Hiram Jones Electronics, No. Hollywood, CA 91605 ... 213-875-0213
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298 ... 215-842-3675
The J. M. Ney Company, Bloomfield, CT 06002 ... 203-242-2281
Texas Instruments, Connector Systems, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450
§† Tri-Star Elctrns., Dallas, TX 75243 ... 214-553-8011
United Foam Plastics, Georgetown, MA 01833 ... 508-352-2200

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Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 ... B•1019
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690 ... B•1020
C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657, 800-347-2484 ext. 4529 ... B•1027
Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530 ... B•1033
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ... D•1117
§ AFE Technologies Inc., Charlottesville, VA 22901 ... 804-974-7801
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 ... 516-921-7300
§ Cirrus Logic, Inc., Fremont, CA 94538 ... 510-623-8300
§# Craft Data, Inc., Mission Viejo, CA 92691 ... 714-582-8284
General Digital Corp., Enfield, CT 06082 ... 203-741-7171
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN ... 415-288-0390
§ IICon Corporation, Morgan Hill, CA 95037 ... 408-779-7466
Imagraph Corp., Microfield Graphics, Chelmsford, MA 01824 ... 508-256-4624
Imagraph Corp., Microfield Graphics, Chelmsford, MA 01824 ... 508-256-4624
Leeds & Northrup, General Signal, North Wales, PA 19454 ... 215-699-2000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
§ Ziatech, San Luis Obispo, CA 93401 ... 805-541-0488

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Controls, Frequency-2200 — *See Vol. D*

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Controls, Machine Tool-2200 — *See Vol. D*

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Converters, Binary to Decimal-2325 — ***See Vol. D***

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Converters, DC to DC, 5 to 10 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 10 to 15 W Output — See Converters DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 1 W to 300 W Output-4025 — ***See Vol. D***

Converters, DC to DC, 30 to 50 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

Converters, DC to DC, 50 to 200 W Output — See Converters, DC to DC, 1 W to 300 W Output (Vol. D)

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Converters, DC to DC, Greater than 300 W Output-4025 — ***See Vol. D***

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Converters, Digital to Analog-2325 — ***See Vol. D***

Converters, Digital to Paper Tape-2000 — ***See Vol. D***

Converters, Digital to Resolver-2325 — ***See Vol. D***

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Converters, Thermal-5300

Best Technology Inc., Seattle, WA 98109, 206-382-1300	**B•1863**
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100

Converters, UHF to VHF-1900 — ***See Vol. D***

Converters, VLF to HF-1900 — ***See Vol. D***

Converters, Voltage to Frequency-2325 — ***See Vol. D***

Converters (MIL) DC to DC-2440

† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
† Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930	**D•2067**
Apex Microtechnology Corp., Tucson, AZ 85741, 602-690-8600	**D•2069**
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	**D•1574-1576,2056-2057**
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	**D•1585-1586**
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1403**
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100	**D•2112-2118**
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1817,2130**
† Modular Devices, Shirley, NY 11967, 516-345-3100	**D•1837-1842,1844,2136**
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•2284**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	D•2137
Polytron Devices, Inc., Paterson, NJ 07544, 201-345-5885	**D•2292**
Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211	**A•2508**
RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	**D•2204**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	D•1960
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	**D•2212-2214**
Wilmore Electronics Co., Inc., Hillsborough, NC 27278, 919-732-9351	**D•2041,2218**
† Adtech Power Inc., Anaheim, CA 92806	714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003	805-642-0660
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
† EG & G Power Systems, Inc., Covina, CA 91724	818-967-9521
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474

† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† Film Microelectronics Inc., Peabody, MA 01960	508-532-9913
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
Interelectronics Corp., Congers, NY 10920	914-EL8-8000
International Power Devices Inc., Boston, MA 02134	617-782-3331
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
† Power Functions Engineering, Garland, TX 75042	214-278-0996
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402	805-528-5858
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
ULTRAVOLT, Inc., Ronkonkoma, NY 11779	800-876-POWER
§† Vicor Corp., Andover, MA 01810	508-470-2900
§ Wall Industries, Exeter, NH 03833	603-778-2300

Converters (MIL), Frequency-2440

Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512**
Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	**D•2230**
† **Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500**	**D•2232,2234,2238**
† **Avtel/Unitron, Dallas, TX 75238, 214-340-8600**	**D•2241-2243**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2248**
† **Modular Devices, Shirley, NY 11967, 516-345-3100**	**D•1837-1840,1842,2136**
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•2284**
† Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
§† EIP Microwave, Inc., Milpitas, CA 95035	408-945-1477
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
† Georator Corp., Manassas, VA 22110-5512	800-523-9938
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
† Magnum Microwave Corp., Fremont, CA 94538	510-657-9898
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751

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Coulometers — See Timers, Electrolytic Cell (Vol. D)

Countermeasures (CM) Sets (MIL)-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050

Counter/Timers-2900 — *See Vol. D*

Counters, Bidirectional-2200 — *See Vol. D*

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Counters, Electromagnetic-2200 — *See Vol. D*

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Counters, Photoelectric-2200 — *See Vol. D*

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Counters, Proportional — See Counters, Particle (Vol. D)

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Couplers, Communications, Acoustic, Telephone-1900 — *See Vol. D*

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Couplers, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... B•1202-1206,1209, C•1163
†**Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1219,1287**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1325
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1332
T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227 .... B•1814
#Accu-Tech Corporation, Roswell, GA 30076-3890 .... 404-751-9473;800-221-4767
AOFR, Inc., Richardson, TX 75081 214-644-1394
Aster, a Porta Systems Company, Hopkinton, MA 01748 508-435-0101
§AT&T Microelectronics, Allentown, PA 18103 .... 1-800-372-2447;In Can.:1-800-553-2448
§AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 .... 1-800-344-0223, Ext. 1027
BT & D Technologies, Kennett Square, PA 19348 .... 215-444-6888;800-545-4306
§†Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Corning Incorporated, Opto-Electronics Group, Corning, NY 14831 1-800-525-2524
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550 508-347-9191
GTE Control Devices, Inc., Standish, ME 04084 207-642-4535
§GTE Supply. GTE, Irving, TX 75038 800-433-4837
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4544
†Interoptics, Purdy Group, Burlingame, CA 94010 415-347-7727
§3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
3M Telecom Markets Division, Austin, TX 78726 .... 512-984-3400;800-426-8626
§†Methode Electronics, Inc., Chicago, IL 60656 708-867-9600
§Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
#Olympic Wire & Cable, Fairfield, NJ 07004 201-227-7996
§Onan Power/Electronics, Minneapolis, MN 55344-3577 612-943-4600
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621 714-521-8673
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500

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Couplers, Rotary-3450 — *See Vol. A*

Couplers (MIL), Directional-2440

§†**Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 .... A•1655-1656**
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 .... A•2440-2441
†Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
†Dielectric Communications, General Signal, Raymond, ME 04071 .... 207-655-4555; 800-341-9678
†International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
†KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
MACOM, Inc., Lowell, MA 01851 617-272-3000
§†M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§†Midwest Microwave, Saline, MI 48176-9569 .... 313-429-4773;800-521-4410
†Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 .... 514-694-6666; 800-724-3911
†Pasternack Enterprises, Irvine, CA 92713 714-261-1920
†Pro Com Technology Inc., Plainview, NY 11803 .... 516-293-4443;800-762-3785
†RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
†Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§†ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
†TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
†Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
†TRM, Inc., Manchester, NH 03110 603-627-6000
†Werlatone, Inc., Brewster, NY 10509 914-279-6187

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Couplings, Shaft, Rigid & Flexible-2400 — *See Vol. C*

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Crystals, Quartz, Low Frequency (1 KHz-999KHz)-2300 — *See Vol. A*

Crystals, Quartz, Strip-2300 — *See Vol. A*

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†**Bliley Electric Co., Erie, PA 16506, 814-838-3571 .... A•1344**
†**Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248 .... A•1348**
†**CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 .... A•1373-1374**
†**Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 .... A•1402**
†**McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 .... A•1415,1417**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 .... A•1420-1421,1423
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 .... A•1425,1427
§†**M-Tron Industries, Yankton, SD 57078, 605-665-9321 .... A•1431**
Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 .... A•1445
Raltron Electronics, Miami, FL 33172, 305-593-6033 .... A•1460
†**Statek Corp., Orange, CA 92668, 714-639-7810 .... A•1482**
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
§†Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 819-821-4524
Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
†CTS Corporation, Elkhart, IN 46514 219-293-7511
†EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
†Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
§†KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
†Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
†Piezo Technology Inc., Orlando, FL 32804 407-298-2000
†Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
†Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248 717-243-5929
†Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 .... 305-563-1333;800-359-5400
†Sentry Manufacturing Company, Chickasha, OK 73023 405-224-6780
†ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188 617-337-4200
†Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Cups, Encapsulation-1600 — *See Vol. C*

Curing Systems, Photo Magnetic-1600 — *See Vol. C*

Current Limiters (MIL)-2440

KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 .... A•1969
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... B•1889
§Bussmann Division, Cooper Industries, St. Louis, MO 63178 314-394-2877
INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
†NWL Transformers, Bordentown, NJ 08505 609-298-7300
Quality Thermistor, Boise, ID 83709 208-377-3373

Current Sensors-Also See Transducers, Volt, etc.-2200 — *See Vol. D*

Current Sources-4000 — *See Vol. D*

Custom Molding Services, Plastics — See Services, Custom Molding, Plastics (Vol. D)

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Dampers, Servo-4900 — *See Vol. D*

Dampers, Structural, Chassis, Panel, etc. — See Mounts, Shock & Vibration (Vol. C)

Data Acquisition & Reduction Systems-Also See Modules, Data Acquisition-2325 — *See Vol. D*

Data Collection Equipment, Hand Held-2000 — *See Vol. D*

Data Collection Equipment, Modular-2000 — *See Vol. D*

Data Collection Equipment, Portable-2000 — *See Vol. D*

Data Compressors, Digital-2000 — *See Vol. D*

Data Display Indicators — See Displays Indicator Lights (Vol. B)

Data Display Systems — See Displays, CRT (Vol. A), Terminals, Data Display (Vol. D)

Data Links, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... B•1203,1207-1208, C•1163
Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 .... D•1003,1022-1023
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117,1130-1131
§† **Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001 .... B•1214-1215**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1218-1219**
§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1332**
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 .... B•1225,1227**
§ **S.I. Tech, Batavia, IL 60510, 708-232-8640 .... B•1229**
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ AT&T Microelectronics, Allentown, PA 18103 .... 1-800-372-2447;In Can.:1-800-553-2448
AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 .... 1-800-344-0223, Ext. 1027
Atlantic Scientific Corporation, W. Melbourne, FL 32904 1-800-544-4737
§ Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311 .. 818-718-6300
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
§† Cooper Industries/Belden Div., Richmond, IN 47375 .... 317-983-5200;800-BELDEN-1
DDK Electronics, Inc., Markham, Ont., CANADA L3R 9T2 416-470-1346
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
† Dymec Inc., Winchester, MA 01890 617-729-7870
ETM Electromatic Inc, Newark, CA 94560 510-797-1100
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6 613-226-4000
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359 617-826-0099
† Force, Inc., Christiansburg, VA 24073 703-382-0462
W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
§† Greenwich Instruments USA, Charlotte, NC 28205 704-376-1021
H & L Instruments, Burlingame, CA 94010 415-342-7850
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Richard Hirschmann of America Inc., Riverdale, NJ 07457 201-835-5002
§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
ICS Electronics Corp., Milpitas, CA 95035-5545 .... 408-263-5500;1-800-952-4499
† Interoptics, Purdy Group, Burlingame, CA 94010 415-347-7727
Jaycor, San Diego, CA 92186 619-453-6580
KineticSystems Corp., Lockport, IL 60441 815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7 604-421-8733
Lextel, Inc., Wakefield, MA 01880 617-245-5017
§† Lightwave Communications, Inc., Milford, CT 06460 203-878-9838
§ Lutze, Inc., Charlotte, NC 28217-9805 .... 704-357-8835;800-447-2371
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701 516-226-8950
3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 310-828-7496
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Optivision, Inc., Davis, CA 95616 .... 916-757-4850;800-562-8934
† Ortel Corp., Alhambra, CA 91803 818-281-3636
Packard Electric, General Motors, Warren, OH 44486 .... 216-373-2121,1-800-PACKARD
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 510-471-9717
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
§ Telemet, Geotel, Inc., Hauppauge, NY 11788 516-436-7260
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ TELTEC, Inc., Minneapolis, MN 55425 612-854-9177
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401 803-676-2900
§† Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 .. 512-388-2522
Zexco, Van Nuys, CA 91401 818-997-7895

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Data Loggers-2325 — *See Vol. D*

Data Recording, Hard Disk-2000 — *See Vol. D*

Data Security Devices: Encryptors, Decryptors — See Security Systems, Data (Vol. D)

Data Switches — See Switches, Data (Vol. D)

Data Systems (MIL)-2440

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 .... D•1117
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1218
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
Cyber Sys., Inc., Anaheim, CA 92806 714-502-6950
† Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
†# Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Transmagnetics, Farmingdale, NY 11735 516-293-3100

Data Translators — See Translators, Data

DCXO — See Oscillators, Digitally Compensated Crystal (Vol. A)

Decade Boxes, Capacitance-2900 — *See Vol. D*

Decade Boxes, Inductance-2900 — *See Vol. D*

Decade Boxes, Resistance-2900 — *See Vol. D*

Decade Boxes, Resistance, Programmable-2900 — *See Vol. D*

Decade Boxes, Transformer-2900 — *See Vol. D*

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Decoders, Digital To Analog — See Converters, Digital To Analog (Vol. D)

Decoders, Pulse-1900 — *See Vol. D*

Decoders, Readout — See Drivers & Decoders For Readouts (Vol. B)

Decoders, Telemetry — See Decoders, Tone (Vol. D)

Decoders, Tone-1900 — *See Vol. D*

Decoders, Video-1900 — *See Vol. D*

Decontaminants — See Cleaners & Solvents (Vol. C)

Decoys (MIL), Buoy-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
# NAVAN Corporation, Media, PA 19063 215-352-8464

Decoys (MIL), IR Flare-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100

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Deep Drawn Metal Cases, Enclosures, Stampings — See Cases, Equipment, Instrument, Meter (Portable) (Vol. C), Cases Equipment, Instrument, Meter (Stationary) (Vol. C), Enclosures, Metal (Vol. C), Stampings (Vol. C)

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Delay Lines, Cable-2350 — *See Vol. A*

Delay Lines, Digital-2350 — *See Vol. A*

Delay Lines, Distributed Constant (Fixed)-2350 — *See Vol. A*

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Delay Lines, Programmable-2350 — *See Vol. A*

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Delay Lines, Ultrasonic-2350 — *See Vol. A*

Delay Lines, Video — See Delay Lines, Ultrasonic (Vol. A)

Delay Lines (MIL)-2440

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 .... A•1514
† **Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 .... A•1528-1529,1543-1544**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 .... A•1552-1565**
§† **JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 .... A•1567**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 .... A•1568-1569**

† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900	**A•1648**
† Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900	**A•1576**
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211	**A•2508**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054	**A•1577**
† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960	**A•1579**
† Technitrol, Philadelphia, PA 19134, 215-426-9105	**A•1580-1581**
† Automatic Coil Corp., Miami, FL 33147	305-696-6660
Bel Fuse, Jersey City, NJ 07302	201-432-0463
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226	602-940-0740
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735	516-694-0125
Datatronics, Inc., Romoland, CA 92585	909-928-7700
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† Hytek Microsystems, Inc., Carson City, NV 89706	702-883-0820
† Phonon Corporation, Simsbury, CT 06070	203-651-0211
† Sawtek Inc., Orlando, FL 32860-9501	407-886-8860
† ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188	617-337-4200
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291

Demagnetizers-1850 — *See Vol. A*

Demodulators-1900 — *See Vol. D*

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Desoldering Tools & Equipment — See Soldering Accessories (Vol. C); Soldering Equip. (Vol. C), Soldering Guns (Vol. C), etc.

Detection & Ranging Systems (MIL)-2440

† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
E M S Development Corp., Farmingdale, NY 11735	516-293-7900
§† Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056	708-803-5100
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
§ Namco Controls Corporation, Mentor, OH 44060	216-946-9900
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400

Detection Systems, Laser-3700

# Norman N. Axelrod Assocs.:Electro-optical, Laser, & Machine Vision Div., New York, NY 10028	212-228-0900
Eltec Instruments Inc., Daytona Bch., FL 32120	904-253-5328
§ Laser Imaging Systems Inc., Punta Gorda, FL 33950	813-639-3533
§ Namco Controls Corporation, Mentor, OH 44060	216-946-9900
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626	714-662-3232;800-366-7010
§ SC Technology, Inc., Livermore, CA 94550	510-373-9230
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
Spiricon, Inc., Logan, UT 84321	801-753-3729

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Detectors, Arc (for high power tubes)-2900 — *See Vol. D*

Detectors, RF-2900 — *See Vol. D*

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Detectors, Coaxial-2900 — *See Vol. D*

Detectors, Corona — See Testers, Corona (Vol. D)

Detectors, Crystal-2300 — *See Vol. A*

Detectors, Fiber Optic-2475

† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902	**B•1312,1315**
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
† EG & G Judson, Montgomeryville, PA 18936	215-368-6900
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
# Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550	508-347-9191
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
§† Germanium Power Devices, Andover, MA 01810-3065	508-475-5982
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820	908-549-9001
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Ortel Corp., Alhambra, CA 91803	818-281-3636
# Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
PULNiX America, Inc., Sunnyvale, CA 94086	408-733-1560
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
† Silicon Sensors, Dodgeville, WI 53533	608-935-2707
Spiricon, Inc., Logan, UT 84321	801-753-3729
I I Stanley Co., Inc., Irvine, CA 92714	1-800-LED-LCD1
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933
Swan Associates, New Haven, CT 06534	203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085

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Detectors, GaAs-3450 — *See Vol. A*

Detectors, Gas-2900 — *See Vol. D*

Detectors, Impedance — See Meters, Impedance (Vol. D)

Detectors, Infrared-3700

† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902	**B•1312,1315**
§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815	**B•1136**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442	**B•1153**
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960	**B•1317-1318**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1324**
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
† Astro International Corp., League City, TX 77573	713-332-2484
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164
† Barnes Engineering Div., EDO Corporation, Shelton, CT 06484	203-926-1777
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Dexter Research Ctr., Inc., Dexter, MI 48130	313-426-3921
§ Dialight Corporation, Manasquan, NJ 08736	908-223-9400
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
† EG & G Judson, Montgomeryville, PA 18936	215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
Elna America, Inc., Cypress, CA 90630	714-761-8600
Eltec Instruments Inc., Daytona Bch., FL 32120	904-253-5328
The Eppley Laboratory, Inc., Newport, RI 02840	401-847-1020
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550	508-347-9191
§ George Risk Industries, Inc., Kimball, NE 69145	308-235-4645
§† Germanium Power Devices, Andover, MA 01810-3065	508-475-5982
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
† Graseby Infrared, Graseby PLC, Orlando, FL 32826	407-282-7700
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
HEI, Inc., Optoelectronics Div., Victoria, MN 55386	612-443-2500
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Honeywell Microswitch Div., Richardson, TX 75081	214-470-4271
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
§ Lite-On Inc., Milpitas, CA 95035	408-946-4873
§ Marktech International Corp., Latham, NY 12110	518-786-6591
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
† OptoElectronics Textron, Petaluma, CA 94975-0039	707-763-5900
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
Peter Parts & Assocs., Webster, NY 14580	716-265-2540
Process & Analytical Instruments Div., A Subsidiary of Ametek Inc., Pittsburgh, PA 15238	412-828-9040
§ Promax-Johnton Electronic Corp., Irvine, CA 92714	714-975-1245
Quality Technologies, Sunnyvale, CA 94086	408-720-1440
Quantex Corporation, Rockville, MD 20850	301-258-2701;800-992-5149 (Sls. only)
† Raytheon Co., Electronic Components Division, Waltham, MA 02254	617-899-8400
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626	714-662-3232;800-366-7010
§# Milton Roy Co, Process & Environ., Orange, CA 92665-4134	714-974-5560
† Scientech, Inc., Boulder, CO 80303	303-444-1361;800-525-0522
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
Servomex Company, Inc., Norwood, MA 02062	617-769-7710
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500

Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014	408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
† Silicon Sensors, Dodgeville, WI 53533	608-935-2707
§ Sitronic GmbH, Steyregg, AUSTRIA	732-640-591-0
Spiricon, Inc., Logan, UT 84321	801-753-3729
Swan Associates, New Haven, CT 06534	203-387-3917
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085
† Thermometrics, Inc., Edison, NJ 08817-4695	908-287-2870
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586
§ Three-Five Sys., Inc., Phoenix, AZ 85044	602-496-0035
§ Victory Engineering Corp., Springfield, NJ 07081	201-379-5900

Detectors, Leak-2900 — *See Vol. D*

Detectors, Light Intensity — See Meters, Light, Nonphotographic (Vol. D)

Detectors, Magnetic — See Meters, Gauss (Vol. D)

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Detectors (MIL), IR-2440

§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815	**B•1136**
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
† Alan Industries Inc., Columbus, IN 47202	812-372-8869
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
† EG & G Judson, Montgomeryville, PA 18936	215-368-6900
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
† OptoElectronics Textron, Petaluma, CA 94975-0039	707-763-5900
Spiricon, Inc., Logan, UT 84321	801-753-3729

Detectors (MIL), Radar-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200

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Diode Arrays (Incl. Photo)-3700

Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902	**B•1313**
Crydom Company, Long Beach, CA 90805, 310-865-3536	**A•2138**
§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815	**B•1136**
Dialight Corporation, Manasquan, NJ 08736, 908-223-9400	**B•1145**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1148**
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960	**B•1319-1321**
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1704**
Ledtech Electronics Corp., Valencia, CA 91355, 805-257-6964	**B•1082-1083**
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1332**
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691	**A•2172**
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111	**A•2180**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**A•2118**
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160	**B•1339**
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311	**A•2219**
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100	**A•2227**
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605	508-795-1300
§† Allen Co., Inc., Robert G., N. Hollywood, CA 91605	818-765-8300;800-827-7422
American Microsemiconductor, Inc., Madison, NJ 07940	201-377-9566
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
† Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† Basic Electronics, Inc., Stanton, CA 90680	714-530-2400
§† California Micro Devices, Inc., Milpitas, CA 95035	408-263-3214
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075	214-422-1844; 1-800-872-0044
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
† Dionics, Westbury, NY 11590	516-997-7474
† EG & G Judson, Montgomeryville, PA 18936	215-368-6900
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197	408-738-4266
§ EG & G Vactec, St. Louis, MO 63132	314-423-4900
Electronic Devices, Inc., Yonkers, NY 10710	914-965-4400
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
† HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386	612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386	612-443-2500
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Honeywell Microswitch Div., Richardson, TX 75081	214-470-4271
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§ Lite-On Inc., Milpitas, CA 95035	408-946-4873
† Marc Enterprises, Laguna Niguel, CA 92677	714-249-0302
§† Microsemi Corp., Santa Ana, CA 92799-6890	714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390	602-941-6300
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
† Opto Diode Corp., Newbury Park, CA 91320	805-499-0335
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
§ Pioneer Components, Brooklyn, NY 11234	718-444-3880
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705	714-966-0710
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013	615-641-2020
§ SC Technology, Inc., Livermore, CA 94550	510-373-9230
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014	408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
† Solid State Devices, La Mirada, CA 90638	714-670-7734
Spiricon, Inc., Logan, UT 84321	801-753-3729
† Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085
† Voltage Multipliers, Inc., Visalia, CA 93291	209-651-1402

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AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... B•1207
Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 .... B•1210
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1132-1133
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 .... B•1316
§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136-1139
§ **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 .... B•1141-1147**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 .... B•1148
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 .... B•1063**
§ **Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 .... B•1151**
† **Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1152-1156**
§ **Idea, Inc., Brea, CA 92621, 310-697-4332 .... B•1164**
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 .... B•1166-1167**
§ **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 .... B•1168**
§ **Kingbright USA Corp., Kingbright Elec. Co., Ltd., City of Industry, CA 91789, 909-468-0500 .... B•1169**
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001 .... B•1213-1214
Ledtech Electronics Corp., Valencia, CA 91355, 805-257-6964 .... B•1082-1084
§ **Micro Lamps, Inc., Batavia, IL 60510-1488, 708-879-0900 .... B•1174**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1325
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .... B•1175
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .... B•1327
NKK Switches, Scottsdale, AZ 85260, 602-991-0942 .... B•1783-1785
§ **NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 .... A•2149**
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1098**
§ **Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 140, 03-3471-8548 .... B•1176**
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 .... A•2172**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 .... B•1179**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... A•2118, B•1181
† **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 .... B•1182-1187**
§ **I I Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1 .... B•1188-1189**
Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 .... B•1196-1199
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Alpha Dist. Corp., Richfield, OH 44286 .... 216-659-7100; 1-800-628-0841
Altair Exchange Corporation, Valencia, CA 91355 805-257-6964
§ AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
BT & D Technologies, Kennett Square, PA 19348 .... 215-444-6888;800-545-4306
Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702 805-499-5902
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 .... 800-347-2484 ext. 4529
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
Elna America, Inc., Cypress, CA 90630 714-761-8600
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 714-993-6970
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
† Imtronics Industries Inc., St. Petersburg, FL 33716 813-572-9010
§ Injectorall Electronics (Woman Owned), Bohemia, NY 11716 516-563-3388
Inter-Market, Glenview, IL 60025 708-729-5330
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 .... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 310-534-1505
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
§ Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
Littelfuse, Inc., Des Plaines, IL 60016 .... 708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ Marktech International Corp., Latham, NY 12110 518-786-6591
§ Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701 516-226-8950
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
† Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Optotek Limited, Kanata, Ont., CANADA K2K 2A9 613-591-0336
† Oxley Inc., Branford, CT 06405 203-488-1033
Pacific Microtronics Corp., New York, NY 10021 212-517-5622
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Pioneer Components, Brooklyn, NY 11234 718-444-3880
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Schroff, Inc., Warwick, RI 02886 401-732-3770
§ Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
§# Solico/Mec, Hartford, CT 06114 203-527-3092
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
§ Sorenson Lighted Controls, Hartford, CT 06114 .... 203-527-3092;1-800-275-7089
†# Spectrum Devices, Sugar Land, TX 77487-1586 713-242-6417
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
§ Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
§ Wiko, Ltd., Orlando Park, IL 60462 1-800-323-1107
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 .... B•1019
§ **Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530 .... B•1033**
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 .... B•1063**
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000 .... B•1073
Kingbright USA Corp., Kingbright Elec. Co., Ltd., City of Industry, CA 91789, 909-468-0500 .... B•1169
Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1098
§ **Optrex/Satori, Torrance, CA 90503, 310-214-1791 .... B•1102-1103**
§ **SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425 .... B•1110-1111**
I I Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1 .... B•1189
TMP Inc., Santa Ana, CA 92705, 714-558-8028 .... B•1195
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 .... 800-347-2484 ext. 4529
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 .... 516-937-3475;800-626-6116
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
Ocular Inc., Richardson, TX 75081 214-437-3888
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Standish Industries, Standish LCD Div., Lake Mills, WI 53551 414-648-1000
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
† UCE, Inc., Norwalk, CT 06854 203-838-7509
VL Electronics, Inc., Los Angeles, CA 90010-1603 213-738-8700

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† **Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 .... B•1312-1314**
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 .... B•1317,1319-1321
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1324-1325
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .... B•1328-1335
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... A•2118
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 .... B•1339
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 .... A•2227
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271

- § NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
- §† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
- Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
- § Relay Specialties, Oakland, NJ 07436 201-337-1000
- † Silicon Sensors, Dodgeville, WI 53533 608-935-2707
- § Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
- § Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
- § Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664

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- §† **BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 .... A•2131**
- **Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 .... B•1312**
- § **Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 .... A•2180**
- † Edal Industries, East Haven, CT 06512 203-467-2591
- † EG & G Judson, Montgomeryville, PA 18936 215-368-6900
- † MDF Products Inc., Danbury, CT 06811 203-743-3579
- §† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
- §† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
- §† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 .... 408-730-0300;800-PENSTOCK
- §† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
- † 2M Sales Company, Burnsville, MN 55337 612-890-7774
- † Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

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Direction Finding Sets & Systems (MIL)-2440

- Condor Systems, Inc., San Jose, CA 95124 408-371-9580
- † Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
- † Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
- † E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
- † General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
- Glatzer Industries Corp., New Rochelle, NY 10801 914-576-2700
- Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
- † Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
- † Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
- † Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700

Discharge Systems, Energy-4000 — *See Vol. D*

Discriminators-1900 — *See Vol. D*

Disks, Alignment, Flexible Disk Drive-2000 — *See Vol. D*

Disks, Diagnostic, Flexible Disk Drive-2000 — *See Vol. D*

Disks, Magnetic 3½″-2000 — *See Vol. D*

Disks, Magnetic, 5¼″ Flexible-2000 — *See Vol. D*

Disks, Magnetic, 8″ Flexible-2000 — *See Vol. D*

Disks, Magnetic, Front-loading Cartridge-2000 — *See Vol. D*

Disks, Magnetic, Pack-2000 — *See Vol. D*

Disks, Magnetic, Top-loading Cartridge-2000 — *See Vol. D*

Disks, Magnetic, Winchester Module-2000 — *See Vol. D*

Disks, Memory, Flexible — See Memory Systems, Disk, Flexible (Vol. D)

Disks, Optical Encoder — See Encoders, Shaft Angle, Optical (Vol. B)

Dispensers, Adhesive-1600 — *See Vol. C*

Dispensers, DIP & IC — See Machines, Component Handling (Vol. D)

Display Modules-2450

- **American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 .... B•1665**
- **Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 .... B•1019**
- † **Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 .... B•1021**
- †# **Canyon Elctrns., Inc., Phoenix, AZ 85021, 602-944-4421 .... B•1022**
- **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1023**
- **C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657, 800-347-2484 ext. 4529 .... B•1027**
- § **Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800 .... B•1035**
- § **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... B•1024-1026**
- **Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1340-1342**
- **DCI Inc., Olathe, KS 66062, 913-782-5672 .... B•1032**
- §† **Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530 .... B•1033**
- **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 .... B•1143,1145**
- § **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 .... B•1825**
- **Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838 .... B•1043**
- **Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... D•2107**
- **Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 .... B•1062**
- §† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... B•1065, D•1347-1348**
- **F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 .... B•1066-1069**
- **Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1156**
- § **Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 .... B•1070-1071**
- § **Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000 .... B•1074,1076**
- § **Idea, Inc., Brea, CA 92621, 310-697-4332 .... B•1164-1165**
- † **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 .... B•1078,1835**
- **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 .... B•1167**
- † **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .... B•1175**
- § **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .... B•1090**
- **Nissei Electronics, Mountain View, CA 94043, 415-969-1100 .... B•1091-1093**
- **Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020 .... B•1094-1095**
- **Ocular Inc., Richardson, TX 75081, 214-437-3888 .... B•1096-1097**
- § **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1098-1099**
- **Optrex/Satori, Torrance, CA 90503, 310-214-1791 .... B•1102-1103**
- **Polytronix, Inc., Richardson, TX 75081, 214-238-7045 .... B•1106**
- § **SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425 .... B•1110-1111**
- **Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 .... B•1113**
- **Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA .... B•2015**
- § **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 .... B•1114,1116**
- § **Standish Industries, Standish LCD Div., Lake Mills, WI 53551, 414-648-1000 .... B•1118**
- **Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000 .... B•1119-1123**
- § **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035 .... B•1124-1125**
- **VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 .... B•1127**
- † **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389-1390,1394**
- **World Products Inc., Sonoma, CA 95476, 707-996-5201 .... B•1128-1129**
- AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
- Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
- † Capitol Switch Inc., Bethel, CT 06801 203-744-3300
- C-Tek Inc., Wakefield, MA 01880 617-246-1720
- † Data Check Corporation, San Diego, CA 92126 619-578-0101
- Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455
- § Extech Instruments Corp., Waltham, MA 02154 617-890-7440
- § Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
- Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
- † Infodex, Inc., Wolcott, CT 06716 203-879-4944
- † Interface Products, Inc., Oceanside, CA 92056 619-945-0230
- § IVO Industries, Inc., Eatontown, NJ 07724 .... 908-542-5151;800-932-0489
- KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
- Kristel Corporation, West Chicago, IL 60185 708-293-0850
- § Lite-On Inc., Milpitas, CA 95035 408-946-4873
- § Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831 510-471-4700
- Optotek Limited, Kanata, Ont., CANADA K2K 2A9 613-591-0336
- Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
- Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
- Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
- SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
- § Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
- Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
- Texmate, Inc., Vista, CA 92083-8397 619-598-9899
- 2M Sales Company, Burnsville, MN 55337 612-890-7774
- § VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
- World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Display Power Supplies — See Converters, DC to DC (Vol. D), Power Supplies, AC Output (Vol. D)

Displays, CRT-2450

Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800	**B•1035**
Data Ray Corp., Westminster, CO 80234, 1-800-926-5556; 303-451-1300	**B•1028-1031**
Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	**B•1825**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117,1124**
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944**	**B•1012-1013,1080**
Intronics, Inc., Canton, MA 02021, 800-367-0004	**B•1081**
Omni Vision Inc., Glendale Heights, IL 60139, 708-893-1720	**B•1101**
Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300	**B•1108-1109**
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Aspect Electronics Inc., Auburn, CA 95602	916-887-1008
Aydin Corp., Horsham, PA 19044	215-657-7510
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
† CELCO, Mahwah, NJ 07430	201-327-1123
† Collins Commercial Avionics, Rockwell Intl., Cedar Rapids, IA 52498	319-395-1000
§# Computerware, Inc., Vienna, VA 22182-2266	703-821-8200
§ Conrac Display Products, Inc., Duarte, CA 91010	818-303-0095
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Display Technologies, Inc., Elgin, IL 60123	708-931-2100;1-800-544-8823
§ Dotronix, New Brighton, MN 55112	612-633-1742
Electrohome Limited, Kitchener, Ontario, CANADA N2G 4J6	519-744-7111
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
Kikusui International Corp., Signal Hill, CA 90804-1203	310-986-1677;800-545-8784
§ KMS Advanced Products, Inc., Ann Arbor, MI 48106-1868	313-769-1780
§ Krenz Instruments, Inc., Bonsall, CA 92003	619-630-3488
Kristel Corporation, West Chicago, IL 60185	708-293-0850
§ Leader Instruments Corp., Hauppauge, NY 11788-3694	516-231-6900; 1-800-645-5104
Megadata Corp., Bohemia, NY 11716	516-589-6800
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
§ Metra Corporation, San Jose, CA 95131	408-432-1110
# MEXITRONIX (Woman Owned), Kingman, AZ 86401	602-757-9798
§† Mitsubishi Electronics, Torrance, CA 90502	213-515-3993
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068	503-638-1000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§† Teltron, Inc., Birdsboro, PA 19508	610-582-2711
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201
†# XKD Corporation, Dynatech, Los Gatos, CA 95030	408-395-3700

Displays, Dot Matrix-2450

Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143	**B•1019**
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690	**B•1020**
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100	**B•1021**
# **Canyon Elctrns., Inc., Phoenix, AZ 85021, 602-944-4421**	**B•1022**
CBM America Corp., Santa Monica, CA 90404, 310-828-8245	**D•1084-1085**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1023**
§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665**	**D•1151**
§ **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506**	**B•1024-1026**
§† **Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530**	**B•1033**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1039-1041**
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838	**B•1043**
Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300	**B•1050-1060**
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747	**B•1062**
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223**	**B•1063**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020	**B•1067-1069**
§ **Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191**	**B•1070-1071**
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000	**B•1075-1076**
§ **Kingbright USA Corp., Kingbright Elec. Co., Ltd., City of Industry, CA 91789, 909-468-0500**	**B•1169**
Ledtech Electronics Corp., Valencia, CA 91355, 805-257-6964	**B•1083**
LXD, Inc., Cleveland, OH 44146, 216-786-8700	**B•1086-1087**
§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782**	**B•1088-1090**
Nissei Electronics, Mountain View, CA 94043, 415-969-1100	**B•1091-1092**
Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020	**B•1094-1095**
Ocular Inc., Richardson, TX 75081, 214-437-3888	**B•1096**
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488**	**B•1098**
Optrex/Satori, Torrance, CA 90503, 310-214-1791	**B•1102-1103**
Polytronix, Inc., Richardson, TX 75081, 214-238-7045	**B•1106**
§ **SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425**	**B•1110-1111**
§ **Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770**	**B•1113**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850**	**B•1114**
§ **Standish Industries, Standish LCD Div., Lake Mills, WI 53551, 414-648-1000**	**B•1118**
§ **I I Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1**	**B•1188-1189**
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000	**B•1119,1121-1123**
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035**	**B•1124-1125**
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700	**B•1127**
World Products Inc., Sonoma, CA 95476, 707-996-5201	**B•1128-1129**
§ ACI Components, Inc., Laguna Hills, CA 92653	714-588-9611
Altair Exchange Corporation, Valencia, CA 91355	805-257-6964
§ AND, William J. Purdy Co., Burlingame, CA 94010	415-347-9916
§† Atlantic Optical Moulding, Webster, MA 01570	508-943-1746
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
Computerwise, Olathe, KS 66062	913-829-0600
§# Craft Data, Inc., Mission Viejo, CA 92691	714-582-8284
Crystaloid Electronics, Hudson, OH 44236	216-655-2429
Dotronix, New Brighton, MN 55112	612-633-1742
† EEV Inc., Elmsford, NY 10523	914-592-6050
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173	708-884-1444
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Idea, Inc., Brea, CA 92621	310-697-4332
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409	818-787-0311
Inter-Market, Glenview, IL 60025	708-729-5330
International Instrumentation, Inc., Westlake Vlg., CA 91361	805-495-7673
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6	416-292-4463
§ Lite-On Inc., Milpitas, CA 95035	408-946-4873
§† Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831	510-471-4700
§ Marktech International Corp., Latham, NY 12110	518-786-6591
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
§ Micro Lamps, Inc., Batavia, IL 60510-1488	708-879-0900
§ Noritake Co., Inc., Electronics Division, LA Branch, Compton, CA 90220	310-603-9770
Optotek Limited, Kanata, Ont., CANADA K2K 2A9	613-591-0336
† Orbit Instrument Corp., Hauppauge, NY 11788	516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630	714-527-0561
§ Pixelworks, Inc., Hudson, NH 03051	603-880-1322
Planar Systems, Inc., Beaverton, OR 97006-1992	503-690-1100
§ Promax-Johnton Electronic Corp., Irvine, CA 92714	714-975-1245
Quantum Electronics, Inc., Lewistown, PA 17044	717-242-1132
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013	615-641-2020
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014	408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
Spectrum Corp., Houston, TX 77075	713-944-6200;1-800-392-5050(Sls)
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265	214-995-6611
Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
2M Sales Company, Burnsville, MN 55337	612-890-7774
† UCE, Inc., Norwalk, CT 06854	203-838-7509
§ Uticor Technology, Bettendorf, IA 52722	319-359-7501
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661	916-783-7878
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201

Displays, Edge Lighted & Back Lighted-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143	**B•1019**
§† **Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530**	**B•1033**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1042**
Eltech, Horsham, PA 19044, 215-441-0404	**B•1149**
Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300	**B•1052-1060**
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747	**B•1062**
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223**	**B•1063**
§ **Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191**	**B•1070-1071**
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000	**B•1075-1076**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1837, C•1665**
Ledtech Electronics Corp., Valencia, CA 91355, 805-257-6964	**B•1082**
† **LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766, 603-448-3444**	**B•1172**
Ocular Inc., Richardson, TX 75081, 214-437-3888	**B•1096**
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488**	**B•1099**
§ **Optrex/Satori, Torrance, CA 90503, 310-214-1791**	**B•1102-1103**
Polytronix, Inc., Richardson, TX 75081, 214-238-7045	**B•1106**

SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425	**B•1111**
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770	**B•1113**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850**	**B•1114,1116**
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035**	**B•1124-1125**
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700	**B•1127**
World Products Inc., Sonoma, CA 95476, 707-996-5201	**B•1128-1129**
Altair Exchange Corporation, Valencia, CA 91355	805-257-6964
AND, William J. Purdy Co., Burlingame, CA 94010	415-347-9916
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Barrington Plastics, Mt. Laurel, NJ 08054	609-235-5151
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
Crystaloid Electronics, Hudson, OH 44236	216-655-2429
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
§† Data Display Products, El Segundo, CA 90245-4630	310-640-0442;800-421-6815
† Eaton Corp., Control Displays, Colmar, PA 18915	215-822-3383
E-L Products Company, Sub. of Astronics Corporation, E. Aurora, NY 14224	716-655-0800
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
KMC Systems, Inc., Midland Pk., NJ 07432	201-447-0007
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
§ Luminator Aircraft Products, Plano, TX 75074	214-424-6511
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
† Penn Keystone Corp., Wallingford, CT 06492	203-294-0537
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
† Spectra Lux Corp., Kirkland, WA 98034	206-823-6857
Standish Industries, Standish LCD Div., Lake Mills, WI 53551	414-648-1000
Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
2M Sales Company, Burnsville, MN 55337	612-890-7774
† UCE, Inc., Norwalk, CT 06854	203-838-7509
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201

Displays, Electroluminescent-2450

BKL, King of Prussia, PA 19406, 215-277-2910	**B•1134**
Eltech, Horsham, PA 19044, 215-441-0404	**B•1149**
Endicott Research Group, Endicott, NY 13760, 607-754-9187	**B•1048**
Idea, Inc., Brea, CA 92621, 310-697-4332	**B•1164**
† **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311**	**B•1835**
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944**	**B•1012-1013,1080**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836-1837**
Leading Edge, Minnetonka, MN 55343, 612-936-7744	**B•1170-1171**
† **LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766, 603-448-3444**	**B•1172**
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1088-1090**
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850	**B•1114**
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700	**B•1127**
World Products Inc., Sonoma, CA 95476, 707-996-5201	**B•1128-1129**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Apollo Display Technologies, Inc., Holtsville, NY 11742	1-800-LCD-STOC; 516-654-1143
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
† Applied Display Technology, Inc., Newbury Park, CA 91320	805-498-4984
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087	708-662-9200
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
Computer Dynamics Sales, Greer, SC 29650	803-877-8700
§# Craft Data, Inc., Mission Viejo, CA 92691	714-582-8284
DataLux Corp., Winchester, VA 22602	703-662-1500
§ Dialight Corporation, Manasquan, NJ 08736	908-223-9400
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092	404-409-3000
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
§ KMS Advanced Products, Inc., Ann Arbor, MI 48106-1868	313-769-1780
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831	510-471-4700
† Orbit Instrument Corp., Hauppauge, NY 11788	516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630	714-527-0561
Planar Systems, Inc., Beaverton, OR 97006-1992	503-690-1100
† Quantex Corporation, Rockville, MD 20850	301-258-2701;800-992-5149 (Sls. only)
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
2M Sales Company, Burnsville, MN 55337	612-890-7774
† UCE, Inc., Norwalk, CT 06854	203-838-7509
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201

Displays, Electromagnetic-2450

F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020	**B•1066**
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944**	**B•1012-1013**
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261**	**B•1175**
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000	**B•1119-1121,1123**
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
Chrono-log Corp., Havertown, PA 19083	800-247-6665
§† Densitron Corporation, Densitron International, Torrance, CA 90505	310-530-3530
IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409	818-787-0311
Spectrum Corp., Houston, TX 77075	713-944-6200;1-800-392-5050(Sls)

Displays, Electromechanical-2450

Electrodynamics, Inc., A Talley Inds. Co., Rolling Meadows, IL 60008, 708-259-0740	**D•1159**
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261**	**B•1175**
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000	**B•1120-1121,1123**
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§† Densitron Corporation, Densitron International, Torrance, CA 90505	310-530-3530
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1	416-624-3020
The Hirol Company, Ft. Lauderdale, FL 33309	305-974-4900
IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409	818-787-0311
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
† Penn Keystone Corp., Wallingford, CT 06492	203-294-0537
Quantum Electronics, Inc., Lewistown, PA 17044	717-242-1132
Schroff, Inc., Warwick, RI 02886	401-732-3770
Spectrum Corp., Houston, TX 77075	713-944-6200;1-800-392-5050(Sls)
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201

Displays, Fiber Optic-2475

Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143	**B•1019**
Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530	**B•1033**
AND, William J. Purdy Co., Burlingame, CA 94010	415-347-9916
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1	416-624-3020
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550	508-347-9191
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
# GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400

Displays, Graphic — See Displays, Dot Matrix (Vol. B)

Displays, Graphic Systems-2000 — *See Vol. D*

Displays, Head Up (HUD)-2450

† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944**	**B•1012**
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
Displaytech, Inc., Boulder, CO 80301	303-449-8933
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173	708-884-1444
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550	508-347-9191
Optotek Limited, Kanata, Ont., CANADA K2K 2A9	613-591-0336
† Oxley Inc., Branford, CT 06405	203-488-1033
Polytronix, Inc., Richardson, TX 75081	214-238-7045
Standish Industries, Standish LCD Div., Lake Mills, WI 53551	414-648-1000
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† UCE, Inc., Norwalk, CT 06854	203-838-7509

Displays, Indicator Lights-2450

Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1701**
§† **Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815**	**B•1136**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1036**
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747	**B•1062**
§ **Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300**	**B•1151**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442	**B•1157,1160**
Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989	**B•1167**
§† **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019**	**B•1168**
§ **Kingbright USA Corp., Kingbright Elec. Co., Ltd., City of Industry, CA 91789, 909-468-0500**	**B•1169**
§ **Micro Lamps, Inc., Batavia, IL 60510-1488, 708-879-0900**	**B•1174**
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261**	**B•1175**
SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425	**B•1111**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035**	**B•1124**
§ ACI Components, Inc., Laguna Hills, CA 92653	714-588-9611
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Altair Exchange Corporation, Valencia, CA 91355	805-257-6964
AND, William J. Purdy Co., Burlingame, CA 94010	415-347-9916
Automation Displays Inc., Eau Claire, WI 54703	715-834-9595
Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
GBC, Inc., Lamp Division, Ocean, NJ 07712	908-774-8502
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409	818-787-0311
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
§† Ledco, Wilbrecht Elctrns., St. Paul, MN 55107	612-222-2791
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6	416-292-4463
Leecraft Mfg., Long Island City, NY 11101	718-392-8800
§ Lite-On Inc., Milpitas, CA 95035	408-946-4873

§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§† Luminator Aircraft Products, Plano, TX 75074 214-424-6511
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
Oxley Inc., Branford, CT 06405 203-488-1033
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
† Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Schroff, Inc., Warwick, RI 02886 401-732-3770
§ Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
§ Sorenson Lighted Controls, Hartford, CT 06114 .... 203-527-3092;1-800-275-7089
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
2M Sales Company, Burnsville, MN 55337 612-890-7774
§† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Displays, Intelligent-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 .... B•1665
Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 .... B•1019
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690 .... B•1020
§ **CBM America Corp., Santa Monica, CA 90404, 310-828-8245 .... D•1084-1085**
§ **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... B•1026**
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 .... B•1063**
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944 .... B•1013**
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1098**
§ **Optrex/Satori, Torrance, CA 90503, 310-214-1791 .... B•1102-1103**
§ **Standish Industries, Standish LCD Div., Lake Mills, WI 53551, 414-648-1000 .... B•1118**
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035 .... B•1124-1125**
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Applied Data Systems, Inc., Baltimore, MD 21202 .... 800-541-2003;410-576-0335
† Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
§ Cincinnati Electrosystems, Milford, OH 45150 513-831-6800
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 .... 800-347-2484 ext. 4529
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
Computer Dynamics Sales, Greer, SC 29650 803-877-8700
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
§ Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
§ Isocom Inc., Campbell, CA 95008 408-370-2212
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
§ Krenz Instruments, Inc., Bonsall, CA 92003 619-630-3488
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Marktech International Corp., Latham, NY 12110 518-786-6591
Planar Systems, Inc., Beaverton, OR 97006-1992 503-690-1100
Polytronix, Inc., Richardson, TX 75081 214-238-7045
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 310-517-7770
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Spectrum Corp., Houston, TX 77075 .... 713-944-6200;1-800-392-5050(Sls)
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
2M Sales Company, Burnsville, MN 55337 612-890-7774
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Uticor Technology, Bettendorf, IA 52722 319-359-7501
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
VL Electronics, Inc., Los Angeles, CA 90010-1603 213-738-8700
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440

Displays, Laser-2450

Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 206-364-7881

Displays, Light-emitting Diode (LED)-2450

Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 .... B•1019
Canyon Elctrns., Inc., Phoenix, AZ 85021, 602-944-4421 .... B•1022
† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 .... B•1687**
§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665 .... D•1151**
§† **Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136-1139**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1340-1343
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333 .... D•1186
§ **Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530 .... B•1033**
§ **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 .... B•1141,1145,1147**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .... B•1036,1039,1042
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838 .... B•1043
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 .... B•1063**
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... B•1065, D•1160,1346-1351**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 .... B•1069
§ **Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 .... B•1151**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1155-1156
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1377,1381
Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686 .... B•1077
§ **Idea, Inc., Brea, CA 92621, 310-697-4332 .... B•1164-1165**
§† **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 .... B•1079**
Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 .... B•1166-1167
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .... B•1756, D•1162
§ **Kingbright USA Corp., Kingbright Elec. Co., Ltd., City of Industry, CA 91789, 909-468-0500 .... B•1169**
Ledtech Electronics Corp., Valencia, CA 91355, 805-257-6964 .... B•1082
Micro Lamps, Inc., Batavia, IL 60510-1488, 708-879-0900 .... B•1174
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .... B•1175**
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550 .... B•1044
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... D•1360**
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1098-1099**
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 .... B•1113
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA .... B•2015
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 .... B•1115,1179**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181
Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 .... B•1182-1187
§ **I I Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1 .... B•1188-1189**
Telegenix/Grim Corp., Cherry Hill, NJ 08034, 609-424-5220 .... D•1074
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1377,1381
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035 .... B•1124-1125**
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 .... B•1127
† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389,1392,1394-1396**
§ ACI Components, Inc., Laguna Hills, CA 92653 714-588-9611
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
Altair Exchange Corporation, Valencia, CA 91355 805-257-6964
§ AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
§ Cincinnati Electrosystems, Milford, OH 45150 513-831-6800
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 .... 800-347-2484 ext. 4529
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
† Digitec, Marion, OH 43302 614-387-3444
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
§ Electrol Co., York, PA 17405 717-848-1722
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 714-993-6970
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086 408-736-3191
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 .... 800 452 4844
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Inter-Market, Glenview, IL 60025 708-729-5330
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 .... 516-937-3475;800-626-6116
§ Isocom Inc., Campbell, CA 95008 408-370-2212
Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 310-534-1505
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ Marktech International Corp., Latham, NY 12110 518-786-6591
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
Optotek Limited, Kanata, Ont., CANADA K2K 2A9 613-591-0336
§ Paccom Electronics, Redmond, WA 98052-5350 .... 206-883-9200;800-426-6254
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§† Quality Technologies, Sunnyvale, CA 94086 408-720-1440
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Schroff, Inc., Warwick, RI 02886 401-732-3770
§ Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Spectrum Corp., Houston, TX 77075 .... 713-944-6200;1-800-392-5050(Sls)

† Teledyne Microelectronics, Los Angeles, CA 90066 ...... 310-822-8229;310-305-0248
† Texas Optoelectronics, Inc., Garland, TX 75042 ... 214-487-0085
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492 203-269-3337
2M Sales Company, Burnsville, MN 55337 ... 612-890-7774
§ Uticor Technology, Bettendorf, IA 52722 ... 319-359-7501
Vorne Industries, Inc., Chicago, IL 60631 ... 312-775-9440
§ Wamco, Inc., Fountain Valley, CA 92708 ... 714-545-5560
Wayne Kerr Inc., Farnell Electronics plc, Woburn, MA 01801 ... 617-938-8390; 1-800-933-9319
§ Wiko, Ltd., Orlando Park, IL 60462 ... 1-800-323-1107
Wilbrecht Electronics, St. Paul, MN 55107 ... 612-222-2791
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 ... 813-646-3909
World Products Inc., Systems Devices Grp., Sonoma 95476 ... 707-996-5201

Displays, Lighted Segment-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 ... B•1665
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 ... B•1021
# **Canyon Elctrns., Inc., Phoenix, AZ 85021, 602-944-4421 ... B•1022**
Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ... B•1687
DCI Inc., Olathe, KS 66062, 913-782-5672 ... B•1032
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ... B•1036-1037,1040-1041
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838 ... B•1043
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ... B•1063**
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 ... D•1160,1346-1347,1351**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ... B•1066,1068-1069
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ... B•1156
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1372,1377
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 ... B•1070
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000 ... B•1074-1076
Idea, Inc., Brea, CA 92621, 310-697-4332 ... B•1164-1165
† **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ... B•1078**
§ **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ... B•1168**
Ledtech Electronics Corp., Valencia, CA 91355, 805-257-6964 ... B•1082-1083
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1175**
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ... B•1088-1089
Ocular Inc., Richardson, TX 75081, 214-437-3888 ... B•1096-1097
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 ... B•1098**
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ... B•1114-1115
§ **Standish Industries, Standish LCD Div., Lake Mills, WI 53551, 414-648-1000 ... B•1118**
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000 ... B•1119-1121
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1372,1377
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035 ... B•1124-1125**
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ... B•1127
§ ACI Components, Inc., Laguna Hills, CA 92653 ... 714-588-9611
§ A E G Corporation, Basking Ridge, NJ 07920 ... 908-204-8900
Altair Exchange Corporation, Valencia, CA 91355 ... 805-257-6964
§ AND, William J. Purdy Co., Burlingame, CA 94010 ... 415-347-9916
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 ... 708-662-9200
§ Cincinnati Electrosystems, Milford, OH 45150 ... 513-831-6800
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 ... 800-347-2484 ext. 4529
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 ... 402-563-6506
§† Densitron Corporation, Densitron International, Torrance, CA 90505 ... 310-530-3530
§ Dialight Corporation, Manasquan, NJ 08736 ... 908-223-9400
† EEV Inc., Elmsford, NY 10523 ... 914-592-6050
Excel Technology Intl. Corp., Belle Mead, NJ 08502 ... 908-874-4747
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 ... 708-884-1444
Ghielmetti, Inc., Westlake Village, CA 91361 ... 800-228-1097
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Inter-Market, Glenview, IL 60025 ... 708-729-5330
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 ... 415-347-8217
IVO Industries, Inc., Eatontown, NJ 07724 ... 908-542-5151;800-932-0489
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 ... 416-292-4463
§ Lite-On Inc., Milpitas, CA 95035 ... 408-946-4873
§† Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831 ... 510-471-4700
§ Marktech International Corp., Latham, NY 12110 ... 518-786-6591
Optotek Limited, Kanata, Ont., CANADA K2K 2A9 ... 613-591-0336
Quantum Electronics, Inc., Lewistown, PA 17044 ... 717-242-1132
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 ... 206-834-2500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 ... 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 ... 201-321-3400
Spectrum Corp., Houston, TX 77075 ... 713-944-6200;1-800-392-5050(Sls)
† Teledyne Microelectronics, Los Angeles, CA 90066 ... 310-822-8229;310-305-0248
2M Sales Company, Burnsville, MN 55337 ... 612-890-7774
Vorne Industries, Inc., Chicago, IL 60631 ... 312-775-9440
§† Wamco, Inc., Fountain Valley, CA 92708 ... 714-545-5560
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136 ... 216-238-2550
World Products Inc., Systems Devices Grp., Sonoma 95476 ... 707-996-5201

Displays, Liquid Crystal (LCD)-2450

Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 ... B•1019
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690 ... B•1020
CBM America Corp., Santa Monica, CA 90404, 310-828-8245 ... D•1085
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... D•1340-1342
DCI Inc., Olathe, KS 66062, 913-782-5672 ... B•1032
Endicott Research Group, Endicott, NY 13760, 607-754-9187 ... B•1045-1047
§ **Epson America, Inc./OEM Div., Torrance, CA 90503, 310-787-6300 ... B•1050-1061**
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 ... B•1062
† **Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ... B•1063**
# **F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ... B•1069**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ... D•1377
§ **Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 ... B•1070-1071**
§ **Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000 ... B•1073-1076**
Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686 ... B•1077
† **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ... B•1079**
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .. D•1162
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 ... B•1841
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ... B•1843
§ **LXD, Inc., Cleveland, OH 44146, 216-786-8700 ... B•1086-1087**
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550 ... B•1044
Nissei Electronics, Mountain View, CA 94043, 415-969-1100 ... B•1091-1093
† **Ocular Inc., Richardson, TX 75081, 214-437-3888 ... B•1096-1097**
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 ... B•1098-1099**
§ **Optrex/Satori, Torrance, CA 90503, 310-214-1791 ... B•1102**
Polytronix, Inc., Richardson, TX 75081, 214-238-7045 ... B•1106
SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425 ... B•1110-1111
§ **Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ... B•1113**
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ... B•2015
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ... B•1114-1116**
§ **Standish Industries, Standish LCD Div., Lake Mills, WI 53551, 414-648-1000 ... B•1118**
§ **I I Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1 ... B•1188-1189**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ... D•1377
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035 ... B•1124-1125**
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ... B•1195
VL Electronics, Inc., Los Angeles, CA 90010-1603, 213-738-8700 ... B•1127
† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ... D•1390**
§ Action Instruments, San Diego, CA 92123 ... 619-279-5726
A E G Corporation, Basking Ridge, NJ 07920 ... 908-204-8900
§ AND, William J. Purdy Co., Burlingame, CA 94010 ... 415-347-9916
† Applied Display Technology, Inc., Newbury Park, CA 91320 ... 805-498-4984
Casio LCD Sales, Kanematsu USA Inc., Arlington Hgts., IL 60005 ... 708-981-5692
§ Cincinnati Electrosystems, Milford, OH 45150 ... 513-831-6800
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 ... 800-347-2484 ext. 4529
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 ... 416-292-4463
Computer Dynamics Sales, Greer, SC 29650 ... 803-877-8700
Computerwise, Olathe, KS 66062 ... 913-829-0600
§# Craft Data, Inc., Mission Viejo, CA 92691 ... 714-582-8284
Crystaloid Electronics, Hudson, OH 44236 ... 216-655-2429
C-S Electronic Sales, Inc., Frankfort, IN 46041 ... 317-659-1874
# Current Components, Inc., Middleton, MD 21769 ... 301-473-5333
§ DataLux Corp., Winchester, VA 22602 ... 703-662-1500
§† Densitron Corporation, Densitron International, Torrance, CA 90505 ... 310-530-3530
† EEV Inc., Elmsford, NY 10523 ... 914-592-6050
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503 ... 310-782-5318
Hyundai Electronics Industries Co. Ltd., Kyoungki-do, KOREA ... (0336)30-4114,(02)741-0661
† Interface Products, Inc., Oceanside, CA 92056 ... 619-945-0230
International Instrumentation, Inc., Westlake Vlg., CA 91361 ... 805-495-7673
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475;800-626-6116
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 908-291-0500;800-631-2165
Peripheral Resources, Los Angeles, CA 90035 ... 310-552-3888;800-533-2297
MFI, Los Angeles, CA 90025 ... 310-447-6633;800-533-2297
Mouser Electronics, Santee, CA 92071 ... 800-346-6873
Mouser Electronics, Mansfield, TX 76063 ... 800-346-6873
Mouser Electronics, Gilroy, CA 95020 ... 800-346-6873
§ PCI Ltd., San Jose, CA 95128 ... 408-282-0200
Peripheral Resources, Los Angeles, CA 90035 ... 310-552-3888;800-533-2297
§# Peter Parts & Assocs., Webster, NY 14580 ... 716-265-2540
Printer Products, Boston, MA 02134 ... 617-254-1200
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 ... 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 ... 201-825-8080
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 ... 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
Taliq Corp., Sunnyvale, CA 94089 ... 408-745-0750
† Teledyne Microelectronics, Los Angeles, CA 90066 ... 310-822-8229;310-305-0248
† Texas Optoelectronics, Inc., Garland, TX 75042 ... 214-487-0085
2M Sales Company, Burnsville, MN 55337 ... 612-890-7774
† UCE, Inc., Norwalk, CT 06854 ... 203-838-7509
§ VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 ... 916-783-7878
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811 ... 813-646-3909

World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Message-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 .... B•1665
Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 .... B•1019
§ **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... B•1024**
DCI Inc., Olathe, KS 66062, 913-782-5672 .... B•1032
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .... B•1036,1041-1042
Electronic Displays, Inc., Wood Dale, IL 60191, 708-860-5838 .... B•1043
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747 .... B•1062
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... B•1065**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 .... B•1066
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1379
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086, 408-736-3191 .... B•1071
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000 .... B•1074-1076
Idea, Inc., Brea, CA 92621, 310-697-4332 .... B•1164-1165
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 .... B•1841
Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020 .... B•1094-1095
Ocular Inc., Richardson, TX 75081, 214-437-3888 .... B•1097
Optrex/Satori, Torrance, CA 90503, 310-214-1791 .... B•1103
SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425 .... B•1111
S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500 .... C•1534
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 .... B•1114
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000 .... B•1121-1122
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1379
† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Alusett U.S.A., Inc., Peekskill, NY 10566 914-737-0120
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
Applied Display & Control, Arlington Heights, IL 60005 708-228-9690
† Aydin Corp., Horsham, PA 19044 215-657-7510
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
§ Cincinnati Electrosystems, Milford, OH 45150 513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ ESE, El Segundo, CA 90245 310-322-2136
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
ITF Corp., Buford, GA 30518 404-945-3844
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Spectrum Corp., Houston, TX 77075 .... 713-944-6200;1-800-392-5050(Sls)
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Uticor Technology, Bettendorf, IA 52722 319-359-7501
Vorne Industries, Inc., Chicago, IL 60631 312-775-9440
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Multifunction-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 .... B•1665
Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143 .... B•1019
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690 .... B•1020
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800 .... B•1035
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... B•1026
Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530 .... B•1033
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... D•1160,1346,1349-1351**
Hitachi America, Ltd., Electron Tube Division, Norcross, GA 30092, 404-409-3000 .... B•1074-1076
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944 .... B•1012**
Optrex/Satori, Torrance, CA 90503, 310-214-1791 .... B•1102-1103
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
† Applied Display Technology, Inc., Newbury Park, CA 91320 805-498-4984
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 .... 800-347-2484 ext. 4529
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 619-931-3000
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Ledtronics, Inc., Torrance, CA 90505 310-534-1505
Ocular Inc., Richardson, TX 75081 214-437-3888
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
Spectrum Corp., Houston, TX 77075 .... 713-944-6200;1-800-392-5050(Sls)
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Planar Gas Discharge-2450

# Canyon Elctrns., Inc., Phoenix, AZ 85021, 602-944-4421 .... B•1022
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1023
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1099**
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5100
§# Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Densitron Corporation, Densitron International, Torrance, CA 90505 310-530-3530
† Displays, Inc., Lewistown, PA 17044 717-242-2541
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
2M Sales Company, Burnsville, MN 55337 612-890-7774

Displays, Plasma-2450

Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100 .... B•1021
Canyon Elctrns., Inc., Phoenix, AZ 85021, 602-944-4421 .... B•1022
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1023**
§ **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... B•1024-1026**
§† **Densitron Corporation, Densitron International, Torrance, CA 90505, 310-530-3530 .... B•1033**
Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... D•2107
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 .... B•1098**
§ AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
Apollo Display Technologies, Inc., Holtsville, NY 11742 .... 1-800-LCD-STOC; 516-654-1143
Applied Display & Control, Arlington Heights, IL 60005 708-228-9690
§† Atlantic Optical Moulding, Webster, MA 01570 508-943-1746
§# Craft Data, Inc., Mission Viejo, CA 92691 714-582-8284
Displays, Inc., Lewistown, PA 17044 717-242-2541
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
† Librascope Corp., Loral Corp., Glendale, CA 91201 818-244-6541
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831 510-471-4700
† Miltope Corp., Melville, NY 11747 516-420-0200
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630 714-527-0561
Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
† Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
2M Sales Company, Burnsville, MN 55337 612-890-7774
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Programmable-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 .... B•1665
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690 .... B•1020
§ **Chrono-log Corp., Havertown, PA 19083, 800-247-6665 .... D•1151**
§ **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... B•1026**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .... B•1036-1042
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000 .... B•1065, D•1160,1347,1351**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 .... B•1069
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1380
Intronics, Inc., Canton, MA 02021, 800-367-0004 .... B•1081
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 .... B•1843
Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020 .... B•1094-1095
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 .... B•1113
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1380
§ **Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035 .... B•1124-1125**
† **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1390,1392**
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
† Applied Display Technology, Inc., Newbury Park, CA 91320 805-498-4984
† Aydin Corp., Horsham, PA 19044 215-657-7510

Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087	708-662-9200
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
Colt Electronics Co., Inc., Lenexa, KS 66219	913-888-1673
Displays, Inc., Lewistown, PA 17044	717-242-2541
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173	708-884-1444
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
§ ITT Gilfillan, ITT Defense Inc., Van Nuys, CA 91409	818-988-2600
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831	510-471-4700
Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4	514-685-2630
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
Omega Engineering, Stamford, CT 06907	800-826-6342
Quantum Electronics, Inc., Lewistown, PA 17044	717-242-1132
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014	408-257-7910
Spectrum Corp., Houston, TX 77075	713-944-6200;1-800-392-5050(Sls)
Taliq Corp., Sunnyvale, CA 94089	408-745-0750
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
† UCE. Inc., Norwalk, CT 06854	203-838-7509
§ Uticor Technology, Bettendorf, IA 52722	319-359-7501
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Displays, Projection Type (CRT; Electromechanical; Film; Light Valve)-2450

CBM America Corp., Santa Monica, CA 90404, 310-828-8245	**D•1085**
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800	**B•1035**
Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686	**B•1077**
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311	**B•1078**
Aydin Corp., Horsham, PA 19044	215-657-7510
§ Conrac Display Products, Inc., Duarte, CA 91010	818-303-0095
§ Covid, Inc., Tempe, AZ 85281	602-966-2221
Dotronix, New Brighton, MN 55112	612-633-1742
Electrohome Limited, Kitchener, Ontario, CANADA N2G 4J6	519-744-7111
Excel Technology Intl. Corp., Belle Mead, NJ 08502	908-874-4747
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
† Librascope Corp., Loral Corp., Glendale, CA 91201	818-244-6541
Mitsubishi Electronics, Torrance, CA 90502	213-515-3993
† Orbit Instrument Corp., Hauppauge, NY 11788	516-435-8300
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630	714-527-0561
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
§† Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
† Terminal Data Corp., Rockville, MD 20855	301-921-8282
2M Sales Company, Burnsville, MN 55337	612-890-7774
† UCE. Inc., Norwalk, CT 06854	203-838-7509

Displays, Remote-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690	**B•1020**
§ Chrono-log Corp., Havertown, PA 19083, 800-247-6665	**D•1151**
DCI Inc., Olathe, KS 66062, 913-782-5672	**B•1032, D•1344**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1036-1041**
§ Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
Excel Technology Intl. Corp., Belle Mead, NJ 08502, 908-874-4747	**B•1062**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1347,1349-1351**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020	**B•1069**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1384**
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944	**B•1012**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1357**
Nissei Electronics, Mountain View, CA 94043, 415-969-1100	**B•1091-1093**
§ OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900	**D•1364**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1384**
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389-1391**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Apollo Display Technologies, Inc., Holtsville, NY 11742	1-800-LCD-STOC; 516-654-1143
Applied Data Systems, Inc., Baltimore, MD 21202	800-541-2003;410-576-0335
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
# Canyon Elctrns., Inc., Phoenix, AZ 85021	602-944-4421
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087	708-662-9200
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219	913-888-1673
§# Craft Data, Inc., Mission Viejo, CA 92691	714-582-8284
C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
Datachron Inc., Anaheim, CA 92805	714-385-1705
Datum Timing, Datum Inc., Anaheim, CA 92806-5790	714-533-6333
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
DCT Instruments, Columbus, OH 43212	1-800-328-1028
Displays, Inc., Lewistown, PA 17044	717-242-2541
Electronic Displays, Inc., Wood Dale, IL 60191	708-860-5838
FTS/AUSTRON, Austin, TX 78761-4766	512-251-2341
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Inter-Market, Glenview, IL 60025	708-729-5330
§ International Microtronics, Tucson, AZ 85714	602-748-7900
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
KMC Systems, Inc., Midland Pk., NJ 07432	201-447-0007
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
§ Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831	510-471-4700
MACOM, Inc., Lowell, MA 01851	617-272-3000
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
Planar Systems, Inc., Beaverton, OR 97006-1992	503-690-1100
Systems Data, Inc., Akron, OH 44321	216-666-0085
Two Technologies,Inc., Horsham, PA 19044	215-441-5305
† UCE, Inc., Norwalk, CT 06854	203-838-7509
§ Uticor Technology, Bettendorf, IA 52722	319-359-7501
§ Vidco, Inc., Beaverton, OR 97005	503-641-1804
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
§ Ziatech, San Luis Obispo, CA 93401	805-541-0488

Displays, Status-2450

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143	**B•1019**
Applied Display & Control, Arlington Heights, IL 60005, 708-228-9690	**B•1020**
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100	**B•1021**
Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1116,1187-1189**
DCI Inc., Olathe, KS 66062, 913-782-5672	**B•1032**
§ Dialight Corporation, Manasquan, NJ 08736, 908-223-9400	**B•1145-1146**
† Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1036,1038,1040-1041**
Electro-Numerics, Inc., Temecula, CA 92590, 909-699-2437	**D•1345**
§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1347,1351**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020	**B•1066,1068-1069**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1379**
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311	**B•1078**
§ JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019	**B•1168**
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261	**B•1175**
SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425	**B•1110-1111**
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000	**B•1120-1123**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1379**
§ Three-Five Sys., Inc., Phoenix, AZ 85044, 602-496-0035	**B•1124-1125**
† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389-1390,1396**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Altair Exchange Corporation, Valencia, CA 91355	805-257-6964
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
Automation Displays Inc., Eau Claire, WI 54703	715-834-9595
# Canyon Elctrns., Inc., Phoenix, AZ 85021	602-944-4421
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219	913-888-1673
C-Tek Inc., Wakefield, MA 01880	617-246-1720
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Displays, Inc., Lewistown, PA 17044	717-242-2541
Electronic Displays, Inc., Wood Dale, IL 60191	708-860-5838
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
† Infodex, Inc., Wolcott, CT 06716	203-879-4944
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
KMC Systems, Inc., Midland Pk., NJ 07432	201-447-0007
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
†# Luminator Aircraft Products, Plano, TX 75074	214-424-6511
MicroDimensions, Inc., Mentor, OH 44060	216-974-8070
Mitsubishi Electronics, Torrance, CA 90502	213-515-3993
Optotek Limited, Kanata, Ont., CANADA K2K 2A9	613-591-0336
† Penn Keystone Corp., Wallingford, CT 06492	203-294-0537
Quantum Electronics, Inc., Lewistown, PA 17044	717-242-1132
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
§† Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
§ Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
Spectrum Corp., Houston, TX 77075	713-944-6200.1-800-392-5050(Sls)
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† UCE, Inc., Norwalk, CT 06854	203-838-7509
§ Vidco, Inc., Beaverton, OR 97005	503-641 1804
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Displays, Storage Tube — See Displays, CRT (Vol. A)

Displays, Surface Mount-2450

Idea, Inc., Brea, CA 92621, 310-697-4332	**B•1164-1165**
Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989	**B•1167**

† Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389-1390,1397**
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
† Barrington Plastics, Mt. Laurel, NJ 08054	609-235-5151
† Data Check Corporation, San Diego, CA 92126	619-578-0101
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173	708-884-1444
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409	818-787-0311
§ Lite-On Inc., Milpitas, CA 95035	408-946-4873
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013	615-641-2020

Displays, Touch Sensitive (Infrared & Mechanical) — See Touch Monitors (Vol. D), Touch Panels (Vol. D), Touch Terminals (Vol. D)

Displays, Tube — See Tubes, Readout (Vol. A)

Displays, Vacuum Fluorescent-2450

†# Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805, 714-491-5100	**B•1021**
Endicott Research Group, Endicott, NY 13760, 607-754-9187	**B•1045-1046, D•2107**
§† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311	**B•1078,1835**
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1088-1090**
Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020	**B•1094-1095**
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850	**B•1114**
Apollo Display Technologies, Inc., Holtsville, NY 11742	1-800-LCD-STOC; 516-654-1143
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§ Densitron Corporation, Densitron International, Torrance, CA 90505	310-530-3530
§† Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173	708-884-1444
§† Lucas Deeco, Lucas Industries, Hayward, CA 94544-7831	510-471-4700
§ Noritake Co., Inc., Electronics Division, LA Branch, Compton, CA 90220	310-603-9770
Pacific Industrial Components Corp., See Altair Exchange Corp.	
Printer Products, Boston, MA 02134	617-254-1200
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
2M Sales Company, Burnsville, MN 55337	612-890-7774
§ Uticor Technology, Bettendorf, IA 52722	319-359-7501
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440

Display Sets (MIL), Computer-2440

† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311	**B•1078,1835**
Eaton Corp., Control Displays, Colmar, PA 18915	215-822-3383
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
Intronics, Inc., Canton, MA 02021	800-367-0004
† Librascope Corp., Loral Corp., Glendale, CA 91201	818-244-6541
† Miltope Corp., Melville, NY 11747	516-420-0200
† Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
Ocular Inc., Richardson, TX 75081	214-437-3888
Two Technologies,Inc., Horsham, PA 19044	215-441-5305

Dissipators, Heat — See Heat Sinks, Semiconductor (Vol. C), Heat Sinks, Soldering (Vol. C)

Distortion Analyzers, Indicators — See Analyzers, AF (Vol. D)

Distributed Control Systems & Components-2200 — *See Vol. D*

Dividers, Frequency-3450 — *See Vol. A*

Dividers, Power (LF, HF, VHF, UHF)-3450 — *See Vol. A*

Dividers, Power, Microwave-3450 — *See Vol. A*

Dividers, Voltage-Also See Networks, Resistance; Transformers, Voltage Dividing-2900 — *See Vol. D*

Dome, Metal (for membrane switches)-5150

Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448	**B•1843**

Doublers, Frequency — See Multipliers, Frequency (Vol. A)

Doublers, Voltage-Also See Rectifiers, Bridges & Assemblies-4800 — *See Vol. A*

Down Converters-3450 — *See Vol. A*

Drafting Machines-4200 — *See Vol. C*

Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)-4200 — *See Vol. C*

Drawers, Sliding-1400 — *See Vol. C*

Drills & Accessories, Manual & Power-5400 — *See Vol. C*

Drivers & Decoders For Readouts-2450

Apollo Display Technologies, Inc., Holtsville, NY 11742, 1-800-LCD-STOC;516-654-1143	**B•1019**
§ Dialight Corporation, Manasquan, NJ 08736, 908-223-9400	**B•1147**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1042**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020	**B•1068**
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561	**D•1167**
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691	**A•2172**
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
Automation Displays Inc., Eau Claire, WI 54703	715-834-9595
Avasem Corporation, San Jose, CA 95126	408-297-1201
Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805	714-491-5100
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
† Dionics, Westbury, NY 11590	516-997-7474
† Exar Corp., San Jose, CA 95161-9007	408-434-6400
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Holt Inc., Irvine, CA 92718	714-859-8800
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409	818-787-0311
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
† Orbit Instrument Corp., Hauppauge, NY 11788	516-435-8300
Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
§† Teledyne Components, Mountain View, CA 94039-7267	415-968-9241
§ Three-Five Sys., Inc., Phoenix, AZ 85044	602-496-0035
† UCE, Inc., Norwalk, CT 06854	203-838-7509
§ Wilson, H. F., Engineering Co., Glen Ellyn, IL 60137	708-469-7473

Drivers, Chopper-1100 — *See Vol. D*

Drivers, Hardware & Software-2000 — *See Vol. D*

Drivers, Nut-5400 — *See Vol. C*

Drivers, Solenoid-4550

† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**B•1593**
DDI Inc., Beverly, MA 01915-1703	508-927-7976
† Dionics, Westbury, NY 11590	516-997-7474
§ MKC Electronics Corp., Overland Park, KS 66215	913-894-9711
§ Namco Controls Corporation, Mentor, OH 44060	216-946-9900
§† Silicon General, Garden Grove, CA 92641	714-898-8121
Voltex, Amityville, NY 11701	516-842-2772

Drivers, Speaker-1300 — *See Vol. D*

Drivers, Switch-3450 — *See Vol. A*

Drivers, Tube — See Drivers & Decoders for Readouts (Vol. B)

Drives & Drive Mechanisms (Dial)-2400 — *See Vol. C*

Drives/Subsystems, Core Disk Emulator-2000 — *See Vol. D*

Drives/Subsystems, Disk, 3½″ Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 3¼″ Winchester-2000 — *See Vol. D*

Drives/Subsystems, Disk, 5¼″ Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 5¼″ Winchester-2000 — *See Vol. D*

Drives, Subsystems, Disk, 8″ Diskette-2000 — *See Vol. D*

Drives/Subsystems, Disk, 8″ Winchester-2000 — *See Vol. D*

Drives/Subsystems, Disk, 14″ Winchester-2000 — *See Vol. D*

Drives/Subsystems, Disk, Fixed-2000 — *See Vol. D*

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Drives/Subsystems, Disk Array-2000 — *See Vol. D*

Drives/Subsystems, Magnetic Tape, ¼″ Cartridge-2000 — *See Vol. D*

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Drives/Subsystems, Semiconductor Emulator-2000 — *See Vol. D*

Dry Transfer Letters & Numbers — See Kits, Marking (Vol. C)

Ducts, Wiring-6000 — *See Vol. C*

Ducts, Fiber Optic-2475

# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† Cole-Flex Corporation, West Babylon, NY 11704	516-249-6150
§ Panduit Corp., Tinley Park, IL 60477-0981	800-777-3300
The Wiremold Company, W. Hartford, CT 06110	203-233-6251

Dummy Loads, Electronic-2900 — *See Vol. D*

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Dummy Loads, Power-2900 — *See Vol. D*

Dummy Loads, Programmable-2900 — *See Vol. D*

Dummy Loads, Resistive-2900 — *See Vol. D*

Dummy Loads (MIL), RF-2440

† Tru-Connector Corp., Peabody, MA 01960, 508-532-0775;1-800-262-9787;1-800-COAXTRU	**C•1507**
† Alan Industries Inc., Columbus, IN 47202	812-372-8869
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
† Antenna Specialists, The Allen Group, Cleveland, OH 44139	216-349-8400
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
§† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
Continental Electronics Corporation, Dallas, TX 75227	214-381-7161
† Electro Impulse, Neptune, NJ 07754-0278	908-776-5800
† International Telecommunications Components, Inc., Deer Park, NY 11729	516-243-1444
† KDI/Triangle Electronics, Whippany, NJ 07981	201-887-5700
§† Midwest Microwave, Saline, MI 48176-9569	313-429-4773;800-521-4410
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† Pasternack Enterprises, Irvine, CA 92713	714-261-1920
† Pro Com Technology Inc., Plainview, NY 11803	516-293-4443;800-762-3785
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047	818-707-2020

Duplexers, Microwave-3450 — *See Vol. A*

Duplexers, Nonmicrowave-1900 — *See Vol. D*

Duplicators, Magnetic Tape-1300 — *See Vol. D*

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DVMs — See Meters, Volt, Digital (Vol. D)

Earphones — See Headphones (Vol. D)

Earth Stations, TV, Receive Only-1900 — *See Vol. D*

Earth Stations; TV, Receive/Transmit-1900 — *See Vol. D*

Edge Clips, Surface Mount-2500 — *See Vol. C*

Edge Connectors, Surface Mount-2100 — *See Vol. C*

Editing Equipment, Tape-1300 — *See Vol. D*

Ejectors & Extractors, PC Boards — See Pullers, Circuit Board (Vol. C)

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Electret — See Microphones, Condenser (Vol. D)

Electrical Measurement & Test Services — See Services, Electrical Measurement & Test (Vol. D)

Electrodes, Electroplating — See Electroplating Equipment & Supplies (Vol. D)

Electrodes, High Voltage-2900 — *See Vol. D*

Electromagnets-1850 — *See Vol. A*

Electronic Counter Countermeasures (ECCM) Fixes (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
New Wave Instruments, Provo, UT 84604	801-373-4909
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900

Electronic Countermeasures (ECM) (MIL), Cruise Missiles-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248

ECM Sets (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900

ECM Systems (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

ECM Systems (MIL), Deceptive-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
† Aydin Corp., Horsham, PA 19044	215-657-7510
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
# NAVAN Corporation, Media, PA 19063	215-352-8464
† Noise Com Inc., Paramus, NJ 07652	201-261-8797
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900

Electronic Intelligence (Elint) (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
New Wave Instruments, Provo, UT 84604	801-373-4909
† SCOPE Incorporated, Reston, VA 22090	703-471-5600
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Electronic Loads — See Dummy Loads (Vol. D)

Electronic Support Measures (ESM) Sets (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
AMASCO, Torrance, CA 90501	310-781-9494
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Electronic Warfare (EW) Sets (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729	516-595-3094
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
Computer Systems Technical Support, Anaheim, CA 92807	714-632-1300
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788	516-273-9800
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500

† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900

Electroplating Equipment & Supplies-4100 – *See Vol. D*

Electrostatic Discharge Guns - Also See Generators, ESD-2900 – *See Vol. D*

Electrostatic Discharge (MIL)-2440

Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566 .... A•1602, D•1322
§† ACL Inc., Elk Grove Village, IL 60007 .... 708-981-9212;1-800-782-8420
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
# Electrostatic Consulting Assocs., Groton, MA 01450 508-448-5485
† Gordon Brush Mfg. Co., Inc., Los Angeles, CA 90021-1786 213-627-6889
† KeyTek Instrument Corp., Wilmington, MA 01887 508-658-0880
§† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072 716-773-7634
Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
Plastic Systems Inc., Marlboro, MA 01752-3004 508-485-7390
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
§ Semtronics Corp., Peachtree City, GA 30269 404-487-6681
Simco Co., Hatfield, PA 19440 215-822-2171
§† Stackbin Corp., Lincoln, RI 02865 .... 401-333-1600;800-333-1603
§† Testone Inc., Skippack, PA 19474-1589 215-584-9658

Elements, Sensing – See Transducers (Vol. B)

Eliminators, Battery – See Power Supplies, AC to DC Adapter (Vol: D)

Emitter Location & Identification System (MIL), Automatic Ground Transportable-2440

Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Emitters, Infrared-3700

§ Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 .... B•1141
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1152-1153
§ Idea, Inc., Brea, CA 92621, 310-697-4332 .... B•1164
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1324-1325
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ...... B•1326
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 .... A•2172
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 .... B•1339
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ...... 214-422-1844; 1-800-872-0044
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
† DBA Systems, Inc., Melbourne, FL 32902-0550 407-727-0660
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 .... 215-524-2000; 800-441-8246
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101 708-543-6200
† Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 310-534-1505
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Marktech International Corp., Latham, NY 12110 518-786-6591
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
Quality Technologies, Sunnyvale, CA 94086 408-720-1440
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Swan Associates, New Haven, CT 06534 203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

Emitters, Fiber Optic-Also See Diodes, Laser-2475

Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1153
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001 .... B•1213
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
AT&T Microelectronics, Allentown, PA 18103 .... 1-800-372-2447;In Can.:1-800-553-2448
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
BT & D Technologies, Kennett Square, PA 19348 .... 215-444-6888;800-545-4306
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ Marktech International Corp., Latham, NY 12110 518-786-6591
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701 516-226-8950
3M Private Network Products, 3M, Austin, TX 78726 ..... 512-984-3400;800-426-8626
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Ortel Corp., Alhambra, CA 91803 818-281-3636
# Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ I I Stanley Co., Inc., Irvine, CA 92714 .... 1-800-LED-LCD1
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

Emulators, In-circuit-2900 – *See Vol. D*

Emulators, RTS-2900 – *See Vol. D*

Emulators, Terminal-2900 – *See Vol. D*

Encapsulating Materials – See Compounds, Encapsulating, Molding, Potting (Vol. C)

Encapsulation Services – See Services, Encapsulation (Vol. D)

Enclosures, Circuit Board, Module, & Relay Mounting-1400 – *See Vol. C*

Enclosures, CRT – See Mounts CRT (Vol. C)

Enclosures, Equipment & Panel Mounting-1400 – *See Vol. C*

Enclosures, Instrument-1400 – *See Vol. C*

Enclosures, Keyboard-1400 – *See Vol. C*

Enclosures, Metal-1400 – *See Vol. C*

Enclosures, Nonmetallic-1400 – *See Vol. C*

Enclosures, Portable - Also See Cases-1400 – *See Vol. C*

Enclosures, Power Distribution-1400 – *See Vol. C*

Enclosures, Shielded-1400 – *See Vol. C*

Enclosures, Shipping-1400 – *See Vol. C*

Enclosures, (MIL)-2440

Amco Engineering, Schiller Pk., IL 60176, 708-671-6670;800-833-3156 .... C•1010,1012
† Compac, Holbrook, NY 11741, 516-585-3400 .... C•1020
ECS Composites, Grants Pass, OR 97526, 503-476-8871 .... C•1021
† EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268, 818-442-2572 ...... C•1022
Electronic Packaging System, Marion, IA 52302, 319-377-3423 .... C•1023
Electrorack Products Co., Anaheim, CA 92806, 714-776-5420 .... C•1097
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 .... B•1827, C•1031
Emcor Products, Crenlo, Inc., Rochester, MN 55901, 507-289-3371 .. C•1034,1037
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200 .... C•1042
† Gemini Inc., Cannon Falls, MN 55009, 507-263-3957;800-533-3631 ...... C•1047
† General Devices Co., Inc., Indianapolis, IN 46239-0100, 317-897-7000,1-800-626-9484 .... C•1048
† Optima Electronic Packaging Systems, Tucker, GA 30084-5088, 404-496-4000 .... C•1058,1061
Par Metal Products, Inc., Par Industrial Complex, Brooklyn, NY 11216, 718-774-5900 .... C•1069
TDJ Co., Inc., San Diego, CA 92110, 619-276-5920 .... C•1100
Zero Cabinets (Stantron), Pacoima, CA 91331-2226, 818-890-3445 .. C•1118-1123
† Zero East, Zero Corporation, Monson, MA 01057-0128, 413-267-5561 .... C•1124-1127
† A & J Manufacturing Co., Tustin, CA 92680 714-544-9570
§† Abalon Precision Mfg., Bronx, NY 10459 .... 718-589-5682;1-800-888-ABALON
A.B. Controls & Technology, Inc., Houston, TX 77090 .... 713-876-3728;301-984-6020
Action USA, St. Petersburg, FL 33704 .... 813-821-5000;800-821-5001
ADE, Inc., Chicago, IL 60633 312-646-3400
† Cabtron Systems, Inc., Northbrook, IL 60062 708-498-6090
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ...... 214-422-1844; 1-800-872-0044
† Compucraft Fabricators Inc., Warminster, PA 18974 215-443-7107
† EDAK Inc., EDAK Ltd., Melbourne, FL 32934 .... 407-242-2953;800-462-8478
† Electronic Enclosures, Div. Wyle Laboratories, El Segundo, CA 90245 ... 310-643-8181
† Equipto Electronics Corp., Aurora, IL 60506-9988 708-897-4691
† Gordon, L., Packaging, Baltimore, MD 21230 410-539-6537
Graham Electronic Manufacturing Inc., Escondido, CA 92025 .... 619-747-9177; 800-628-4095
§† Hardigg Cases, Hardigg Industries, South Deerfield, MA 01373 413-665-2163
† Hoffman Engineering, Anoka, MN 55303 612-421-2240
† Instrument Enclosures, Tulare, CA 93274 209-688-1100
† Langley:Fleet Aerospace, Inc., San Diego, CA 92112 619-264-3181

Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762 508-695-2000
# Project Pro, Twinsburg, OH 44087 216-425-8888
Quantum Scientific Inc., Toronto, ONT M8W 4Y4 .... 416-503-8555;800-268-6000
Rose Enclosures Sys., Inc., Frederick, MD 21701-8353 301-696-9800
† S & S Associates, Inc., San Luis Obispo, CA 93401 805-544-2500
Schell Inc., St. Petersburg, FL 33733 .... 813-822-2600; 800-237-2600
† SKB Coporation, Orange, CA 92667 714-637-1252
† Skydyne Div., AAR Mfg., Port Jervis, NY 12771 .... 914-856-6655;800-428-CASE
§ Star Case Manufacturing Co., Inc., Munster, IN 46321 .... 219-922-4440;800-822-STAR (outside IN);800-782-CASE (inside IN)
† STRONGBOX, Culver City, CA 90231-2726 310-305-8288
† Underwater Kinetics, San Marcos, CA 92069 619-744-7560
† Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 801-298-5900

Encoders, Digital – See Encoders, Shaft Angle (Vol. B)

Encoders, Displacement, Linear-3500

Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 .... B•1924-1925
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 .... B•1926
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1173-1175**
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193, 508-658-6100 .... B•1935
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1967
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 .... B•1968, D•2316
† **Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 .... B•1849, D•1167**
U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451 .... D•1327
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Burleigh Instruments, Fishers, NY 14453-0755 716-924-9355
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928 707-584-7558
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Enprotech Corp., Kalamazoo, MI 49007 616-381-0665
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Heidenhain Corp., Schaumberg, IL 60173 708-490-1191
§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298 215-842-3675
† Ocean Motions Co., Barrington, RI 02806 401-246-1394
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636 412-744-4451
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
§† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11042-5416 516-328-3300
† Teledyne Gurley, Troy, NY 12181 .... 518-272-6300;800-759-1844
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
Transmagnetics, Farmingdale, NY 11735 516-293-3100
§ Trumeter Company, Inc., New York, NY 10001 .... 212-564-0666;800-537-2261
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Encoders, Fiber Optic-2475

BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 .... B•1917
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 .... D•1164
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311 818-341-6161
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203 501-851-4000
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Daido Precision Engineered Products/, Sumtak Electronics, Somerset, NJ 08875 908-805-1900
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248

Encoders, Magnetic Strip-3500

Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1967
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 .... B•1968, D•1164
§ American Magnetics Corporation, Group 4, Carson, CA 90745 213-775-8651
Copal (USA), Inc., Torrance, CA 90501 310-618-0225
Elcom Industries, Inc., St. Louis, MO 63132 314-429-3100
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Identatronics, Inc., Elk Grove Village, IL 60007-2082 .... 708-437-2654;1-800-323-5403
§ Mag-Tek, Carson, CA 90746 213-631-8602
Neuron Electronics, Inc., Torrance, CA 90503 .... 213-793-1300;1-800-FON-4-NEI
Q-Card, Inc., Owings Mills, MD 21117-1634 410-581-0112
† Vertex Industries, Inc., Clifton, NJ 07014 201-472-1331
§ Xico, Inc., Chatsworth, CA 91311 818-709-4403

Encoders, Proof-2000 – *See Vol. D*

Encoders, Shaft Angle, Contacting-3500

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 .... B•1239
§ **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 .... B•1922-1923**
§ **Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 .... B•1926**
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1172-1175**
Data Technology, Inc., Woburn, MA 01811, 617-935-8820 .... B•1931
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 .... D•1190**
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .... B•1960-1961
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1967
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•2004-2005
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 .... B•1304
U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451 .... D•1327
§† Allen-.Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Daido Precision Engineered Products/, Sumtak Electronics, Somerset, NJ 08875 908-805-1900
§ Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
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§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
J. R. Merritt Controls, Inc., Norwalk, CT 06854 .... 203-855-9100;800-333-5762
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Motor-Tronics, Inc., Vista, CA 92083 619-727-7425
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§ Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
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§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 .... 708-390-6680; 800-323-6693
Transmagnetics, Farmingdale, NY 11735 516-293-3100
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Encoders, Shaft Angle, Magnetic-3500

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1172,1174-1175**
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IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .... B•1960-1961
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1967
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 .... B•1968, D•2316**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1971
Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300 .... B•1307
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§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817 .... 908-819-7070; 908-572-0500
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§ Encoder Products, Sandpoint, ID 83864 208-263-8541
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
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§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
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† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Tenor Controls Comp, New Berlin, WI 53151 414-782-3800
† Transmagnetics, Farmingdale, NY 11735 516-293-3100

Encoders, Shaft Angle, Optical-3500

BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 .... B•1917
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 .... B•1917
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 .... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 .... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000 .... B•1917
§ **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 .... B•1922-1923**

Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700	**B•1924-1925**
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044	**B•1926**
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1172,1175**
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**B•1248**
§ Data Technology, Inc., Woburn, MA 01811, 617-935-8820	**B•1931**
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193, 508-658-6100	**B•1935**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643	**D•1117**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO	**B•1271**
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489	**B•1960-1961**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1294-1295,1968, D•2316**
OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200	**B•1979**
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100	**B•1306**
U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451	**B•2019-2021,2023, D•1327**
§† Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
Copal (USA), Inc., Torrance, CA 90501	310-618-0225
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
Daido Precision Engineered Products/, Sumtak Electronics, Somerset, NJ 08875	908-805-1900
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Disc Instruments, Honeywell, Costa Mesa, CA 92626	714-433-0343
§ Dynapar, Gurnee, IL 60031	312-662-2666
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
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§† FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
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Hansen Corp., Princeton, IN 47670-0023	812-385-3415
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Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ Heidenhain Corp., Schaumberg, IL 60173	708-490-1191
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§† Honeywell Microswitch Div., Richardson, TX 75081	214-470-4271
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
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Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† Measurement Systems, Inc., Fairfield, CT 06430	203-336-4590
Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
† Orbit Instrument Corp., Hauppauge, NY 11788	516-435-8300
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
Penny & Giles Controls, Inc., Attleboro, MA 02703	508-226-3008
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
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§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
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† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800
Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
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§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005	314-532-5887

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BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161	**B•1917**
BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414	**B•1917**
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000	**B•1917**
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1173**
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
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Data Delay Devices, Clifton, NJ 07013-1915	201-773-2299
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# Sekai Electronics of America, Inc.; Santa Fe Springs, CA 90670-5234	310-921-7775
† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844

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§† Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311	818-718-6300

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Data Translation, Inc., Marlboro, MA 01752	508-481-3700
† DEI, Escondido, CA 92029	619-743-8344

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† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330	**B•1249**
McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550, 609-799-0100	**C•1606-1607**
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§ Contact East, N. Andover, MA 01845	508-682-2000
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† Hi-Tech, Inc., Zion, IL 60099	708-746-2447
§ Interfan, William J. Purdy Co., Burlingame, CA 94010	415-347-1203
† Kooltronic, Inc., Hopewell, NJ 08525	609-466-3400
† Kooltronic, Inc., Ventura, CA 93003	805-642-8521
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IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117,1130-1131
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 ..... B•1219
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ..... B•1325
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 ..... B•1229
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§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Systran Corp., Dayton, OH 45432-3068 1-800-252-5601

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§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... B•1203, C•1163
Daniels Manufacturing Corp., Orlando, FL 32824, 407-855-6161 ..... C•1700
# Accu-Tech Corporation, Roswell, GA 30076-3890 ..... 404-751-9473;800-221-4767
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ..... 1-800-344-0223, Ext. 1027
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3M Private Network Products, 3M, Austin, TX 78726 ..... 512-984-3400;800-426-8626
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† Homalite, Whitco, Inc., Wilmington, DE 19804, 302-652-3686 ..... B•1077
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 ..... B•1837
† JMJ Technical Prods., Westfield, NJ 07090, 201-589-4257 ..... C•1531
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† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 ..... B•1151
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Jayco Interface Technology, Orange, CA 92665, 714-974-1701 ..... B•1841
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† Dontech, Inc., Doylestown, PA 18901	215-348-5010
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090	215-659-3080
† Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
† Homalite, Whitco, Inc., Wilmington, DE 19804	302-652-3686
International Polarizer, Inc., Marlborough, MA 01752	508-481-7495
† Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014	412-224-1800
†# Luminator Aircraft Products, Plano, TX 75074	214-424-6511
† Marks Polarized Corp., Hauppauge, NY 11788	516-273-8900
§ Optics for Research, Inc., Caldwell, NJ 07006	201-228-4480
† Optima Precision, Inc., West Linn, OR 97068	800-544-4118;503-638-2525
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Oxley Inc., Branford, CT 06405	203-488-1033
Penny Technologies, Inc., Greenpoint, NY 11222	718-782-4149
† Plummer Precision Optics, Pennsburg, PA 18073	215-679-6272
† Pomfret Research Optics, Orange, VA 22960	703-854-4350
Rolyn Optics Co., Covina, CA 91722-2199	818-915-5707/5717
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310	305-563-1333;800-359-5400
Schneider Corp. of America, Woodbury, NY 11797	516-496-8500
† Schott Glass Technologies, Inc., Duryea, PA 18642	717-457-7485
Silicon Sensors, Dodgeville, WI 53533	608-935-2707
† Southwall Technologies Inc., Palo Alto, CA 94303	415-962-9111
† TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807	714-630-7127
§ Volpi-MFG-USA, Auburn, NY 13021-1289	315-255-1737

Filters, Programmable — See Filters, Variable (Vol. A)

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Filters, Single Sideband-2750 — *See Vol. A*

Filters, Surface Acoustic Wave (SAW)-2300 — *See Vol. A*

Filters, Synchronous Tracking-2750 — *See Vol. A*

Filters, Telemetering-1900 — *See Vol. D*

Filters, Tone, Telegraph-2750 — *See Vol. A*

Filters, Tunable — See Filters, Continuously Variable (Vol. A)

Filters, Tuning Fork-2300 — *See Vol. A*

Filters, UHF & VHF-2750 — *See Vol. A*

Filters, Variable-2750 — *See Vol. A*

Filters, Vestigial Sideband-2750 — *See Vol. A*

Filters, Video-2750 — *See Vol. A*

Filters, Waveguide-3450 — *See Vol. A*

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Filters (MIL), Electrical & Networks-2440

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333	**A•1623**
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600	**A•1601**
† Eagle Wichita, Wichita, KS 67277, 316-942-5100	**A•1626-1628,1631**
† Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333	**A•1633**
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003	**A•1593-1594**
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300	**A•1641**
Hisonic, Inc., Olathe, KS 66051, 913-782-0012	**A•2360**
Interpoint Corporation, Redmond, WA 98052, 206-882-3100	**D•2118-2120**
§† JMK, Inc., Amherst, NH 03031, 603-886-4100	**A•1596-1597**
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900	**A•1648**
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411	**A•1417**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366	**A•1651-1652, C•1419**
§ Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666	**A•1655**
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600	**B•1974**
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**A•1660-1661**
Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500	**D•2196-2197**
§† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000	**A•1678-1679, C•1468**
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614	**A•1680**
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400	**A•1684-1685**
Alpha Components, Mechanicsburg, PA 17055	717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410	718-441-5207
§† Amphenol Canada Corp., Scarborough, Ontario, CANADA M1B 2X6	416-291-4401
† Anatech Electronics, Inc., Garfield, NJ 07026	201-772-4242
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057	800-666-9655;315-463-2309
Comstron A Div. of Aeroflex, Plainview, NY 11803	516-752-2351
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380	607-724-2484
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232	513-542-5555
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714	714-476-6070
Engineered Components Co., San Luis Obispo, CA 93403-8121	805-544-3800
† ESC Electronics Corp., Palisades Pk., NJ 07650	201-947-0400
† Ferretec Inc., Fremont, CA 94538-6525	510-226-1216
† Filtron, RFI Corporation, Bayshore, NY 11706	516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120	816-231-7375
Frequency Selective Networks, Woodside, NY 11377	718-424-7500
§† Hybrids International, Frequency Products Div., Olathe, KS 66062	913-764-4544
Hycomp, Inc., Marlborough, MA 01752	508-485-6300
† K&L Microwave, Inc., Salisbury, MD 21801	410-749-2424
Keytronics, Inc., Endicott, NY 13760	607-754-5405
† Magnetic Component Engineering, Inc., Inglewood, CA 90301	310-677-6600
Marway Prods. Inc., Santa Ana, CA 92703	714-973-1800
† North Hills Signal Processing, Syosset, NY 11791	516-682-7740
OPT Industries, Inc., Phillipsburg, NJ 08865	908-454-2600
† Oxley Inc., Branford, CT 06405	203-488-1033
† Pico Electronics, Inc., Mt. Vernon, NY 10552	914-699-5514;800-431-1064
† Piezo Technology Inc., Orlando, FL 32804	407-298-2000
† Polyphase Instrument, Ft. Washington, PA 19034	215-643-6950
RFI Corporation, Bay Shore, NY 11706	516-231-6400
RME Filters, Inc., Amherst, NH 03031	603-595-4573
† Rtron Corp., Skokie, IL 60076	708-679-7180
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
† SFE Technologies, San Fernando, CA 91340	818-365-9411
† Time and Frequency Ltd., Miami, FL 33172	305-593-8000
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9	403-259-3200

Flanges (MIL), Waveguide-2440

† International Telecommunications Components, Inc., Deer Park, NY 11729	516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
Microwave Development Laboratories, Natick, MA 01760	508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666; 800-724-3911
§ Pro Com Technology Inc., Plainview, NY 11803	516-293-4443;800-762-3785
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900

Flashers-2200 — *See Vol. D*

Flashers (MIL)-2440

† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**B•1556**
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
† Modular Devices, Shirley, NY 11967	516-345-3100
† Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717

Flat Packages, Integrated Circuit — See Packages, Integrated Circuit (Vol. A)

Fluid Flow Indicators — See Meters, Fluid Flow (Vol. D)

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Foil, Magnetic Shielding — See Shields, Magnetic (Vol. C)

Forks, Tuning — See Tuning Forks (Vol. A)

Forms, Coil — See Coil Assemblies & Forms (Vol. A)

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Freeze Spray — See Refrigerants, Spray (Vol. C), Coolants, Circuit & Component (Vol. C)

Frequency Analyzers — See Analyzers, Spectrum (Vol. D)

Frequency Extenders — See Dividers, Frequency (Vol. A)

Frequency Sources — See Oscillators (Vol. A)

Frequency Standards — See Standards, Frequency (Vol. D)

Frozen Epoxies — See Compounds, Encapsulating, Molding, Potting (Vol. C)

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Furnaces, Gas (Production)-4100 — *See Vol. D*

Furnaces, Infrared-4100 — *See Vol. D*

Furnaces, Ultraviolet-4100 — *See Vol. D*

Furnaces, Vacuum-4100 — *See Vol. D*

Furniture, Electronic Lab. — See Benches, Consoles, Stools, Tables (Lab & Shop) (Vol. C)

Fuse Clips — See Clips & Holders, Fuse (Vol. B)

Fuseholders – See Clips & Holders, Fuse (Vol. B)

Fuses & Fuse Elements-4300

§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463	**B•1344-1345,1347-1349**
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594	**B•1359**
§† Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400	**B•1366-1367**
Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491	**A•1103**
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**A•1127**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**B•1376-1377**
Raychem Corporation, Menlo Park, CA 94025, 415-361-3863;800-2-RAYCHEM/ext. 6900	**A•2179, B•1384-1385,1894-1895, D•1466**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1386-1388, C•1452**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
§ Wickmann USA, Inc., Atlanta, GA 30336, 404-699-7820	**B•1394-1398**
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577	803-448-9411
§† Bussmann Division, Cooper Industries, St. Louis, MO 63178	314-394-2877
§ Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101	718-937-8000
Elcom Systems, Inc., Boca Raton, FL 33487	407-994-1774
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772	516-758-0700
§† Ferraz Corporation, Parsippany, NJ 07054	201-428-8400;800-526-9067
† Fuses Unlimited, D.E.I., Van Nuys, CA 91406	818-786-8111
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
§ GlobTek, Inc., Northvale, NJ 07647	201-784-1000
§ Gould Shawmut, Newburyport, MA 01950	508-462-6662/3131
Indium Corporation of America, Utica, NY 13502	315-853-4900;1-800-4INDIUM
§ International Components Corp., Melville, NY 11747	516-293-1500
† KRL/Bantry Components, Inc., Manchester, NH 03103	603-668-3210
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
Mepcopal Company, San Diego, CA 92121-1307	619-481-0210
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
Omega Engineering, Stamford, CT 06907	800-826-6342
§† RCD Components, Inc., Manchester, NH 03109	603-669-0054
§ San-O Industrial Corp., Holbrook, NY 11741	516-472-6666
§ Semikron, Inc., Hudson, NH 03051-0066	603-883-8102;1-800-258-1308
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487

Fuses, Failure Indicating-4300

Bel Fuse, Jersey City, NJ 07302, 201-432-0463	**B•1344-1345,1347**
§ FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594	**B•1359**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591	**B•1883**
§ Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400	**B•1366-1367**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**B•1376-1377**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1386-1388**
§ Wickmann USA, Inc., Atlanta, GA 30336, 404-699-7820	**B•1394-1398**
§† Bussmann Division, Cooper Industries, St. Louis, MO 63178	314-394-2877
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§† Ferraz Corporation, Parsippany, NJ 07054	201-428-8400;800-526-9067
† Fuses Unlimited, D.E.I., Van Nuys, CA 91406	818-786-8111
§ Gould Shawmut, Newburyport, MA 01950	508-462-6662/3131
§ San-O Industrial Corp., Holbrook, NY 11741	516-472-6666
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500

Fuses, Fuseholders, Boxes & Panels (MIL)-2440

Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300	**B•1873**
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594	**B•1359**
§† Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400	**B•1366-1367**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1386-1388, C•1454**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
† Alan Industries Inc., Columbus, IN 47202	812-372-8869
§ Bussmann Division, Cooper Industries, St. Louis, MO 63178	314-394-2877
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
Connector Corp., Chicago, IL 60646	312-539-3108
Doran Manufacturing Co., Cincinnati, OH 45225	513-681-5424
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Ferraz Corporation, Parsippany, NJ 07054	201-428-8400;800-526-9067
§ GlobTek, Inc., Northvale, NJ 07647	201-784-1000
§ International Components Corp., Melville, NY 11747	516-293-1500
ISL Products Int'l. Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
§† Keystone Electronics Corp., Astoria, NY 11105-2017	718-956-8900
Marway Prods. Inc., Santa Ana, CA 92703	714-973-1800
§ Nedco Electronics, Inc., Morton Grove, IL 60053	708-967-0500
Omega Engineering, Stamford, CT 06907	800-826-6342
§ San-O Industrial Corp., Holbrook, NY 11741	516-472-6666
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
§ Trimm Inc., Libertyville, IL 60048	708-362-3700

Fuses, International, 5x20 mm-4300

§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463	**B•1344-1346**
§ Littelfuse, Inc., Des Plaines, IL 60016, 708-824-1188;708-824-0400	**B•1367**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**B•1376-1377, C•1428**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1386-1388, C•1452-1453**
§ Wickmann USA, Inc., Atlanta, GA 30336, 404-699-7820	**B•1394-1398**
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§ Arcolectric Corp., Canoga Park, CA 91304	818-700-1933
§† Bussmann Division, Cooper Industries, St. Louis, MO 63178	314-394-2877
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§† Ercona, Patchogue, NY 11772	516-758-0700
§ Ferraz Corporation, Parsippany, NJ 07054	201-428-8400;800-526-9067
§† FIC Corp., Rockville, MD 20852	301-881-8124;800-638-6594
Fuses Unlimited, D.E.I., Van Nuys, CA 91406	818-786-8111
§ Gould Shawmut, Newburyport, MA 01950	508-462-6662/3131
Pass & Seymour Canada, Inc., Legrand, Concord, ONT L4K 3M9	416-738-9195
§ Qualtek Electronics Corp., Mentor, OH 44060	216-951-3300
§ San-O Industrial Corp., Holbrook, NY 11741	516-472-6666
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500

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Gaskets – See Seals (Vol. C)

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Gas Sensors – See Detectors, Gas (Vol. D)

Gates, Computer Circuit (AND, OR, NOR, etc.) – See Cards, Logic (Vol. D)

Gauges, Centerhole, Flexible Disk-2900 – *See Vol. D*

Gauges, Displacement, Linear-5400 – *See Vol. C*

Gauges, Humidity-2900 – *See Vol. D*

Gauges, Ionization-2900 – *See Vol. D*

Gauges, Pressure-Also See Transducers, Pressure-2900 – *See Vol. D*

Gauges, Strain-5500

§ Data Instruments, Inc., Acton, MA 01720, 800-332-3282	**B•1930**
DCI Inc., Olathe, KS 66062, 913-782-5672	**D•1344**
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1936-1937,1944-1945**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1886-1887,2004-2005, C•1792, D•1314,1362-1363**
ADAC Corporation, Woburn, MA 01801	617-935-6668
Advanced Process Controls, Woburn, MA 01801	617-932-9262
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
BLH Electronics, Inc., Canton, MA 02021-9111	617-821-2000
HBM, Inc., Marlboro, MA 01752	508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
§† Kistler-Morse, Redmond, WA 98073	206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Measurements Group, Inc., Raleigh, NC 27611	919-365-3800
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
Sensor Developments Inc., Lake Orion, MI 48361	313-391-3000
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Gauges, Temperature-2900 – *See Vol. D*

Gauges, Torque-2900 – *See Vol. D*

Gearheads & Speed Reducers - Also see gears and gear mechanisms-3500

Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330	**B•1249**
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1296-1297, D•2316**
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
§† Berg, W. M., Inc., East Rockaway, NY 11518	516-599-5010
§† Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089	708-215-9600
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Electrol Co., York, PA 17405	717-848-1722
§† Electronic Hardware Corp. Formerly Jan Hardware Mfg. Co., Farmingdale, NY 11735	516-752-1950
§ Empire Magnetics, Rohnert Park, CA 94928	707-584-2801
† Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§† Globe Motors, Dayton, OH 45404	513-228-3171
† H D Systems, Inc., Hauppauge, NY 11788	516-231-6630
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† Moore Reed & Co. Ltd., Andover. HAMPSHIRE SP 105AB	0264-324155
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762	203-758-8272
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
† Precision Mechanisms, Westbury, NY 11590	516-ED3-5955
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111

§† Sterling Instruments, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-3300
† Stock Drive Products, a DSG Company, New Hyde Pk, NY 11042-5416	516-328-0200;328-3300
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Gears & Gear Mechanisms (Precision)-2500 – ***See Vol. C***

Generator Groups (MIL), Signal-2440

Durmitor Inc., King City, Ont., CANADA LOG 1K0	416-833-3148
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Rohde & Schwarz, Inc., Lanham, MD 20706	301-459-8800

Generators, AM-2900 – ***See Vol. D***

Generators, AM/FM-2900 – ***See Vol. D***

Generators, Arbitrary Waveform-2900 – ***See Vol. D***

Generators, Audio-2900 – ***See Vol. D***

Generators, Bar, Dot & Crosshatch-2900 – ***See Vol. D***

Generators, Baud Rate-1900 – ***See Vol. D***

Generators, Character-2325 – ***See Vol. D***

Generators, Color Bar-2900 – ***See Vol. D***

Generators, Digital Delay – See Generators, Timing, Digital (Vol. D)

Generators, Electrical Power-4000 – ***See Vol. D***

Generators, Electrostatic Discharge - Also See Electrostatic Discharge Guns-2900 – ***See Vol. D***

Generators, FM-2900 – ***See Vol. D***

Generators, FM/Stereo-2900 – ***See Vol. D***

Generators, Frequency Synthesizer-2900 – ***See Vol. D***

Generators, Function-2900 – ***See Vol. D***

Generators, Gating/Timing-2900 – ***See Vol. D***

Generators, Hall-4800 – ***See Vol. A***

Generators, Harmonic-2900 – ***See Vol. D***

Generators, High Power Pulse-2900 – ***See Vol. D***

Generators, Impulse-2900 – ***See Vol. D***

Generators, Infrared – See Lamps, Infrared (Vol. B)

Generators, Ion - Also see Static Eliminating Materials and Equipment; Generators ESD-2900 – ***See Vol. D***

Generators, Light Pulse-2900 – ***See Vol. D***

Generators, Low Frequency-2900 – ***See Vol. D***

Generators, Marker-2900 – ***See Vol. D***

Generators, Microwave-3450 – ***See Vol. A***

Generators, Noise, Random (Electrical)-2900 – ***See Vol. D***

Generators, Optical Signal – See Generators, Light Pulse (Vol. D)

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Hardware (MIL), Connector-2440

§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571	**C•1358**
Kit Master, Peekskill, NY 10566, 914-736-1010	**C•1541**
† Nielsen Hardware, Zero Corporation, Hartford, CT 06141, 203-522-8145	**C•1544**
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
Autosplice, Inc., San Diego, CA 92121	619-535-0077
Autoswage Products, Shelton, CT 06484	203-929-1401
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007	708-981-6000
§ Elite Electronics, Inc., Plano, TX 75074	214-881-0026;800-553-4376
§† ITT Cannon, Santa Ana, CA 92705-5684	714-557-4700
§† Johnson, E. F., Co., Waseca, MN 56093	1-800-247-8256
§ Lyn-Tron, Inc., Burbank, CA 91505	213-849-6211;800-423-2734
U.S. Terminals Inc., Cincinnati, OH 45243	513-561-8145

Harnesses, Wire – See Cable Assemblies & Harnesses (Vol. C)

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Headsets (MIL)-2440

JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024-1025,1042,1044**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1060**
Accusonic Products, Global Market Development, New Hyde Park, NY 11040	516-437-6000
§Φ Clear-Com Intercom Systems, Berkeley, CA 94710	510-527-6666
† Roanwell, New York, NY 10014	212-989-1090
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911

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Heaters & Heating Elements (For Components & Equipment)-Also See Ovens-5300

Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004, D•1362**
Ajax Magnethermic Corp., Warren, OH 44483	216-372-8511
† Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302	716-278-2521
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
Cogebi, Inc., Dover, NH 03820	603-749-6896
† DELTA M Corporation, Oak Ridge, TN 37830	615-483-1569
§† Despatch Industries, Minneapolis, MN 55418	612-781-5363
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
† Electrofilm, Valencia, CA 91355	805-257-2242
† Elmwood Sensors, Pawtucket, RI 02861	401-727-1300
Eraser Co., Syracuse, NY 13221	315-454-3237
† Glenro, Inc., Paterson, NJ 07501-1715	201-279-5900;800-922-0106
§ Hoffman Engineering, Anoka, MN 55303	612-421-2240
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857	814-781-1591
† Minco Products, Minneapolis, MN 55432	612-571-3121
† Molecu-Wire, Farmingdale, NJ 07727	908-938-9473
§ Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
Ogden Manufacturing Co., Arlington Heights, IL 60005	708-593-8050
§ Pamran Inc., Racine, WI 53404	414-637-7999
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Sylvania, Emissive Products/Process Heat, Exeter, NH 03833	603-772-4331
† Technical Heaters, Inc./Thermolab, San Fernando, CA 91340	818-365-9435
† TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807	714-630-7127
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
† Trent, Inc., Philadelphia, PA 19127	215-482-5000

Heat Exchangers & Systems-2600 – *See Vol. C*

Heat Guns, Production-5400 – *See Vol. C*

Heat Pumps – See Cooling/Heating Modules, Thermoelectric (Vol. B)

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Heat Sinks, Soldering-4600 – *See Vol. C*

Heat Sinks, Surface Mount-2600 – *See Vol. C*

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§† AAVID Engineering, Inc., Laconia, NH 03247-0400, 603-528-3400	**C•1561**
The Bergquist Co., Minneapolis, MN 55439, 800-347-4572	**C•1654-1655,1657**
§† EG & G Wakefield Engineering, Wakefield, MA 01880, 617-245-5900	**C•1580**
§† IERC, Burbank, CA 91502, 213-849-2481	**C•1592**
† Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000	**B•1119**
§† Thermalloy, Inc., Dallas, TX 75381-0839, 214-243-4321	**C•1646-1647**
† Applied Design Company, Minneapolis, MN 55413	612-378-0094
§† Calmark Corp., San Gabriel, CA 91776	818-287-0451
Delbert Blinn Co., Inc., Pomona, CA 91769	909-629-3900
Dow Corning Corp., Midland, MI 48686-0994	517-496-4000
Extrusion Technology, Inc., Randolph, MA 02368	617-963-7200
† Noren Products Inc., Menlo Pk., CA 94025	415-322-9500
† North Texas Circuit Board, Grand Prairie, TX 75050	214-790-7610
Precision Extrusions, Inc., Bensenville, IL 60106	708-766-0340
†# Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039	401-433-7000

† Star-Tron Corporation, Providence, RI 02909	401-274-5090
† Thermacore Inc., Lancaster, PA 17601	717-569-6551

Hermetic Sealing – See Machines, Hermetic Sealing (Vol. D), Seals, Hermetic (Vol. C), Services, Hermetic Sealing (Vol. D)

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Hybrid Voltage Regulators – See Regulators & Stabilizers (Vol. D)

Identification, Friend or Foe (IFF) ESM (MIL)-2440

† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England	44(582)471200
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788	516-273-9800
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500

Igniters, Electronic & Piezo-2300 – *See Vol. A*

Image Processing Systems – See Processors, Image (Vol. D)

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Imagers, Charge-Coupled Devices-3700

§ DALSA INC., Waterloo, Ont., CANADA N2V 2E9	519-886-6000
Eastman Kodak Company, Motion Analysis Systems Division, San Diego, CA 92121-1097	619-535-2908
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197	408-738-4266
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265	214-995-6611
Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511	201-812-9000

IEEE 488 (GPIB) Bus – See Controllers, IEEE 488 (GPIB) (Vol. C), Cable, IEEE (Vol. D)

Impedance Comparators – See Bridges, Impedance (Vol. D)

Impedance Converters, Microwave-3450 – *See Vol. A*

Inclinometers-2900 – *See Vol. D*

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Indexers (Stepping Motor)-3500

§ Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561	**B•1309**
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
§ Design Components, Inc. (DCI), Franklin, MA 02038	508-528-7300;800-341-4811
Hurst Manufacturing Div., Princeton, IN 47670	812-385-2564
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451

Precision MicroControl, San Diego, CA 92111 619-565-1500
§ ServoByte Inc., Millbury, MA 01527 508-865-0225
United Motion Technology, Santa Clara, CA 95054 ..... 408-970-9742;1-800-424-STEP

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Indicator Lights — See Lights, Indicator (Vol. B)

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BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 .... B•1917
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 .... B•1917
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 .... B•1917
† **BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 .... B•1917**
† **BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000 .... B•1917**
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1172-1174**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ...... D•1176,1178, 1181**
† **Humphrey, Inc., San Diego, CA 92123, 619-565-6631 .... B•1956-1957**
† **North Atlantic Instruments, Inc., Bohemia, NY 11716-2416, 516-567-1100 .... D•1312**
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208-1209**
U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451 .... B•2019-2021,2023, D•1327
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§† Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
† Electric Tachometer, Philadelphia, PA 19142 215-726-7723
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
† HH Controls Co., Inc., Arlington, MA 02174 617-646-2626
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
§ International Microtronics, Tucson, AZ 85714 602-748-7900
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 619-662-2235
§† Meco Precision/Inds. Inc., Bridgeport, CT 06607 203-333-4900
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB 0264-324155
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
§ OTTOTEK, IMC, Tucson, AZ 85714 602-748-7900
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636 412-744-4451
† Teledyne Gurley, Troy, NY 12181 .... 518-272-6300;800-759-1844
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116 215-464-9300
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Indicators, Azimuth-3500

† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1173**
Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 .... D•1176
† **Humphrey, Inc., San Diego, CA 92123, 619-565-6631 .... B•1956**
§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§† Danaher Controls, Gurnee, IL 60031-1282 708-662-2666
† GAP Instrument Corp., Hauppauge, NY 11788 516-273-0909
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 619-662-2235
§† Meco Precision/Inds. Inc., Bridgeport, CT 06607 203-333-4900
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416 516-567-1100
Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 215-539-4400
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116 215-464-9300

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Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1132
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 .... A•2309, B•1455,1927
§† **Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136-1138**
§† **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 .... B•1142-1147**
§† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 .... B•1714**
§† **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 .... B•1359**
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 .... B•1066
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 .... B•1166-1167**
Mechanical Products Inc., Jackson, MI 49204, 517-782-0391 .... B•1369,1371
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1175**
Osram Sylvania, Hillsboro, NH 03244, 603-464-5533;603-464-5538 .... B•1193
Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000 .... D•1168
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300**
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000 ... B•1119-1120,1123
TMP Inc., Santa Ana, CA 92705, 714-558-8028 .... B•1195
Applied Controls Co., Inc., Fairfield, NJ 07004 201-227-5454
† Capitol Switch Inc., Bethel, CT 06801 203-744-3300
Computer Doctors, College Park, MD 20740 .... 1-800-RAM-STAR;301-474-3095
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Dreefs Switch, Inc., Waukegan, IL 60087 .... 708-662-7667;800-323-9605
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
EMICO Inc., Manchester, NH 03109 603-669-5121
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
GTE Products Corporation, Miniature Lighting Products, Hillsboro, NH 03244 .... 603-464-5533;603-464-5538
GTE Supply, GTE, Irving, TX 75038 800-433-4837
Lark Electronics, Inc., New York, NY 10040 212-569-0430
Ledtronics, Inc., Torrance, CA 90505 310-534-1505
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 619-662-2235
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§ Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 140 03-3471-8548
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410 203-271-6000
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Square D Co., Palatine, IL 60067 708-397-2600
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 908-572-9512
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Tracewell Enclosures, Inc., Westerville, OH 43081 .... 614-846-6175;800-848-4525
§† Unimax, A Divison of C & K, Wallingford, CT 06492 203-269-8701
Visual Communications Co., Inc., San Diego, CA 92126 619-549-6900
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1132
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 .... B•1066
International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 .... D•1354
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1175**
Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000 .... D•1168
Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 .... D•2300
Staver Co., Inc., Bay Shore, NY 11706-9998, 516-666-8000 ... B•1119-1120,1123
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940 215-968-0660
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 .... 800-347-2484 ext. 4529
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
§ CUI Stack Inc., Beaverton, OR 97005 503-643-4899
† Dixson, Inc., Grand Junction, CO 81503 303-244-1241
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
EMICO Inc., Manchester, NH 03109 603-669-5121
FENWAL Inc., Ashland, MA 01721 508-881-2000
FIC Corp., Rockville, MD 20852 .... 301-881-8124;800-638-6594
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
† Hickok Electrical Instrument Company, Cleveland, OH 44108 216-541-8060
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
Ledtronics, Inc., Torrance, CA 90505 310-534-1505

§ Lite-On Inc., Milpitas, CA 95035	408-946-4873
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
Marway Prods. Inc., Santa Ana, CA 92703	714-973-1800
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Penn Keystone Corp., Wallingford, CT 06492	203-294-0537
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
§ Schurter, Inc., Petaluma, CA 94954	800-848-2600 ext.62
Sensitive Research Instruments, Mt. Vernon, NY 10550	914-699-9717
Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643	714-554-4200
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Indicators, Liquid Level-2200 — *See Vol. D*

Indicators, Null-2900 — *See Vol. D*

Indicators, Numeric Readout — See Tubes, Readout (Vol. A)

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Indicators, Phase Sequence-2200 — *See Vol. D*

Indicators, Positioning-2200 — *See Vol. D*

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Indicators, Shorted Turn — See Testers, Coil (Vol. D)

Indicators, Sound Level — See Meters, Audio Level (Vol. D)

Indicators, Speed-3500

§† FOX METER INC., DeKalb, IL 60115, 815-758-7000	**D•1160,1346,1348-1350**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
† Atec, Inc., Houston, TX 77055	713 468 7971
§ AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Bartlett Instrument Co., Ft. Madison, IA 52627	319-372-8366
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
§ Bindicator, Port Huron, MI 48061-0009	313-987-2700
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
Comptus Inc., New Boston, NH 03070	603-487-5512
† Computer Instruments Corp., Westbury, NY 11590	516-876-8400
Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ C-Tek Inc., Wakefield, MA 01880	617-246-1720
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Disc Instruments, Honeywell, Costa Mesa, CA 92626	714-433-0343
† Dixson, Inc., Grand Junction, CO 81503	303-244-1241
§ Dynalco Controls, Ft. Lauderdale, FL 33309	305-739-4300
§ Dynapar, Gurnee, IL 60031	312-662-2666
† Electric Tachometer, Philadelphia, PA 19142	215-726-7723
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983	203-848-9271
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099	508-365-3400
Mag-Con, St. Paul, MN 55113	612-633-8820
† Mansfield & Green Division, A Subsidiary of Ametek Inc., Largo, FL 34643	813-536-7831
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
PPM, Inc., Cleveland, OH 44122	1-800-899-4776
§ Ragen Data Systems, Inc., Subsidiary of Meggit U.S.A., Central Islip, NY 11722	516-234-3800
Servo-Tek Products Co., Hawthorne, NJ 07506	201-427-3100
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
§ Torq Corp., Bedford, OH 44146	216-232-4100
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
Vorne Industries, Inc., Chicago, IL 60631	312-775-9440
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121
§ Westronics Inc. of Texas, A Baker Hughes Co., Ft. Worth, TX 76161	817-625-2311

Indicators, Temperature — See Meters, Temperature (Vol. D)

Indicators, Temperature (Not Meter Type)-5300

Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1016,1314**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
† Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202	**D•1416**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Atec, Inc., Houston, TX 77055	713-468-7971
§ Athena Controls, Inc., Plymouth Meeting, PA 19462	215-828-2490
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Electronic Controls Design, Milwaukie, OR 97222	503-659-6100
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
§† Fenwal Electronics, Inc., Milford, MA 01757	508-478-6000
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
† Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ IR Scientific, Carlisle, MA 01741	508-667-7110
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
Keystone Carbon, Thermistor Div., St. Marys, PA 15857	814-781-1591
† Lake Shore Cryotronics, Inc., Westerville, OH 43081	614-891-2243
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538	510-226-0488
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
Medicam Technologies Inc., Hudson, NH 03051	603-886-9460
§ Metermaster, Tempe, AZ 85282	602-431-0015
Metrix Instrument Co., Houston, TX 77043	713-461-2131
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
§ National Controls Corp., W. Chicago, IL 60185	708-231-5900
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482	310-478-1134
† PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796	617-527-4385
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
§† Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080	908-757-8300
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818	401-884-4188

Indicators, Tilt-2200 — *See Vol. D*

Indicators, VSWR — See Meters, Standing Wave Ratio (Vol. D)

Indicators (MIL), Fault Locating-2440

CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309**
Electrodynamics, Inc., A Talley Inds. Co., Rolling Meadows, IL 60008, 708-259-0740	**D•1159**
FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594	**B•1359**
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261	**B•1175**
Philips Technologies, Airpax Instruments, Cheshire, CT 06410, 203-271-6000	**D•1168**
§ Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046	**D•1317**
AVO Biddle Instruments, Blue Bell, PA 19422	215-646-9200
Capitol Switch Inc., Bethel, CT 06801	203-744-3300
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Ledtronics, Inc., Torrance, CA 90505	310-534-1505
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000

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Infrared Emitter Detectors — See Emitters/Detectors, Infrared (Vol. B)

Infrared (IR) Equipment (MIL)-2440

§Φ American Laser Systems, Inc., Santa Barbara, CA 93160	805-967-0423
† Astro International Corp., League City, TX 77573	713-332-2484
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211

† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
† Glenro, Inc., Paterson, NJ 07501-1715	201-279-5900;800-922-0106
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
† IR Scientific, Carlisle, MA 01741	508-667-7110
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538	510-226-0488
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
Research Inc., Minneapolis, MN 55424	612-941-3300
† Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
§ Sylvania, Emissive Products/Process Heat, Exeter, NH 03833	603-772-4331
§† Xedar Corp., Boulder, CO 80301	303-443-6441

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Inspection Systems, Visual, Surface Mount-4100 – *See Vol. D*

Installation Equipment, Fiber Optic-2475

# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856	201-770-1420
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6	613-226-4000
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
# Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Instrumentation, Fiber Optic-2475

† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**B•1228,1594**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
Assurance Technologies, Inc., West Chicago, IL 60185	708-231-4800
§ Chiu Technical Corp., Kings Park, NY 11754	516-544-0606
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Dymec Inc., Winchester, MA 01890	617-729-7870
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550	508-347-9191
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§ Metermaster, Tempe, AZ 85282	602-431-0015
MetriCor, Inc., Woodinville, WA 98072	206-483-5577
Olympus Corporation, Industrial Fiberoptics Division, Lake Success, NY 11042-1179	516-488-3880
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
Rifocs Corp., Camarillo, CA 93012	805-389-9800
§ SC Technology, Inc., Livermore, CA 94550	510-373-9230
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
Transonic Systems Inc., Ithaca, NY 14850	607-257-5300
Volpi-MFG-USA, Auburn, NY 13021-1289	315-255-1737

Instrumentation, High Voltage-2900 – *See Vol. D*

Instrument Design Services (Industrial) – See Services, Instrument Design (Industrial) (Vol. D)

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Instruments, Test & Measuring, Cryogenic-2900 – *See Vol. D*

Instruments, Test & Measuring, GPIB (IEEE 488) Compatible-2900 – *See Vol. D*

Instruments, Test & Measuring, Personal Computer-2900 – *See Vol. D*

Instruments, Test & Measuring, VXIbus Compatible-2900 – *See Vol. D*

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Integrated Circuit Design Aids-4200 – *See Vol. C*

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Integrated Circuits, Digital-3130 – *See Vol. A*

Integrated Circuits, Gate Array-3130 – *See Vol. A*

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Integrated Circuits, Logic, Programmable-3130 – *See Vol. A*

Integrated Circuits, Memory-3130 – *See Vol. A*

Integrated Circuits, Microprocessor-3130 – *See Vol. A*

Integrated Circuits, Standard Cells-3130 – *See Vol. A*

Integrated Circuits, Telecommunications-3130 – *See Vol. A*

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Interfaces, Computer/Peripheral-2000 – *See Vol. D*

Interfaces, Telex/Computer-1900 – *See Vol. D*

Interrupters & Detectors, Ground Fault-4300

Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Ericson Manufacturing Co., Willoughby, OH 44094	216-951-8000
Marway Prods. Inc., Santa Ana, CA 92703	714-973-1800
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
§ Raytheon Semiconductor, Mountain View, CA 94043	408-522-7068
§† Square D Co., Palatine, IL 60067	708-397-2600

Interrupters, Optoelectronic-3700

§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1328,1330**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Dialight Corporation, Manasquan, NJ 08736	908-223-9400
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
Quality Technologies, Sunnyvale, CA 94086	408-720-1440
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
† Silicon Sensors, Dodgeville, WI 53533	608-935-2707
Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265	214-995-6611

Interrupters, Photo-3700

§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1328-1329,1333-1335**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
Quality Technologies, Sunnyvale, CA 94086	408-720-1440
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
† Silicon Sensors, Dodgeville, WI 53533	608-935-2707

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Inverters, DC to AC – See Power Supplies, AC Output (Vol. D)

Inverters (MIL), DC to AC-2440

† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500	**D•2232,2234-2237**
Endicott Research Group, Endicott, NY 13760, 607-754-9187	**B•1045-1046, 1048**
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000	**D•1750**

KGS Electronics, Inc., Arcadia, CA 91006, 818-574-1175 .... D•1807,2276
Modular Devices, Shirley, NY 11967, 516-345-3100 .... D•2136
American Monarch, Minneapolis, MN 55421 612-788-9161
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3 905-660-9819
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
Epsco Incorporated, Itasca, IL 60143-1120 708-250-0410
§ Exeltech Inc., Ft. Worth, TX 76118 817-595-4969
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-448-3444
Luxtron Inc., Haverhill, MA 01830-4803 508-372-5211
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
† Transchem, Jetronics Industries, Inc., Corona, CA 91718 909-371-5751

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Isolators, Antenna-1200 — *See Vol. D*

Isolators, Ferrite-3450 — *See Vol. A*

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Isolators, Microwave (all types)-3450 — *See Vol. A*

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Isolators, Optoelectronic-3700

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1185
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .... B•1088,1328-1332
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 .... A•2172
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1594
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 .... B•1339
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670 .... 800-262-4638; 800-525-3536
BT & D Technologies, Kennett Square, PA 19348 .... 215-444-6888;800-545-4306
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 .... 214-422-1844; 1-800-872-0044
† Dionics, Westbury, NY 11590 516-997-7474
Dymec Inc., Winchester, MA 01890 617-729-7870
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662 201-368-0123
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Opto 22, Temecula, CA 92590 714-695-9299
† Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§† Quality Technologies, Sunnyvale, CA 94086 408-720-1440
§† Raytheon Company, Quincy Operation, Quincy, MA 02269 617-479-5300
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§† Teledyne Solid State, Hawthorne, CA 90250 213-777-0077
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 512-388-2522

Isolators, Signal (I, V,)-1900 — *See Vol. D*

Isolators, Source — See Isolators, Line (Vol. D)

Isolator Systems, Multiplexed-1900 — *See Vol. D*

Jack Adapters (All Types)-2100 — *See Vol. C*

Jack Covers-2100 — *See Vol. C*

Jack Panel Assemblies & Access. — See Panels, Jack (Vol. C)

Jacks (All Types)-2100 — *See Vol. C*

Jacks, Coaxial-2100 — *See Vol. C*

Jacks, Modular Telephones-2100 — *See Vol. C*

Jacks (MIL)-2440

§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... C•1163
§ Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571 .... C•1291,1540
Jolo Industries, Inc., Garden Grove, CA 92643, 714-554-6840 .... C•1361
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 .... C•1477-1478,1480
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020 .... C•1505
Accessories For Electronics, Inc., Baldwin, NY 11510-3593 516-546-1751
† Accurate Electronics Corp., Elyria, OH 44036 .... 216-366-6330;1-800-334-5904
† ADC Telecommunications, Inc., Minneapolis, MN 55435 612-938-8080
† Andon Elctrns. Corp., Lincoln, RI 02865 401-333-0388
Autoswage Products, Shelton, CT 06484 203-929-1401
† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§# Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
† Direct Sound Corporation, Boston, MA 02116 1-800-372-1616
† Electronic Hardware Corp, Formerly Jan Hardware Mfg. Co., Farmingdale, NY 11735 516-752-1950
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
§† Johnson, E. F., Co., Waseca, MN 56093 1-800-247-8256
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Texas Instruments, Connector Systems, Attleboro, MA 02703 .... 508-699-5269; 508-699-3450
† Tru-Connector Corp., Peabody, MA 01960 .... 508-532-0775;1-800-262-9787; 1-800-COAXTRU
U.S. Terminals Inc., Cincinnati, OH 45243 513-561-8145

Jammers (MIL)-2440

† Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1311
† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Jamming Systems (MIL)-2440

† Noise Com Inc., Paramus, NJ 07652, 201-261-8797 .... D•1311
† AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† E-Systems, Greenville Div., Greenville, TX 75403-6056 903-455-3450
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Jigs And Fixtures, Chassis & Circuit Board-4100 — *See Vol. D*

Joint Compounds, Semiconductor — See Coatings, Compounds, Lubricants, etc., Heat Conductive (Vol. C)

Joints, Rotary, Fiber Optic-2475

† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1278,1287-1288
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060 703-552-2111

Joints, Rotary, Microwave-3450 — *See Vol. A*

Joysticks — See Controls, Computer Input (Vol. D)

Joysticks, Inductive-2200 — *See Vol. D*

Joysticks, Potentiometer-2200 — *See Vol. D*

Joystick, Toggle Switch-2200 — *See Vol. D*

Jumpers, Bonding-2100 — *See Vol. C*

Jumpers, Circuit Board-2100 — *See Vol. C*

Jumpers, Wire, Terminated — See Cords, Patch (Vol. C)

Junctions, Hybrid, Microwave-3450 — *See Vol. A*

Keyboard Legends and Symbols-5150

Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 .... B•1825
Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 .... B•1829
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1832
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 .... B•1836-1837, C•1665
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 .... B•1840-1841
Metro-Mark Inc., Minnetonka, MN 55343, 612-935-8844 .... B•1846
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 .... B•1847
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 .... B•1849
# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 .... B•1816
Advanced Input Devices, Coeur d'Alene, ID 83814 .... 208-765-8000;800-444-5923
§# Arkay Engravers, Inc., Ronkonkoma, NY 11779 516-467-7795
Aztec Industries, Inc., Mesa, AZ 85210 .... 602-833-3131;800-729-3132
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151

Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007 ... 708-952-8800
† Cortron Inc., Methuen, MA 01844 ... 508-975-5445
§ DataLux Corp., Winchester, VA 22602 ... 703-662-1500
Eaton Corp., Control Displays, Colmar, PA 18915 ... 215-822-3383
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 ... 408-922-9000
GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
§ Grayhill Inc., La Grange, IL 60525 ... 708-354-1040
† Interface Products, Inc., Oceanside, CA 92056 ... 619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 ... 415-347-8217
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 ... 804-766-1500
§ Mantex Corp., Oxford, MI 48371 ... 313-628-8210
§ MEC A/S, Ballerup, DENMARK DK-2750 ... 011-45-44973366
MOLEX, Inc., Lisle, IL 60532 ... 708-969-4550
NMB Technologies Inc., Chatsworth, CA 91311 ... 818-341-3355
Plasticorp, Harbor City, CA 90710 ... 310-539-9530
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 ... 708-438-4000

Keyboards, Address Encoded-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 ... B•1819
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ... B•1829
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ... B•1832
IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ... B•1078-1079
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ... B•1849
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469 ... B•1852
† Amkey, Methuen, MA 01844 ... 508-975-5445
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 ... 219-747-3121
† Capitol Switch Inc., Bethel, CT 06801 ... 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 ... 708-662-9200
† Cortron Inc., Methuen, MA 01844 ... 508-975-5445
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 ... 408-922-9000
† Interface Products, Inc., Oceanside, CA 92056 ... 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 ... 416-727-9491
§ Mantex Corp., Oxford, MI 48371 ... 313-628-8210
MGR Industries Inc., Ft. Collins, CO 80524 ... 303-221-2201
New England Keyboard Inc., Fitchburg, MA 01420 ... 508-345-8332
† Orbit Instrument Corp., Hauppauge, NY 11788 ... 516-435-8300
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 ... 708-438-4000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
† SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960

Keyboards, Capacitive-5150

Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 ... B•1825
† Amkey, Methuen, MA 01844 ... 508-975-5445
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 ... 414-355-8300
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007 ... 708-952-8800

Keyboards, Conductive Rubber-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 ... B•1819
† Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223 ... B•1063
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ... B•1829
Fujipoly, America Corp., Cranford, NJ 07016, 908-272-3850 ... B•1830
§ IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ... B•1078-1079,1835
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 ... B•1836-1837
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ... B•1839
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 ... B•1840-1841
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550 ... B•1853-1854
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ... B•1847
Advanced Connector Technology, Ventura, CA 93003 ... 805-644-9990
† AME Corporation, Towaco, NJ 07082-0195 ... 201-263-1700
Conductive Rubber Technology, Inc., Bothell, WA 98021 ... 206-486-8559
# Eastprint, Inc., N. Andover, MA 01845 ... 508-975-5255
GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757 ... 800-874-9063
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475;800-626-6116
§ Laube Technology, Woodland Hills, CA 91367 ... 818-703-1188
MGR Industries Inc., Ft. Collins, CO 80524 ... 303-221-2201
Paneltec, Santa Clara, CA 95054 ... 408-496-1175
Shin-Etsu Polymer America, Inc., Union City, CA 94587 ... 510-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 ... 508-699-3800
West Electronic Sales Team, Huntington Beach, CA 92647 ... 714-375-6500; 310-495-5569

Keyboards, Full Travel-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 ... B•1819
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ... B•1687
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ... B•1824
CTI Electronics, Stratford, CT 06497, 203-386-9779 ... D•1086
§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 ... B•1825
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 ... B•1827
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200 ... B•1828
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ... B•1829
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000 ... B•1831
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ... B•1832
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1833
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ... B•1078-1079,1835
Metro-Mark Inc., Minnetonka, MN 55343, 612-935-8844 ... B•1846
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ... B•1847
§ AFE Technologies Inc., Charlottesville, VA 22901 ... 804-974-7801
† Amkey, Methuen, MA 01844 ... 508-975-5445
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 ... 219-747-3121
§ Cincinnati Electrosystems, Milford, OH 45150 ... 513-831-6800
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007 ... 708-952-8800
Cortron Inc., Methuen, MA 01844 ... 508-975-5445
§ DataLux Corp., Winchester, VA 22602 ... 703-662-1500
† Eaton Corp., Control Displays, Colmar, PA 18915 ... 215-822-3383
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 ... 414-449-7326
Electronic Packaging System, Marion, IA 52302 ... 319-377-3423
# Enterprise Systems Corp., Dover, NH 03820 ... 603-742-7363
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 ... 408-922-9000
† Interface Products, Inc., Oceanside, CA 92056 ... 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 ... 416-727-9491
§ Laube Technology, Woodland Hills, CA 91367 ... 818-703-1188
§ NMB Technologies Inc., Chatsworth, CA 91311 ... 818-341-3355
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 ... 708-438-4000
Shin-Etsu Polymer America, Inc., Union City, CA 94587 ... 510-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 ... 206-823-6857

Keyboards, Hard Contact-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 ... B•1819
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200 ... B•1828
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ... B•1829
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ... B•1832
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1833
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ... B•1078-1079,1835
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 ... B•1840-1841
† Amkey, Methuen, MA 01844 ... 508-975-5445
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 ... 219-747-3121
† Capitol Switch Inc., Bethel, CT 06801 ... 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 ... 708-662-9200
Computer Keyboard Systems, Santa Monica, CA 90401 ... 310-395-4639
† Cortron Inc., Methuen, MA 01844 ... 508-975-5445
§ DataLux Corp., Winchester, VA 22602 ... 703-662-1500
Electronic Packaging System, Marion, IA 52302 ... 319-377-3423
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 ... 408-922-9000
† Interface Products, Inc., Oceanside, CA 92056 ... 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 ... 416-727-9491
Marquardt Switches Inc., Cazenovia, NY 13035 ... 315-655-8050
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 ... 708-438-4000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 ... 514-745-0310
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 ... 206-823-6857
Texas Instruments, Connector Systems, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450

Keyboards, Lighted-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 ... B•1819
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 ... B•1687
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 ... B•1829
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000 ... B•1831
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 ... B•1832
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1833
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 ... B•1836-1837
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 ... B•1840-1841
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ... B•1842-1843
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ... B•1845
Metro-Mark Inc., Minnetonka, MN 55343, 612-935-8844 ... B•1846
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 ... B•1847
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ... B•1849, D•1167
Advanced Connector Technology, Ventura, CA 93003 ... 805-644-9990
† Amkey, Methuen, MA 01844 ... 508-975-5445
Aztec Industries, Inc., Mesa, AZ 85210 ... 602-833-3131;800-729-3132
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 ... 414-355-8300
Computer Keyboard Systems, Santa Monica, CA 90401 ... 310-395-4639
Conductive Rubber Technology, Inc., Bothell, WA 98021 ... 206-486-8559
† Cortron Inc., Methuen, MA 01844 ... 508-975-5445
# Eastprint, Inc., N. Andover, MA 01845 ... 508-975-5255
† Eaton Corp., Control Displays, Colmar, PA 18915 ... 215-822-3383
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 ... 414-449-7326
GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757 ... 800-874-9063
† Interface Products, Inc., Oceanside, CA 92056 ... 619-945-0230
§ Laube Technology, Woodland Hills, CA 91367 ... 818-703-1188
§ MGR Industries Inc., Ft. Collins, CO 80524 ... 303-221-2201

Shin-Etsu Polymer America, Inc., Union City, CA 94587 510-475-9000
† Spectra Lux Corp., Kirkland, WA 98034 206-823-6857
† Stacoswitch, Costa Mesa, CA 92626 714-549-3041
§ Topflight, York, PA 17404 .... 717-843-9901;800-233-9386
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403 215-539-4400
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492 203-269-3337

Keyboards, Low Profile-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 .... B•1819
§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 .... B•1825
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200 .... B•1828
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 .... B•1829
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1832
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1833
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 .... B•1078-1079,1835
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 .... B•1836-1837
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 .... B•1841
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 .... B•1842-1843
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 .... B•1845
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 .... B•1847
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 .... B•1849
Advanced Connector Technology, Ventura, CA 93003 805-644-9990
† Amkey, Methuen, MA 01844 508-975-5445
Aztec Industries, Inc., Mesa, AZ 85210 .... 602-833-3131;800-729-3132
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 708-662-9200
Computer Keyboard Systems, Santa Monica, CA 90401 310-395-4639
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Cortron Inc., Methuen, MA 01844 508-975-5445
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
Electronic Packaging System, Marion, IA 52302 319-377-3423
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
§ NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Stacoswitch, Costa Mesa, CA 92626 714-549-3041
§† Texas Instruments, Connector Systems, Attleboro, MA 02703 .... 508-699-5269; 508-699-3450
§ Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214 215-539-4400

Keyboards, Membrane-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 .... B•1819
The Bergquist Co., Minneapolis, MN 55439, 800-347-4572 .... B•1822-1823
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1824
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 .... B•1827
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 .... B•1829
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000 .... B•1831
The Hall Company, Urbana, OH 43078, 513-652-1376 .... B•1834
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 .... B•1078-1079,1835
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 .... B•1836-1837
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 .... B•1840
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 .... B•1842-1843
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 .... B•1845
Metro-Mark Inc., Minnetonka, MN 55343, 612-935-8844 .... B•1846
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550 .... B•1853-1854
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 .... B•1847
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629 .... C•1137
§ Pactec Corp., LaFrance Corp., Philadelphia, PA 19153, 215-365-8400 .... C•1064
Advanced Connector Technology, Ventura, CA 93003 805-644-9990
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
Aztec Industries, Inc., Mesa, AZ 85210 .... 602-833-3131;800-729-3132
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
† C.A.M. Graphics Co., Inc., Amityville, NY 11701 516-842-3400
§ Cincinnati Electrosystems, Milford, OH 45150 513-831-6800
Computerwise, Olathe, KS 66062 913-829-0600
Conductive Rubber Technology, Inc., Bothell, WA 98021 206-486-8559
Eastprint, Inc., N. Andover, MA 01845 508-975-5255
Electronic Packaging System, Marion, IA 52302 319-377-3423
Endicott Research Group, Endicott, NY 13760 607-754-9187
Extrusion Technology, Inc., Randolph, MA 02368 617-963-7200
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757 800-874-9063
# The Hirol Company, Ft. Lauderdale, FL 33309 305-974-4900
HMW Enterprises, Inc., Waynesboro, PA 17268 717-765-4690
Industrial Computer Source, San Diego, CA 92131 619-271-9340
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 804-766-1500
§ Mantex Corp., Oxford, MI 48371 313-628-8210
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
§ MOLEX, Inc., Lisle, IL 60532 708-969-4550
Moxness Products, Inc., Versa Technologies, Racine, WI 53405 .... 414-554-5050; 800-558-5706
§ NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
Paneltec, Santa Clara, CA 95054 408-496-1175
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
† Sheldahl, Inc., Northfield, MN 55057 507-663-8000
Shin-Etsu Polymer America, Inc., Union City, CA 94587 510-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 .... 214-231-6663; 214-924-3289;1-800-331-6600
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
§ Topflight, York, PA 17404 .... 717-843-9901;800-233-9386
West Electronic Sales Team, Huntington Beach, CA 92647 .... 714-375-6500; 310-495-5569

Keyboards, Modular-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 .... B•1819
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1824
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 .... B•1827
† Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040 .... B•1829
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1832
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1833
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 .... B•1078-1079,1835
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600 .... B•1844
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332 .... B•1847
† Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610 .... B•1850-1851
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469 .... B•1852
† Amkey, Methuen, MA 01844 508-975-5445
Aztec Industries, Inc., Mesa, AZ 85210 .... 602-833-3131;800-729-3132
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
Computer Keyboard Systems, Santa Monica, CA 90401 310-395-4639
† Cortron Inc., Methuen, MA 01844 508-975-5445
Extrusion Technology, Inc., Randolph, MA 02368 617-963-7200
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ MEC A/S, Ballerup, DENMARK DK-2750 011-45-44973366
§ MGR Industries Inc., Ft. Collins, CO 80524 303-221-2201
MOLEX, Inc., Lisle, IL 60532 708-969-4550
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
Texas Instruments, Connector Systems, Attleboro, MA 02703 .... 508-699-5269; 508-699-3450

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Keyboards, Programmable-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 .... B•1819
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1824
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469 .... B•1852
VG Controls, Inc., Hewitt, NJ 07421, 201-853-4600 .... B•1855
§ AFE Technologies Inc., Charlottesville, VA 22901 804-974-7801
† Amkey, Methuen, MA 01844 508-975-5445
† Aydin Corp., Horsham, PA 19044 215-657-7510
Computer Keyboard Systems, Santa Monica, CA 90401 310-395-4639
† Cortron Inc., Methuen, MA 01844 508-975-5445
† Da-Tech Corp., Ivyland, PA 18974 215-322-9410
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
HMW Enterprises, Inc., Waynesboro, PA 17268 717-765-4690
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
USAR Systems, Inc., New York, NY 10012 212-226-2042
§ Z-World Engineering, Davis, CA 95616 916-757-3737

Keyboards, Wireless-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923 .... B•1819
Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 .... B•1825
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007 708-952-8800

Extrusion Technology, Inc., Randolph, MA 02368	617-963-7200
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332

Keyboards & Keypads (MIL)-2440

† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300**	**B•1687**
§† **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321**	**B•1825**
† **Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040**	**B•1829**
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000	**B•1831**
† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
† **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311**	**B•1078-1079,1835**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836-1837**
Jayco Interface Technology, Orange, CA 92665, 714-974-1701	**B•1840-1841**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**B•1844**
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332	**B•1847**
† **Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561**	**B•1849, D•1167**
Advanced Connector Technology, Ventura, CA 93003	805-644-9990
† Amkey, Methuen, MA 01844	508-975-5445
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087	708-662-9200
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
Conductive Rubber Technology, Inc., Bothell, WA 98021	206-486-8559
Cortron Inc., Methuen, MA 01844	508-975-5445
† Eaton Corp., Control Displays, Colmar, PA 18915	215-822-3383
Extrusion Technology, Inc., Randolph, MA 02368	617-963-7200
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135	408-922-9000
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757	800-874-9063
Industrial Computer Source, San Diego, CA 92131	619-271-9340
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
§ Laube Technology, Woodland Hills, CA 91367	818-703-1188
Mesa Technology, Peak Technologies, Columbia, MD 21045	410-992-0516; 410-992-0517
§ MGR Industries Inc., Ft. Collins, CO 80524	303-221-2201
Penny & Giles Controls, Inc., Attleboro, MA 02703	508-226-3008
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
† Spectra Lux Corp., Kirkland, WA 98034	206-823-6857
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400

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Keypads-5150

Advanced Input Devices, Coeur d'Alene, ID 83814, 208-765-8000;800-444-5923	**B•1819**
Advanced Rubber Concepts, Formerly Glolite Sales Ltd., Pauls Valley, OK 73075, 405-238-5541;800-654-3662	**B•1820**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1824**
CTI Electronics, Stratford, CT 06497, 203-386-9779	**D•1086**
§ **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321**	**B•1825**
Extrusion Technology, Inc., Randolph, MA 02368, 617-963-7200	**B•1828**
Fema Elctrns. Corp., E. Brunswick, NJ 08816, 908-238-1223	**B•1063**
† **Flex-Key Corporation, Gloucester, MA 01930, 508-281-2040**	**B•1829**
Fujipoly, America Corp., Cranford, NJ 07016, 908-272-3850	**B•1830**
† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1833**
† **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311**	**B•1079,1835**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836-1837, C•1665**
§ **ITT Schadow, Eden Prairie, MN 55344, 612-934-4400**	**B•1839**
Jayco Interface Technology, Orange, CA 92665, 714-974-1701	**B•1840-1841**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-4600	**B•1844, C•1411**
Metro-Mark Inc., Minnetonka, MN 55343, 612-935-8844	**B•1846**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1777**
MultiNational Resources, Inc., Bedford, NH 03110, 603-622-3550	**B•1853-1854**
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332	**B•1847**
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629	**C•1137**
Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561	**B•1849**
† **Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610**	**B•1804-1805,1850-1851**
# **Veetronix, Inc., Lexington, NE 68850, 308-324-4600**	**B•1817**
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469	**B•1852**
VG Controls, Inc., Hewitt, NJ 07421, 201-853-4600	**B•1855**
Advanced Connector Technology, Ventura, CA 93003	805-644-9990
† AME Corporation, Towaco, NJ 07082-0195	201-263-1700
§ American Magnetics Corporation, Group 4, Carson, CA 90745	213-775-8651
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809	219-747-3121
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201	414-355-8300
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
Computer Keyboard Systems, Santa Monica, CA 90401	310-395-4639
Computerwise, Olathe, KS 66062	913-829-0600
§ Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
Conductive Rubber Technology, Inc., Bothell, WA 98021	206-486-8559
Cortron Inc., Methuen, MA 01844	508-975-5445
§ DataLux Corp., Winchester, VA 22602	703-662-1500
† Eaton Corp., Control Displays, Colmar, PA 18915	215-822-3383
EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
Endicott Research Group, Endicott, NY 13760	607-754-9187
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757	800-874-9063
Industrial Computer Source, San Diego, CA 92131	619-271-9340
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8	416-727-9491
§ Laube Technology, Woodland Hills, CA 91367	818-703-1188
§ Mantex Corp., Oxford, MI 48371	313-628-8210
Measurement Systems, Inc., Fairfield, CT 06430	203-336-4590
Memtron Technologies, Inc., Frankenmuth, MI 48734	517-652-2656;800-234-7525
§ MGR Industries Inc., Ft. Collins, CO 80524	303-221-2201
MOLEX, Inc., Lisle, IL 60532	708-969-4550
Moxness Products, Inc., Versa Technologies, Racine, WI 53405	414-554-5050; 800-558-5706
Plasticorp, Harbor City, CA 90710	310-539-9530
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
Shin-Etsu Polymer America, Inc., Union City, CA 94587	510-475-9000
§† Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Three-Five Sys., Inc., Phoenix, AZ 85044	602-496-0035
2M Sales Company, Burnsville, MN 55337	612-890-7774

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Kits, Enclosure Prototyping-1400 — *See Vol. C*

Kits, Fiber Optic-2475

§ **AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752**	**C•1163**
† **Daniels Manufacturing Corp., Orlando, FL 32824, 407-855-6161**	**C•1700**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
# Clifford of Vermont, Inc., Bethel, VT 05032	802-234-9921;800-451-4381
§ Contact East, N. Andover, MA 01845	508-682-2000
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6	613-226-4000
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Klein Tools, Inc., Chicago, IL 60659-9033	708-677-9500
† Light Control Systems Inc., M/A COM Inc., Hudson, NH 03051	603-883-8300
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
† Optelecom, Inc., Gaithersburg, MD 20877	301-840-2121
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401	803-676-2900
# Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Kits, Marking (Dial, Instrument, Equipment, etc.)-2400 — *See Vol. C*

Kits, Potentiometer, Rheostat-4750 — *See Vol. A*

Kits, Printed Circuit-1700 — *See Vol. C*

Kits, Programming Board-4200 — *See Vol. C*

Kits, Shielding-4525 — *See Vol. C*

Kits, Terminal-2100 — *See Vol. C*

Kits, Training Aid-4200 — *See Vol. C*

Knobs, Cast, Molded, & Machined-2400 — *See Vol. C*

Knobs, Collet-2400 — *See Vol. C*

Knobs, Limit Stop-2400 — *See Vol. C*

Knobs, Locking, Control Shaft-2400 — *See Vol. C*

Knobs, Push to Turn-2400 — *See Vol. C*

Knobs, Slip Clutch-2400 — *See Vol. C*

Knobs, Torque, Incremental, Ratio Drive-2400 — *See Vol. C*

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§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862

§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080 908-757-8300

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Laminates, Metal Clad (Including Copper)-2500 — *See Vol. C*

Laminates, Plastic Impregnated (Unclad)-2500 — *See Vol. C*

Laminates, Plastic (With Integral Heating Elements)-5300

# Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
Flexible Technologies, Arlon, E. Providence, RI 02914 401-434-2340

Lamp Adapters-2460

§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136-1138
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1158
Autoswage Products, Shelton, CT 06484 203-929-1401
Display Devices, Inc., Encinitas, CA 92023 619-753-0113
Ledtronics, Inc., Torrance, CA 90505 310-534-1505
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700

Lamp Assembly Color Filters, Lens Mountable-2460

§† A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700 ...... B•1669
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1132
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ...... B•1036
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 .... B•1163,1317
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 .... B•1166
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 .... B•1196-1197
Altair Exchange Corporation, Valencia, CA 91355 805-257-6964
† AME Corporation, Towaco, NJ 07082-0195 201-263-1700
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
§† Ercona, Patchogue, NY 11772 516-758-0700
GBC, Inc., Lamp Division, Ocean, NJ 07712 908-774-8502
§ Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
† LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 815-455-0400
Ledtronics, Inc., Torrance, CA 90505 310-534-1505
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
†# Luminator Aircraft Products, Plano, TX 75074 214-424-6511
§ Pacific Industrial Components Corp., Valencia, CA 91355 805-257-7901
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Lamp Drivers-2460

Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 ...... B•1042
Absopulse Electronics Ltd., Carp, Ont., CAN K0A 1L0 613-836-3511
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409 818-787-0311
Industrial Devices, Inc., Hackensack, NJ 07601 201-489-8989
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500

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§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 ...... B•1135
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
§ Control Laser Corp., Orlando, FL 32809 407-438-2500
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 .... 508-745-3200;1-800-950-3441
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 .... 1-800-544-4828, 508-777-1900
UVP, Inc., San Gabriel, CA 91776 .... 818-285-3123;800-452-6788
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
§ Wiko, Ltd., Orlando Park, IL 60462 1-800-323-1107
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Deutenium-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 ...... B•1135
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 .... B•1317
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
Optronic Laboratories, Inc., Orlando, FL 32811 .... 407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872 203-377-8282

Lamps, Edge Lighting, Panel-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 ...... B•1135
Eltech, Horsham, PA 19044, 215-441-0404 .... B•1149
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1157
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 ...... B•1168
§ Pacific Industrial Components Corp., Valencia, CA 91355, 805-257-7901 ...... B•1104
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
Altair Exchange Corporation, Valencia, CA 91355 805-257-6964
§† Data Display Products, El Segundo, CA 90245-4630 ..... 310-640-0442;800-421-6815
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
† E-L Products Company, Sub. of Astronics Corporation, E. Aurora, NY 14224 716-655-0800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 815-455-0400
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Littelfuse, Inc., Des Plaines, IL 60016 .... 708-824-1188;708-824-0400
§† Luminator Aircraft Products, Plano, TX 75074 214-424-6511
§ Micro Lamps, Inc., Batavia, IL 60510-1488 708-879-0900
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Sorenson Lighted Controls, Hartford, CT 06114 .... 203-527-3092;1-800-275-7089
† Spectra Lux Corp., Kirkland, WA 98034 206-823-6857
Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

Lamps, Electroluminescent-2460

BKL, King of Prussia, PA 19406, 215-277-2910 .... B•1134
Eltech, Horsham, PA 19044, 215-441-0404 .... B•1149
Endicott Research Group, Endicott, NY 13760, 607-754-9187 .... B•1048
Leading Edge, Minnetonka, MN 55343, 612-936-7744 .... B•1170-1171
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766, 603-448-3444 .... B•1172
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
† Durel Corporation, Affiliate of 3M & Rogers Corp., Tempe, AZ 85282 602-731-6200
E-L Products Company, Sub. of Astronics Corporation, E. Aurora, NY 14224 716-655-0800
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
Fujipoly, America Corp., Cranford, NJ 07016 908-272-3850
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 815-455-0400
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 804-766-1500
Optrex/Satori, Torrance, CA 90503 310-214-1791
† Quantex Corporation, Rockville, MD 20850 .... 301-258-2701;800-992-5149 (Sls. only)
THHC Lighting, City of Ind., CA 91748 818-965-6088
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Lamps, Exciter, Photographic-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 ...... B•1135
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 815-455-0400
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 .... 1-800-544-4828, 508-777-1900
§ Wiko, Ltd., Orlando Park, IL 60462 1-800-323-1107
Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Flashtube-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 ...... B•1135
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181
Amglo Kemlite Laboratories Inc., Bensenville, IL 60106 708-350-9470
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 .... 508-745-3200;1-800-950-3441
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904

Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
ILC Technology, Inc., Sunnyvale, CA 94089	408-745-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
Voltarc Technologies, Inc., Fairfield, CT 06430	203-255-2633
§ Wiko, Ltd., Orlando Park, IL 60462	1-800-323-1107
§ Xenon Corp., Woburn, MA 01801	617-938-3594

Lamps, Fluorescent-2460

§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442	**B•1157**
§ **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019**	**B•1168**
§ **Micro Lamps, Inc., Batavia, IL 60510-1488, 708-879-0900**	**B•1174**
§ **Pacific Industrial Components Corp., Valencia, CA 91355, 805-257-7901**	**B•1104**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**B•1178**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**B•1180**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ Contact East, N. Andover, MA 01845	508-682-2000
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
# Electra-Tec, Inc., Div. of Impert Industries, Inc., Otsego, MI 49078	800-225-3532; 616-694-2058
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Leecraft Mfg., Long Island City, NY 11101	718-392-8800
§† Luxo Corporation, Port Chester, NY 10573	914-937-4433;800-222-5896
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
Pacific Industrial Components Corp., See Altair Exchange Corp.	
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
Voltarc Technologies, Inc., Fairfield, CT 06430	203-255-2633
§ Waldmann Lighting Co., Wheeling, IL 60090	708-520-1060;800-634-0007
§ Wiko, Ltd., Orlando Park, IL 60462	1-800-323-1107

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Lamps, High Intensity Discharge (HID)-2460

§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**B•1178**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ Lamp Technology, Inc., Bohemia, NY 11716	516-567-1800
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
§ Wiko, Ltd., Orlando Park, IL 60462	1-800-323-1107
§ Xenon Corp., Woburn, MA 01801	617-938-3594

Lamps, Hollow Cathode-2460

§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960	**B•1317**
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141

Lamps, Incandescent-2460

Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933	**B•1132-1133**
§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
§† **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400**	**B•1147**
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1039,1042**
§ **Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300**	**B•1151**
† **Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442**	**B•1157-1159**
§ **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311**	**B•1078-1079**
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989**	**B•1166-1167**
§† **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019**	**B•1168**
Micro Lamps, Inc., Batavia, IL 60510-1488, 708-879-0900	**B•1174**
Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261	**B•1175**
§† **Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 140, 03-3471-8548**	**B•1176-1177**
Osram Sylvania, Hillsboro, NH 03244, 603-464-5533;603-464-5538	**B•1190**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**B•1178**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**B•1180**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123**	**B•1182-1185,1187**
Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900	**B•1198**
ACI Components, Inc., Laguna Hills, CA 92653	714-588-9611
Altair Exchange Corporation, Valencia, CA 91355	805-257-6964
Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
§ Contact East, N. Andover, MA 01845	508-682-2000
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
GBC, Inc., Lamp Division, Ocean, NJ 07712	908-774-8502
GTE Products Corporation, Miniature Lighting Products, Hillsboro, NH 03244	603-464-5533;603-464-5538
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
§ IDEC Corporation, Sunnyvale, CA 94089-2211	408-747-0550
§ Inter-Market, Glenview, IL 60025	708-729-5330
§ Jensen Tools, Inc., Stanley Works, Phoenix, AZ 85044	602-968-6241
§ Lamp Technology, Inc., Bohemia, NY 11716	516-567-1800
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443	815-455-0400
§ Ledco, Wilbrecht Elctrns., St. Paul, MN 55107	612-222-2791
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6	416-292-4463
Leecraft Mfg., Long Island City, NY 11101	718-392-8800
§ Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
§† Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
§† Luminator Aircraft Products, Plano, TX 75074	214-424-6511
† Lumitron, Summit, NJ 07902-0267	908-273-8998
§† Luxo Corporation, Port Chester, NY 10573	914-937-4433;800-222-5896
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ Mouser Electronics, Santee, CA 92071	800-346-6873
§ Mouser Electronics, Mansfield, TX 76063	800-346-6873
§ Mouser Electronics, Gilroy, CA 95020	800-346-6873
Nedco Electronics, Inc., Morton Grove, IL 60053	708-967-0500
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oxley Inc., Branford, CT 06405	203-488-1033
§ Pacific Industrial Components Corp., Valencia, CA 91355	805-257-7901
§† Precision Lamp, Inc., Cotati, CA 94931	707-792-0333
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
§ Schurter, Inc., Petaluma, CA 94954	800-848-2600 ext.62
§† Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
§† Sylvania Automotive and Miniature Lighting, Osram Sylvania, Hillsboro, NH 03244	603-464-5533
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
THHC Lighting, City of Ind., CA 91748	818-965-6088
§† Wamco, Inc., Fountain Valley, CA 92708	714-545-5560
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187	315-685-8945
§ Wiko, Ltd., Orlando Park, IL 60462	1-800-323-1107

Lamps, Indicator — See Lamps, Miniature & Subminiature (Vol. B)

Lamps, Infrared-2460

§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442	**B•1157**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**B•1178**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
§† Casso-Solar Corp., Pomona, NY 10970	914-354-2500
§ Contact East, N. Andover, MA 01845	508-682-2000
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
E-L Products Company, Sub. of Astronics Corporation, E. Aurora, NY 14224	716-655-0800
Eraser Co., Syracuse, NY 13221	315-454-3237
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
§ Hanovia, Canrad, Newark, NJ 07105	201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089	408-745-7900
§ Lamp Technology, Inc., Bohemia, NY 11716	516-567-1800
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§ Lite-On Inc., Milpitas, CA 95035	408-946-4873
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
§† Luminator Aircraft Products, Plano, TX 75074	214-424-6511
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
† OAL Associates, Inc., Rancho Bernardo, CA 92127-1904	619-451-1799
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
§ Opto Technology, Inc., Wheeling, IL 60090	708-537-4277
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
† Oxley Inc., Branford, CT 06405	203-488-1033
§ Silicon Sensors, Dodgeville, WI 53533	608-935-2707
†# Spectrum Devices, Sugar Land, TX 77487-1586	713-242-6417
Swan Associates, New Haven, CT 06534	203-387-3917
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
§ Three-Five Sys., Inc., Phoenix, AZ 85044	602-496-0035

Lamps, Krypton-2460

§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019	**B•1168**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970	508-745-3200;1-800-950-3441
Gilway Technical Lamp, Woburn, MA 01801	617-935-4442
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
ILC Technology, Inc., Sunnyvale, CA 94089	408-745-7900
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443	815-455-0400
§† Precision Lamp, Inc., Cotati, CA 94931	707-792-0333

§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 .... 1-800-544-4828, 508-777-1900
THHC Lighting, City of Ind., CA 91748 818-965-6088
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, LED & LCD – See Diodes, Light Emitting (Vol. B), Diodes, Liquid Crystal (Vol. B)

Lamps, Magnifying, Inspection-4100 – *See Vol. D*

Lamps, Mercury Vapor-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 .... B•1135
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 .... B•1162-1163,1317
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181
§ American Ultraviolet, Murray Hill, NJ 07974 908-665-2211
Aristo Grid Lamp Prods., Roslyn, NY 11576 516-484-6141
§ BEA electro-optics, inc., Des Plaines, IL 60016 708-298-1420
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
Pacific Industrial Components Corp., See Altair Exchange Corp.
§† Spectronics Corp., Westbury, NY 11590 .... 516-333-4840/1-800-274-8888
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 .... 1-800-544-4828, 508-777-1900
UVP, Inc., San Gabriel, CA 91776 .... 818-285-3123;800-452-6788
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
§ Wiko, Ltd., Orlando Park, IL 60462 1-800-323-1107
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Nanopulse-2460

§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Neon-2460

§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1132-1133
§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 .... B•1135
§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136
§ Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 .... B•1151
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1156-1157
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 .... B•1166-1167
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 .... B•1168
Micro Lamps, Inc., Batavia, IL 60510-1488, 708-879-0900 .... B•1174
Osram Sylvania, Hillsboro, NH 03244, 603-464-5533;603-464-5538 .... B•1190-1191
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .... B•1180
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 .... B•1182,1185,1187
Altair Exchange Corporation, Valencia, CA 91355 805-257-6964
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
§† Dialight Corporation, Manasquan, NJ 08736 908-223-9400
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
† GBC, Inc., Lamp Division, Ocean, NJ 07712 908-774-8502
GTE Products Corporation, Miniature Lighting Products, Hillsboro, NH 03244 .... 603-464-5533;603-464-5538
† Imtronics Industries Inc., St. Petersburg, FL 33716 813-572-9010
§ Inter-Market, Glenview, IL 60025 708-729-5330
International Microelectronics, Arlington, TX 76003 817-473-1730
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
† LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 815-455-0400
§ Ledco, Wilbrecht Elctrns., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 310-534-1505
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Des Plaines, IL 60016 .... 708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 140 03-3471-8548
Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§# Solico/Mec, Hartford, CT 06114 203-527-3092
§ Sorenson Lighted Controls, Hartford, CT 06114 .... 203-527-3092;1-800-275-7089
§ Sylvania Automotive and Miniature Lighting, Osram Sylvania, Hillsboro, NH 03244 603-464-5533
UVP, Inc., San Gabriel, CA 91776 .... 818-285-3123;800-452-6788
Voltarc Technologies, Inc., Fairfield, CT 06430 203-255-2633
Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
§ Wiko, Ltd., Orlando Park, IL 60462 1-800-323-1107

Lamps, Oil Tight-2460

§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
† Ledtronics, Inc., Torrance, CA 90505 310-534-1505
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
†# Spectrum Devices, Sugar Land, TX 77487-1586 713-242-6417
§ Square D Co., Palatine, IL 60067 708-397-2600

Lamps, Press-to-Test-2460

§† Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136
§† Dialight Corporation, Manasquan, NJ 08736 908-223-9400
§ Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
§† Luminator Aircraft Products, Plano, TX 75074 214-424-6511
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 708-397-2600

Lamps, Projection-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 .... B•1135
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 .... B•1115
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
§ Ercona, Patchogue, NY 11772 516-758-0700
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
§† ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
† LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 815-455-0400
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 .... 1-800-544-4828, 508-777-1900
§ Wiko, Ltd., Orlando Park, IL 60462 1-800-323-1107

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Lamps, Stroboscopic Source-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 .... B•1135
Alpha-M Corp., Dallas, TX 75229 214-406-0424
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 .... 508-745-3200;1-800-950-3441
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 .... 603-883-3390; 800-999-3390
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
Vision Engineering Laboratories, Amglo Kemlite Laboratories Inc., Largo, FL 34643 813-539-0448
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Tritium (Hydrogen 3) Powered-2460

† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072 716-773-7634

Lamps, Tungsten Halogen-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 .... B•1135
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 .... B•1160-1161
§ JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019 .... B•1168
Osram Sylvania, Hillsboro, NH 03244, 603-464-5533;603-464-5538 .... B•1190
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171 .... B•1178
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... B•1181
Altair Exchange Corporation, Valencia, CA 91355 805-257-6964
American Ultraviolet, Murray Hill, NJ 07974 908-665-2211
Amglo Kemlite Laboratories, Inc., Halogen Lamp Div., Largo, FL 34643 813-539-1000
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
GTE Products Corporation, Miniature Lighting Products, Hillsboro, NH 03244 .... 603-464-5533;603-464-5538
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 815-455-0400
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6 416-292-4463
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Micro Lamps, Inc., Batavia, IL 60510-1488 708-879-0900
Optronic Laboratories, Inc., Orlando, FL 32811 .... 407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Pacific Industrial Components Corp., Valencia, CA 91355 805-257-7901
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§† Sylvania Automotive and Miniature Lighting, Osram Sylvania, Hillsboro, NH 03244 603-464-5533
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 .... 1-800-544-4828, 508-777-1900
§ Volpi-MFG-USA, Auburn, NY 13021-1289 315-255-1737
§ Waldmann Lighting Co., Wheeling, IL 60090 .... 708-520-1060;800-634-0007
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 315-685-8945

§ Wiko, Ltd., Orlando Park, IL 60462	1-800-323-1107

Lamps, Ultraviolet-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542	**B•1135**
§ JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019	**B•1168**
Pro Battery, Inc., Atlanta, GA 30340, 800-451-7171	**B•1178**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ American Ultraviolet, Murray Hill, NJ 07974	908-665-2211
Aristo Grid Lamp Prods., Roslyn, NY 11576	516-484-6141
† Clean Room Products, Inc., Ronkonkoma, NY 11779-6528	516-588-7000
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Divelbiss Corp., Fredericktown, OH 43019	614-694-9015
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970	508-745-3200;1-800-950-3441
Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
Gilway Technical Lamp, Woburn, MA 01801	617-935-4442
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
§ Hanovia, Canrad, Newark, NJ 07105	201-589-4300
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
ILC Technology, Inc., Sunnyvale, CA 94089	408-745-7900
§ Lamp Technology, Inc., Bohemia, NY 11716	516-567-1800
§ Luxo Corporation, Port Chester, NY 10573	914-937-4433;800-222-5896
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
§† Spectronics Corp., Westbury, NY 11590	516-333-4840/1-800-274-8888
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ UVP, Inc., San Gabriel, CA 91776	818-285-3123;800-452-6788
Voltarc Technologies, Inc., Fairfield, CT 06430	203-255-2633
§ Xenon Corp., Woburn, MA 01801	617-938-3594

Lamps, Xenon-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542	**B•1135**
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960	**B•1162-1163,1317**
§† JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019	**B•1168**
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**B•1180**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
Amglo Kemlite Laboratories Inc., Bensenville, IL 60106	708-350-9470
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970	508-745-3200;1-800-950-3441
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
§ Hanovia, Canrad, Newark, NJ 07105	201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089	408-745-7900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
§ Lamp Technology, Inc., Bohemia, NY 11716	516-567-1800
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Pacific Industrial Components Corp., Valencia, CA 91355	805-257-7901
§† Precision Lamp, Inc., Cotati, CA 94931	707-792-0333
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
THHC Lighting, City of Ind., CA 91748	818-965-6088
UVP, Inc., San Gabriel, CA 91776	818-285-3123;800-452-6788
§ Wiko, Ltd., Orlando Park, IL 60462	1-800-323-1107
§ Xenon Corp., Woburn, MA 01801	617-938-3594

LANs — See Networks, Computer, Local Area (Vol. D)

Laser Systems-4100 — *See Vol. D*

Laser Components & Laser Accessories-3700

† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355	**D•1005,1573**
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772	**D•1234**
ACI Components, Inc., Laguna Hills, CA 92653	714-588-9611
ACL Inc., Elk Grove Village, IL 60007	708-981-9212;1-800-782-8420
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718	516-694-9000
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
BT & D Technologies, Inc., Kennett Square, PA 19348	215-444-6888;800-545-4306
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
Chicago Laser Systems, Inc., Des Plaines, IL 60018	708-827-9620
† Cleveland Crystals, Cleveland, OH 44110	216-486-6100
† Coherent General, Inc., Sturbridge, MA 01566	508-347-2681
† Coherent, Inc., Palo Alto, CA 95054	408-764-4000
Computer Peripherals Inc., Newbury Pk., CA 91320	805-499-5751;800-854-7600
† Control Laser Corp., Orlando, FL 32809	407-438-2500
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
† D. O. Industries, Rochester, NY 14623	716-359-4000
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
† EG&G, Inc., Electronics Components Div., Salem, MA 01970	508-745-3200
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
Eltec Instruments Inc., Daytona Bch., FL 32120	904-253-5328
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
GTE Government Systems Corp., Mountain View, CA 94039	415-966-2000
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009	619-931-3000
Imatronic, Inc., Batavia, IL 60510	708-406-1920
† KLC/Karl Lambrecht Corp., Chicago, IL 60618	312-472-5442
† Kontes, Kimble Div. of Owens/IL, Vineland, NJ 08360	800-223-7150
§† Laser Concepts, Omega Organization Intl., Seattle, WA 98133	206-364-7881
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820	908-549-9001
Lincoln Laser Co., Phoenix, AZ 85004	602-257-0407
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506	619-279-5100
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
Noll, J. A. Co., Monroeville, PA 15146	412-856-7566
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Oxley Inc., Branford, CT 06405	203-488-1033
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110	408-453-7373
Photon, Inc., Santa Clara, CA 95054-3432	408-492-9449
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
Quantronix, Excel Technology, Hauppauge, NY 11788	516-273-6900
Raytheon Co., Laser Products, Quincy, MA 02169	617-479-5300
§ RMF Products, Inc., Batavia, IL 60510	708-879-0020
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Spectra-Physics Lasers Inc., Mountain View, CA 94039-7013	415-961-2550; 800-456-2552
Spiricon, Inc., Logan, UT 84321	801-753-3729
Staffall Inc., Cranston, RI 02910	401-461-5554
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Union Carbide Chemicals & Plastics Company Inc., Industrial Chemicals Div., Crystal, San Diego, CA 92123	619-279-4500
U. S. Laser Corp., Wyckoff, NJ 07481	201-848-9200
§ Xenon Corp., Woburn, MA 01801	617-938-3594
§ Zeus Indl. Prods. Inc., Orangeburg, SC 29116	803-531-2174;800-526-3842

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Latches, Panels & Cabinets-2400 — *See Vol. C*

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§† A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700	**B•1669**
The Hirol Company, Ft. Lauderdale, FL 33309, 305-974-4900	**C•1685**
† JMJ Technical Prods., Westfield, NJ 07090, 201-589-4257	**C•1531**
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900	**B•1196-1197**
Ceramaseal, New Lebanon, NY 12125	518-794-7800
† Cleveland Crystals, Cleveland, OH 44110	216-486-6100
† Coherent, Inc., Palo Alto, CA 95054	408-764-4000
† Diversified Optical Products, Inc., Salem, NH 03079	603-898-1880
† Dontech, Inc., Doylestown, PA 18901	215-348-5010
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856	201-770-1420
† Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772	516-758-0700
§ Genisco Electronics, A Division of GTC, Anaheim, CA 92805	714-563-4300
IDEC Corporation, Sunnyvale, CA 94089-2211	408-747-0550
§ IR Scientific, Carlisle, MA 01741	508-667-7110
† KLC/Karl Lambrecht Corp., Chicago, IL 60618	312-472-5442
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
§† Luminator Aircraft Products, Plano, TX 75074	214-424-6511
† Marks Polarized Corp., Hauppauge, NY 11788	516-273-8900
§ Optics for Research, Inc., Caldwell, NJ 07006	201-228-4480
† Optima Precision, Inc., West Linn, OR 97068	800-544-4118;503-638-2525
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
† Oxley Inc., Branford, CT 06405	203-488-1033
† Plummer Precision Optics, Pennsburg, PA 18073	215-679-6272
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
† S & S Associates, Inc., San Luis Obispo, CA 93401	805-544-2500
§ Saphikon, Inc., Milford, NH 03055	603-673-5831
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310	305-563-1333;800-359-5400
Schneider Corp. of America, Woodbury, NY 11797	516-496-8500
Schott Electronics, Seymour, CT 06483	203-881-0102
† Schott Glass Technologies, Inc., Duryea, PA 18642	717-457-7485
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003	214-231-6663; 214-924-3289;1-800-331-6600

Lenses, Optical & Camera-3700
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... A•1725
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... C•1460
† Coherent, Inc., Palo Alto, CA 95054 ... 408-764-4000
† Diversified Optical Products, Inc., Salem, NH 03079 ... 603-898-1880
† D. O. Industries, Rochester, NY 14623 ... 716-359-4000
† Ealing Electro-Optics, Holliston, MA 01746 ... 508-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 ... 516-758-0700
Gordon Instruments, Inc., Orchard Park, NY 14127 ... 716-662-5353;1-800-333-2672
# Heitz, Karl, Inc., Woodside, NY 11377 ... 718-565-0004
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 ... 312-472-5442
§ Optics for Research, Inc., Caldwell, NJ 07006 ... 201-228-4480
Oriel Corp., Stratford, CT 06497-0872 ... 203-377-8282
Oxley Inc., Branford, CT 06405 ... 203-488-1033
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410 ... 203-271-6525
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110 ... 408-453-7373
† Plummer Precision Optics, Pennsburg, PA 18073 ... 215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199 ... 818-915-5707/5717
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ... 305-563-1333;800-359-5400
Schneider Corp. of America, Woodbury, NY 11797 ... 516-496-8500
† Schott Glass Technologies, Inc., Duryea, PA 18642 ... 717-457-7485
§ Stenning Instruments, Inc., Camarillo, CA 93010 ... 805-484-4996
§ Wiko, Ltd., Orlando Park, IL 60462 ... 1-800-323-1107

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Cut Craft, Inc., Ft. Worth, TX 76102, 817-332-6151 ... C•1662
§ **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ... B•1714-1715**
# **The Hirol Company, Ft. Lauderdale, FL 33309, 305-974-4900 ... B•1072, C•1685**
IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ... B•1078
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ... B•1166**
† **JMJ Technical Prods., Westfield, NJ 07090, 201-589-4257 ... C•1531**
§ **RMF Products, Inc., Batavia, IL 60510, 708-879-0020 ... C•1533**
§ **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ... B•1182,1184-1185,1187**
§ **Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ... B•1196-1198**
§† Atlantic Optical Moulding, Webster, MA 01570 ... 508-943-1746
† Dontech, Inc., Doylestown, PA 18901 ... 215-348-5010
§† Ercona, Patchogue, NY 11772 ... 516-758-0700
§ Genisco Electronics, A Division of GTC, Anaheim, CA 92805 ... 714-563-4300
# GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
Homalite, Whitco, Inc., Wilmington, DE 19804 ... 302-652-3686
IDEC Corporation, Sunnyvale, CA 94089-2211 ... 408-747-0550
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
Ledtronics, Inc., Torrance, CA 90505 ... 310-534-1505
Leecraft Mfg., Long Island City, NY 11101 ... 718-392-8800
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 ... 804-766-1500
§† Luminator Aircraft Products, Plano, TX 75074 ... 214-424-6511
† Marks Polarized Corp., Hauppauge, NY 11788 ... 516-273-8900
Noll, J. A. Co., Monroeville, PA 15146 ... 412-856-7566
§ Optics for Research, Inc., Caldwell, NJ 07006 ... 201-228-4480
† Oxley Inc., Branford, CT 06405 ... 203-488-1033
Penn Keystone Corp., Wallingford, CT 06492 ... 203-294-0537
Rolyn Optics Co., Covina, CA 91722-2199 ... 818-915-5707/5717
† S & S Associates, Inc., San Luis Obispo, CA 93401 ... 805-544-2500
Schneider Corp. of America, Woodbury, NY 11797 ... 516-496-8500
§ Shelly Associates, Inc., Tustin, CA 92680 ... 714-669-9850
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003 ... 214-231-6663; 214-924-3289;1-800-331-6600

Light Choppers-3700
§ BEA electro-optics, inc., Des Plaines, IL 60016 ... 708-298-1420
Displaytech, Inc., Boulder, CO 80301 ... 303-449-8933
Ealing Electro-Optics, Holliston, MA 01746 ... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 ... 619-279-8034
† Electro Optical Industries Inc., Santa Barbara, CA 93111 ... 805-964-6701 (ext. 280)
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 ... 607-272-7640
† Millivac Instruments, Inc., Schenectady, NY 12301 ... 518-355-8300
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 ... 505-822-8801
Oriel Corp., Stratford, CT 06497-0872 ... 203-377-8282
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 ... 408-744-9040

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Light Sources, Fiber Optic - Also see Generators, Light Pulse-2475
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... C•1163
† **Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100 ... D•1239**
Lumitex, Inc., Strongsville, OH 44136, 800-969-5483 ... B•1173
Advantest America, Inc., Buffalo Grove, IL 60089-4503 ... 800-441-0852
Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 ... 408-776-8300
§ Assurance Technologies, Inc., West Chicago, IL 60185 ... 708-231-4800
§ Automation Component Technology, Fremont, CA 94538 ... 510-226-0900; 510-490-3587 (Sales)
§ Banner Engineering Corp., Minneapolis, MN 55441 ... 612-544-3164
BT & D Technologies, Kennett Square, PA 19348 ... 215-444-6888;800-545-4306
§ Bulbtronics, Inc., Farmingdale, NY 11735 ... 516-249-2272;1-800-654-8542
Dolan-Jenner Inds., Woburn, MA 01801 ... 617-935-7444
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 ... 215-524-2000; 800-441-8246
Fiberoptics Technology, Inc., Pomfret, CT 06258 ... 203-928-0443, 800-433-5248
Fiberoptic Systems, Inc., Simi Valley, CA 93063 ... 805-583-2088
§† ILC Technology, Inc., Sunnyvale, CA 94089 ... 408-745-7900
§† LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443 ... 815-455-0400
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820 ... 908-549-9001
§ Laser Precision Corp., Utica, NY 13502 ... 315-797-4449
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 ... 708-359-2790
† 3M Private Network Products, 3M, Austin, TX 78726 ... 512-984-3400;800-426-8626
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 ... 1-800-366-9782
Olympus Corporation, Industrial Fiberoptics Division, Lake Success, NY 11042-1179 ... 516-488-3880
Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
§† Optek Technology Inc., Carrollton, TX 75006 ... 214-323-2200
Optics for Research, Inc., Caldwell, NJ 07006 ... 201-228-4480
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 ... 206-834-2500
Soltec Corp., San Fernando, CA 91340-1597 ... 818-365-0800;800-423-2344
Tektronix, Inc., Wilsonville, OR 97070 ... 800-835-9433
† Texas Optoelectronics, Inc., Garland, TX 75042 ... 214-487-0085
Volpi-MFG-USA, Auburn, NY 13021-1289 ... 315-255-1737
Welch Allyn, Inc., Data Collection Div., Skaneateles Falls, NY 13153-0187 ... 315-685-8945

Light Sources, Infrared - Also see Generators, Light Pulse-3700
† **Berkeley Nucleonics Corp., Richmond, CA 94804, 510-234-1100 ... D•1239**
§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 ... B•1135**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ... B•1159
† **LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766, 603-448-3444 ... B•1172**
§ Banner Engineering Corp., Minneapolis, MN 55441 ... 612-544-3164
BT & D Technologies, Kennett Square, PA 19348 ... 215-444-6888;800-545-4306
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ... 214-422-1844; 1-800-872-0044
Dolan-Jenner Inds., Woburn, MA 01801 ... 617-935-7444
Ealing Electro-Optics, Holliston, MA 01746 ... 508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 ... 619-279-8034
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 ... 418-683-0211; 1-800-663-EXFO
§ IR Scientific, Carlisle, MA 01741 ... 508-667-7110
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820 ... 908-549-9001
Ledtronics, Inc., Torrance, CA 90505 ... 310-534-1505
§ Luminator Aircraft Products, Plano, TX 75074 ... 214-424-6511
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 ... 1-800-366-9782
§† Optek Technology Inc., Carrollton, TX 75006 ... 214-323-2200
Optronic Laboratories, Inc., Orlando, FL 32811 ... 407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872 ... 203-377-8282
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110 ... 408-453-7373
Scanning Devices, Inc., Waltham, MA 02154 ... 617-891-8991
Swan Associates, New Haven, CT 06534 ... 203-387-3917
† Texas Optoelectronics, Inc., Garland, TX 75042 ... 214-487-0085
Vision Engineering Laboratories, Amglo Kemlite Laboratories Inc., Largo, FL 34643 ... 813-539-0448

Light Sources, Photoelectric-3700
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ... B•1316
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ... B•1159
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 ... B•1162,1321
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ... B•1324-1325**
§ Altech Corp., Flemington, NJ 08822-6000 ... 908-806-9400
§ Banner Engineering Corp., Minneapolis, MN 55441 ... 612-544-3164
§ Dolan-Jenner Inds., Woburn, MA 01801 ... 617-935-7444
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 ... 215-524-2000; 800-441-8246
§ EG & G Vactec, St. Louis, MO 63132 ... 314-423-4900
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
Leecraft Mfg., Long Island City, NY 11101 ... 718-392-8800
† Mansfield & Green Division, A Subsidiary of Ametek Inc., Largo, FL 34643 ... 813-536-7831
Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 ... 708-843-7900
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 ... 818-341-5151
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626 ... 714-662-3232;800-366-7010
Scanning Devices, Inc., Waltham, MA 02154 ... 617-891-8991
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717

Light Sources, Stroboscopic-3700
§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542 ... B•1135**
Automation Component Technology, Fremont, CA 94538 ... 510-226-0900; 510-490-3587 (Sales)
Dolan-Jenner Inds., Woburn, MA 01801 ... 617-935-7444
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 ... 508-745-3200;1-800-950-3441
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 ... 908-231-0960
# Hughey & Phillips, Inc., Simi Valley, CA 93062 ... 805-581-5591
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ... 603-883-3390; 800-999-3390

† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107	800-253-1230
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Xenon Corp., Woburn, MA 01801	617-938-3594

Light Sources, Ultraviolet-3700

§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442	**B•1159**
§ **Injectorall Electronics (Woman Owned), Bohemia, NY 11716, 516-563-3388**	**C•1136**
Micro Lamps, Inc., Batavia, IL 60510-1488, 708-879-0900	**B•1174**
† American Ultraviolet, Murray Hill, NJ 07974	908-665-2211
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
§ Chiu Technical Corp., Kings Park, NY 11754	516-544-0606
§ Contact East, N. Andover, MA 01845	508-682-2000
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
§ Efos Inc., Mississauga, Ont., CAN L4Z 2E8	416-568-4268
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970	508-745-3200;1-800-950-3441
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§† Spectronics Corp., Westbury, NY 11590	516-333-4840/1-800-274-8888
† Stenning Instruments, Inc., Camarillo, CA 93010	805-484-4996
Swan Associates, New Haven, CT 06534	203-387-3917
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
§ UVP, Inc., San Gabriel, CA 91776	818-285-3123;800-452-6788
Voltarc Technologies, Inc., Fairfield, CT 06430	203-255-2633
§ Xenon Corp., Woburn, MA 01801	617-938-3594

Lights, Indicator-2460

§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933**	**B•1133**
§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
§† **Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815**	**B•1136-1138**
§† **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400**	**B•1142-1147**
§† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180**	**B•1714**
† **Eltech, Horsham, PA 19044, 215-441-0404**	**B•1149**
§† **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594**	**B•1359**
† **Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442**	**B•1153-1154,1158-1159**
§ **Idea, Inc., Brea, CA 92621, 310-697-4332**	**B•1164-1165**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1522-1523,1738-1739**
§ **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311**	**B•1078-1079**
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989**	**B•1166-1167**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040	**B•1749**
§† **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019**	**B•1168**
† **LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766, 603-448-3444**	**B•1172**
† **Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261**	**B•1175**
NKK Switches, Scottsdale, AZ 85260, 602-991-0942	**B•1783-1785**
§† **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200**	**B•1794**
§ **Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 140, 03-3471-8548**	**B•1176**
§† **Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794**	**B•1797**
Osram Sylvania, Hillsboro, NH 03244, 603-464-5533;603-464-5538	**B•1190-1194**
SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, La Mirada, CA 90638, 310-802-8425	**B•1111**
† **Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610**	**B•1851**
§† **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850**	**B•1179**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**B•1180**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123**	**B•1182-1183,1187**
§ **Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900**	**B•1196-1197**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
Altair Exchange Corporation, Valencia, CA 91355	805-257-6964
§ AND, William J. Purdy Co., Burlingame, CA 94010	415-347-9916
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§ C & K Components, Inc., Newton, MA 02158-1082	617-964-6400
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
CUI Stack Inc., Beaverton, OR 97005	503-643-4899
§ Daitron, Inc., Tigard, OR 97223	503-620-2879
Dio-Rey, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
Display Devices, Inc., Encinitas, CA 92023	619-753-0113
§ Dreefs Switch, Inc., Waukegan, IL 60087	708-662-7667;800-323-9605
§ EAO Switch Corp., Milford, CT 06460	203-877-4577
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Entrelec Inc., Irving, TX 75038	214-550-9025
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1	416-624-3020
Furnas Elec., Batavia, IL 60510	708-879-6000
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010	516-352-2904
GBC, Inc., Lamp Division, Ocean, NJ 07712	908-774-8502
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
§ Genisco Electronics, A Division of GTC, Anaheim, CA 92805	714-563-4300
GTE Products Corporation, Miniature Lighting Products, Hillsboro, NH 03244	603-464-5533;603-464-5538
Hantronix, Inc., Liquid Crystal Display, Sunnyvale, CA 94086	408-736-3191
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
§ Inter-Market, Glenview, IL 60025	708-729-5330
§ Lamb Industries, Inc., Portland, OR 97225	503-297-8878,800-824-9374
§ Lamp Technology, Inc., Bohemia, NY 11716	516-567-1800
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443	815-455-0400
§† Ledco, Wilbrecht Elctrns., St. Paul, MN 55107	612-222-2791
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§† Leecraft Mfg., Long Island City, NY 11101	718-392-8800
§† Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
§† Luminator Aircraft Products, Plano, TX 75074	214-424-6511
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
§ Merix Chemical Co., Chicago, IL 60649	312-221-8242
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
Micro Lamps, Inc., Batavia, IL 60510-1488	708-879-0900
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ Nedco Electronics, Inc., Morton Grove, IL 60053	708-967-0500
† Oxley Inc. Branford, CT 06405	203-488-1033
Penn Keystone Corp., Wallingford, CT 06492	203-294-0537
† Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
† Pyle-National, Chicago, IL 60651	312-342-6300 x210
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
§ Schurter, Inc., Petaluma, CA 94954	800-848-2600 ext.62
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Solico/Mec, Hartford, CT 06114	203-527-3092
§ Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
†# Spectrum Devices, Sugar Land, TX 77487-1586	713-242-6417
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630	312-792-2700
§† Sylvania Automotive and Miniature Lighting, Osram Sylvania, Hillsboro, NH 03244	603-464-5533
§ Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923	1-800-544-4828, 508-777-1900
§† Three-Five Sys., Inc., Phoenix, AZ 85044	602-496-0035
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701
§ Wiko, Ltd., Orlando Park, IL 60462	1-800-323-1107
Wilbrecht Electronics, St. Paul, MN 55107	612-222-2791

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Limiters, Current-4300

§ **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594**	**B•1359**
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081	**B•1878**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591	**B•1880,1883**
Mechanical Products Inc., Jackson, MI 49204, 517-782-0391	**B•1369,1371-1372**
§ **PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170**	**B•1379**
§ **Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500**	**B•1389**
§ **World Products Inc., Sonoma, CA 95476, 707-996-5201**	**A•1177, B•1399**
Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667	714-639-1000
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ Burndy Corporation, An FCI Company, Norwalk,, CT 06856	203-838-4444
§† Bussmann Division, Cooper Industries, St. Louis, MO 63178	314-394-2877
Hitran Corporation, Flemington, NJ 08822-1238	908-782-5525
† NWL Transformers, Bordentown, NJ 08505	609-298-7300
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
§† Silicon General, Garden Grove, CA 92641	714-898-8121
§ Square D Co., Palatine, IL 60067	708-397-2600
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538	419-525-8450
U.S. Sensor Corp., Orange CA 92667	714-639-1000
U.S. Sensor Corp., Orange, CA 92667	714-639-1000
Western Elctrn. Comps. Corp., Camarillo, CA 93012	805-482-8002
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201

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† **Tru-Connector Corp., Peabody, MA 01960, 508-532-0775;1-800-262-9787;1-800-COAXTRU**	**C•1507**

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† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 .... A•1319
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 .... A•1321
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
† Jobmaster Corp., Randallstown, MD 21133-0207 .... 410-655-1400;1-800-642-1400
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
RJF Interantional Corp., Fairlawn, OH 44333 216-668-7689

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Meters (MIL)-2440

International Instruments, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 .... D•1354
† OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1364-1365
§† Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046 .... D•1317
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1330
§ Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1389,1395
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Gralex Industries, Norwood, NJ 07648 800-486-4499

† Ideal Precision Meter, Brooklyn, NY 11222	212-383-6904
§† I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714	602-748-7900
† International Microtronics, Tucson, AZ 85714	602-748-7900
Jobmaster Corp., Randallstown, MD 21133-0207	410-655-1400;1-800-642-1400
§ Metermaster, Tempe, AZ 85282	602-431-0015
† Millivac Instruments, Inc., Schenectady, NY 12301	518-355-8300
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
§ Simpson Electric Co., Elgin, IL 60120	708-697-2260
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015

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† Interpoint Corporation, Redmond, WA 98052, 206-882-3100	**A•1706-1707, D•2112**
† Micro-Precision Technologies, Inc., Salem, NH 03079, 603-893-7600	**A•1703**
† Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762, 508-695-2000	**A•1710**
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025	**A•2001-2003**
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† AlliedSignal Inc., Communications Systems, Towson, MD 21286-5999	410-583-4000
§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442	305-421-8450
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
† Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
† Film Microelectronics Inc., Peabody, MA 01960	508-532-9913
Hycomp, Inc., Marlborough, MA 01752	508-485-6300
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Micro Hybrids, Inc., Medford, NY 11763	516-732-3448
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
§† Sipex Corp., Billerica, MA 01821	508-667-8700
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139	818-781-1642
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248

Microcircuits (MIL), Linear-2440

§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111	**A•2180**
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606	408-720-8737
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
† Aydin Corp., Horsham, PA 19044	215-657-7510
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
† Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
† Film Microelectronics Inc., Peabody, MA 01960	508-532-9913
† Holt Inc., Irvine, CA 92718	714-859-8800
† Micro Hybrids, Inc., Medford, NY 11763	516-732-3448
§† Silicon General, Garden Grove, CA 92641	714-898-8121
§† Sipex Corp., Billerica, MA 01821	508-667-8700
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Third Domain, Inc., Tucson, AZ 85731-7568	602-290-1820

Microcircuits (MIL), Low Power Schottky-2440

§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111	**A•2180**
Alpha Industries, Inc., Woburn, MA 01801	617-935-5150
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
† Micro Hybrids, Inc., Medford, NY 11763	516-732-3448
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248

Microcircuits (MIL), Memories, CMOS, Hybrids-2440

† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1704-1705**
† Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424	**A•1712**
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900	**A•1457**
† Advanced Analog, Intech, Santa Clara, CA 95050	408-988-4930
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428	714-898-0007; 800-64-CHIPS
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052	818-768-7500
† EMC Technology Inc, Cherry Hill, NJ 08034	609-429-7800
† Film Microelectronics Inc., Peabody, MA 01960	508-532-9913
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090	408-727-6116
† Micro Hybrids, Inc., Medford, NY 11763	516-732-3448
M-Tron Industries, Yankton, SD 57078	605-665-9321
§† Sipex Corp., Billerica, MA 01821	508-667-8700
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§† VLSI Technology, Inc., San Jose, CA 95131	408-434-3000
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040	602-437-1520

Microcircuits (MIL), TTL, Schottky, Microprocessor-2440

† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111	**A•1704-1705**
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716	516-589-5656
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635	714-447-2300
† Micro Hybrids, Inc., Medford, NY 11763	516-732-3448
Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
† Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511	201-812-9000

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JEMA, Wilmette, IL 60091, 708-251-3600	**D•1045**
Accusonic Products, Global Market Development, New Hyde Park, NY 11040	516-437-6000
§† Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200

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Microscopes-3700

Applied Fiberoptics, Inc., Southbridge, MA 01550	508-765-9121;800-225-7486
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
Φ Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
Excel Technology Intl. Corp., Belle Mead, NJ 08502	908-874-4747
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Leica Inc., Microscopy & Scientific Instruments, Deerfield, IL 60015	708-405-0123
† Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482	310-478-1134
Research Devices, Inc., Piscataway, NJ 08854	908-572-4800
§ Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§† Vision Engineering, Inc., New Milford, CT 06776	203-355-3776
§ Carl Zeiss, Inc., Thornwood, NY 10594	800-233-2343

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Mirrors, Front Surface-3700

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090	215-659-3080
† Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014	412-224-1800
Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477
§ Optics for Research, Inc., Caldwell, NJ 07006	201-228-4480
† Optima Precision, Inc., West Linn, OR 97068	800-544-4118;503-638-2525
Oxley Inc., Branford, CT 06405	203-488-1033
† Plummer Precision Optics, Pennsburg, PA 18073	215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199	818-915-5707/5717

†TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807 714-630-7127

Mirrors, Rear Surface-3700
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... C•1460
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
†Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
†Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014 412-224-1800
†Optima Precision, Inc., West Linn, OR 97068 .... 800-544-4118;503-638-2525
Oxley Inc., Branford, CT 06405 203-488-1033
Rolyn Optics Co., Covina, CA 91722-2199 .... 818-915-5707/5717
†TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807 714-630-7127

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Mixers, RF-3450 – *See Vol. A*

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Modulator/Demodulators, Laser-3700
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 .... D•2038
#BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
†CATEL Telecommunications, Fremont, CA 94537 510-659-8988
†Coherent, Inc., Palo Alto, CA 95054 408-764-4000
§†Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820 908-549-9001
RE America, Westlake, OH 44145 216-871-7617

Modulators, AM-1900 – *See Vol. D*

Modulators, FM-1900 – *See Vol. D*

Modulators, Light-3700
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1329
†Cleveland Crystals, Cleveland, OH 44110 216-486-6100
Displaytech, Inc., Boulder, CO 80301 303-449-8933
†Electro Optical Industries Inc., Santa Barbara, CA 93111 .... 805-964-6701 (ext. 280)
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
RE America, Westlake, OH 44145 216-871-7617
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433

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Modules, Switching-5100
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455 .... B•1701
§Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1702
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 .... D•1250
Ericsson Components, Inc., Richardson, TX 75081, 214-997-6561 .... D•1692,1695
§Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1460-1461
ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 .... B•1745
§†Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1549-1551,1554-1555
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1777
§Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 .... A•2175
Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610 .... B•1804-1806
Aleph International Corp., San Fernando, CA 91340 .... 818-365-9856;800-423-5622
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089 708-215-9600
Capitol Switch Inc., Bethel, CT 06801 203-744-3300
DDI Inc., Beverly, MA 01915-1703 508-927-7976
§duTec, Inc., Jackson, MI 49204-0964 800-248-1632
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
§Grayhill Inc., La Grange, IL 60525 708-354-1040
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
§International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§International Technologies, Inc., Warwick, RI 02888 401-781-5595
†Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427 513-898-3621
MarLee Switch Co., Upland, CA 91786 714-982-8988
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
†Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
§Schurter, Inc., Petaluma, CA 94954 .... 800-848-2600 ext.62
Signal Switch Company, Corona, CA 91720 909-736-5404
†Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§†Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§#Support Systems Intl. Corp., Richmond, CA 94804 510-234-9090
T-Bar Data Switch Corp., Orange, CT 06477 .... 203-795-0739;800-726-8227
†Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Trimm Inc., Libertyville, IL 60048 708-362-3700
§WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136
§Weidmuller Inc., Richmond, VA 23236 804-794-2877

Modules (MIL), Electronic-2440
†Transmagnetics, Farmingdale, NY 11735, 516-293-3100 .... D•1208
†American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
†Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
†Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 .... 714-898-0007; 800-64-CHIPS
†Diversified Systems, Inc., Indianapolis, IN 46268 317-299-9547
§Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 708-884-1444
†ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
KineticSystems Corp., Lockport, IL 60441 815-838-0005
†Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
†Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
†Modular Devices, Shirley, NY 11967 516-345-3100
†Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
†NAVAN Corporation, Media, PA 19063 215-352-8464
§RTS Systems, Telex Communications, Inc., Burbank, CA 91506 818-566-6700
†Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 401-847-8000
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
#Techrand Corp. of America, Muskegon, MI 49444 616-798-2930
†Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 602-437-1520

Modules (MIL), Standard Electronic-2440

† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428	714-898-0007; 800-64-CHIPS
† Diversified Systems, Inc., Indianapolis, IN 46268	317-299-9547
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173	708-884-1444
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
KineticSystems Corp., Lockport, IL 60441	815-838-0005
† MDF Products Inc., Danbury, CT 06811	203-743-3579
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
# Techrand Corp. of America, Muskegon, MI 49444	616-798-2930
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248

Molding Services — See Services, Molding (Vol. D)

Monitors, Current-2200 — *See Vol. D*

Monitors, Data Link-1900 — *See Vol. D*

Monitors, Error Rate-1900 — *See Vol. D*

Monitors, Frequency-2900 — *See Vol. D*

Monitors, High Resolution-2000 — *See Vol. D*

Monitors, Humidity-2200 — *See Vol. D*

Monitors, Laser Energy-2200 — *See Vol. D*

Monitors, Line & Program-1900 — *See Vol. D*

Monitors, Modulation-2900 — *See Vol. D*

Monitors, Phase & Phase Angle-2900 — *See Vol. D*

Monitors, Phase Sequence & Loss-2200 — *See Vol. D*

Monitors, Power, AC & DC-2200 — *See Vol. D*

Monitors, Power, AF-1300 — *See Vol. D*

Monitors, Power Failure-2200 — *See Vol. D*

Monitors, Power, Microwave-2900 — *See Vol. D*

Monitors, Power, RF-2900 — *See Vol. D*

Monitors, Response Time-2900 — *See Vol. D*

Monitors, Television, Fiberoptic-2475

ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Conrac Display Products, Inc., Duarte, CA 91010	818-303-0095
Peter Parts & Assocs., Webster, NY 14580	716-265-2540
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624	516-957-8700;800-645-5516
§† Teltron, Inc., Birdsboro, PA 19508	610-582-2711

Monitors, Temperature-Also See Controls, Temperature-5300

Control Resources Inc., Harvard, MA 01451, 508-772-4043	**C•1575**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1382**
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846	**D•1355-1357**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**B•1978, D•1359**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1887, D•1362-1363**
PPM, Inc., Cleveland, OH 44122, 1-800-899-4776	**D•1315**
† **Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202**	**D•1416**
Sensor Scientific, Inc., Fairfield, NJ 07004, 201-227-7790;800-524-1610	**B•1898-1901**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1212**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1382**
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450	**B•1904-1905,1907**
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200	**B•1908**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550	**D•1389**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Action Instruments, San Diego, CA 92123	619-279-5726
Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
§ Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
Analogic Corp., Peabody, MA 01960	508-977-3000
Angus Electronics Co., Indianapolis, IN 46224	317-244-7611
Approved Purification Corp., Stamford, CT 06907	203-357-0141
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Atkins Technical Inc., Gainesville, FL 32608	904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Burling Instruments, Inc., Chatham, NJ 07928-0298	201-635-9481
Calex Mfg. Co., Inc., Concord, CA 94520	510-687-4411
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
† Chromalox Instrs. & Controls, La Vergne, TN 37086-3536	615-793-3900
† Climatronics, Bohemia, NY 11716	516-567-7300
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Comptus Inc., New Boston, NH 03070	603-487-5512
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Datel, Inc., Mansfield, MA 02048-1194	508-339-3000
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Digital Dynamics, Inc., Scotts Valley, CA 95066	408-438-4444
† Digitec, Marion, OH 43302	614-387-3444
† Dranetz Technologies, Inc., Edison, NJ 08818-4019	908-287-3680
§ Dynalco Controls, Ft. Lauderdale, FL 33309	305-739-4300
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
Electric Tachometer, Philadelphia, PA 19142	215-726-7723
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ E-Squared Technology Corp., Ventura, CA 93003	805-644-9544
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
§ John Fluke Mfg. Co., Inc., Everett, WA 98203	206-347-6100
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
Gordon Products, Brookfield, CT 06804	203-775-4501
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
† Hancock Electronics Corp., Hingham, MA 02043	617-740-4190
Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
§ Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
International Instruments, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ Intra-computer Inc., Jamacia, NY 11418	718-297-5500
§ Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
Keystone Carbon, Thermistor Div., St. Marys, PA 15857	814-781-1591
KineticSystems Corp., Lockport, IL 60441	815-838-0005
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Lake Shore Cryotronics, Inc., Westerville, OH 43081	614-891-2243
Lambert Engineering Inc., Bend, OR 97702-2181	503-388-2623
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007	215-781-0700; 800-523-8989
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Level Plus, Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538	510-226-0488
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
Mag-Con, St. Paul, MN 55113	612-633-8820
† Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
Medicam Technologies Inc., Hudson, NH 03051	603-886-9460
§ Metra Corporation, San Jose, CA 95131	408-432-1110
Metrix Instrument Co., Houston, TX 77043	713-461-2131
Metrosonics, Inc., Rochester, NY 14692-3075	716-334-7300
§† Mikron Instrument Company, Inc., Wyckoff, NJ 07481	201-891-7330
Minco Products, Minneapolis, MN 55432	612-571-3121
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
§ Non-Linear Systems, San Diego, CA 92121	619-535-2161
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
§ Pacific Transducer Corp., Los Angeles, CA 90064-1482	310-478-1134
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
† Relco Products, Denver, CO 80237	303-756-1143
Scientific Instruments, West Palm Beach, FL 33407	407-881-8500
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§† Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108	800-628-8862
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089	408-744-9040
§ Strawberry Tree, Inc., Sunnyvale, CA 94086	408-736-8800
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
† Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
Technical Services Laboratory Inc., Ft. Walton Beach, FL 32548	904-243-3722
§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080	908-757-8300
§ Temptronic Corporation, Newton, MA 02158	617-969-2501
† Thermo Electric, Saddle Brook, NJ 07662	201-843-5800
Tracewell Enclosures, Inc., Westerville, OH 43081	614-846-6175;800-848-4525
§ VA-Tran Systems Inc., Chula Vista, CA 91911	619-423-4555
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
Western Elctrn. Comps. Corp., Camarillo, CA 93012	805-482-8002
§ Yellow Springs Instruments Co., Yellow Springs, OH 45387	800-765-4974

Monitors, Torque/Speed-2200 — *See Vol. D*

Monitors, Touch — See Touch Monitors (Vol. D)

Monitors, Vibration-2200 — *See Vol. D*

Monitors, Video-1900 — *See Vol. D*

Monitors, Voltage — See Meters, Volt (Vol. D)

Monitors, Waveform — See Oscilloscopes (Vol. D)

Monitors (MIL), Data-2440

Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007, 708-952-8800	**B•1035**
† **Infodex, Inc., Wolcott, CT 06716, 203-879-4944**	**B•1012-1013,1080**

Intronics, Inc., Canton, MA 02021, 800-367-0004	**B•1081**
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
Dixson, Inc., Grand Junction, CO 81503	303-244-1241
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
§ Science/Electronics, Dayton, OH 45401-0986	513-859-5555

Motor & Generator Armatures, Rotors, Stators-3500

† **Georator Corp., Manassas, VA 22110-5512, 800-523-9938**	**D•2261,2263**
Alinabal, Milford, CT 06460	203-877-3241
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065	805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
† Danmar Inds., Moorpark, CA 93021	1-805-529-3788
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Fabricast, S. El Monte, CA 91733	818-443-3247
† Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§† Fibertek Inc., Franklin, TN 37065	615-794-1400
Forster Enterprises, Inc., Waterbury, CT 06708	203-574-3832
Framar Metal Products Co., Inc., Kenilworth, NJ 07033	908-241-0710
† Globe Motors, Dayton, OH 45404	513-228-3171
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
† Island Components Group, Bohemia, NY 11716	516-563-4224
National Lamination Co., National Material Ltd., Des Plaines, IL 60018	708-298-7676
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880	814-355-1521
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210	704-525-8962
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Samatic Winding Machine, Jenlor Ltd., Fayetteville, NY 13066	315-637-9080
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Sko-Die, Inc., Morton Grove, IL 60053	708-965-1130
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Motor Assemblies with Integral Tachometer/Encoder-3500

Data Technology, Inc., Woburn, MA 01811, 617-935-8820	**B•1931**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO	**B•1271**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1275**
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294,1968, D•2316**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299-1301**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1304**
§ **Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300**	**B•1307**
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
† Astromec, Inc., Carson City, NV 89706	702-883-9226
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
§ Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
† Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
Glentek, Inc., El Segundo, CA 90245	310-322-3026
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
Hitachi America, Ltd., Tarrytown, NY 10591	914-631-0600
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
† Inertial Motors, Doylestown, PA 18901	215-345-1010
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
† Island Components Group, Bohemia, NY 11716	516-563-4224
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779	516-467-5151
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532	914-345-5150
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
§ Westamp, Santa Monica, CA 90404	310-393-0401

Motor Generator Sets-3500

† **Georator Corp., Manassas, VA 22110-5512, 800-523-9938**	**D•2261-2263**
Advanced Control Systems, Costa Mesa, CA 92626-4114	714-540-9010
† Ajax Magnethermic Corp., Warren, OH 44483	216-372-8511
Alinabal, Milford, CT 06460	203-877-3241
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
§† Atlas Energy Systems, Inc., Arcadia, CA 91007	818-575-0755
† Avtel/Unitron, Dallas, TX 75238	214-340-8600
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
Forster Enterprises, Inc., Waterbury, CT 06708	203-574-3832
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
† Inertial Motors, Doylestown, PA 18901	215-345-1010
† Island Components Group, Bohemia, NY 11716	516-563-4224
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805	714-956-9200
† Marine Electric Systems, Clifton, NJ 07014-1135	201-471-6800
§ Pacific Scientific Co., Rockford, IL 61109	815-226-3100
§† Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
† Power Systems & Controls, Inc., Richmond, VA 23230	804-355-2803
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
† Sko-Die, Inc., Morton Grove, IL 60053	708-965-1130
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Motorized Components — See Potentiometers, Motorized (Vol.), Rheostats, Motorized (Vol.), Transformers, Variable, Motorized

Motorized Micropositioners-4900 — *See Vol. D*

Motorized Potentiometers — See Potentiometers, Motorized

Motorized Translation Stages-4900 — *See Vol. D*

Motor Speed Drives — See Controls, Motor Speed (Vol. D)

Motors, Brush, DC-3500

Advanced Technology Company, Vista, CA 92083, 619-727-7430	**C•1562-1573**
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1246-1247**
Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131	**B•1250**
Glentek, Inc., El Segundo, CA 90245, 310-322-3026	**B•1262,1264**
KeyMarc Electronics, Inc., Torrance, CA 90501, 310-212-7724	**C•1598**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1274**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751**	**B•1278,1290,1292**
Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622	**B•1293**
†# **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294-1295, D•2316**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299,1301**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1305**
TELCO Intercontinental Corp., TECO, Houston, TX 77095, 713-855-2218	**B•1311**
TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676	**D•2317**
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
† Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
† Astromec, Inc., Carson City, NV 89706	702-883-9226
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Bosch, Robert, Corp., Broadview, IL 60153	708-865-5301
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
Copal (USA), Inc., Torrance, CA 90501	310-618-0225
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697	714-540-1000
Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
§ Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
Electrol Co., York, PA 17405	717-848-1722
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§ Gettys Corporation, an AEG Company, Racine, WI 53404	414-637-6591
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
Hitachi America, Ltd., Tarrytown, NY 10591	914-631-0600
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
† Inertial Motors, Doylestown, PA 18901	215-345-1010
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
ISKRA Electronics, Inc., Plainview, NY 11803	516-349-0222
† Lamb Electric Division, A Subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621	714-671-4500
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
§ Pacific Scientific Co., Rockford, IL 61109	815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532	914-345-5150
Performance Controls, Inc., Horsham, PA 19044	215-675-6500
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000

Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Shinano Kenshi Corp. (SKC), Culver City, CA 90230	310-915-7300
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404	310-393-0401

Motors, Brushless, DC-3500

Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771	**B•1240**
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
† **BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671**	**B•1917**
Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**C•1577**
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330**	**B•1249**
§# **ebm Industries, Inc., Farmington, CT 06034, 203-674-1515**	**C•1579**
Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131	**B•1250**
ETRI, Inc., Monroe, NC 28110, 704-289-5423	**C•1585**
Glentek, Inc., El Segundo, CA 90245, 310-322-3026	**B•1262-1264**
† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564**	**B•1268,1270**
Indek Corporation, San Jose, CA 95131, 408-432-1199	**C•1593-1596**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO	**B•1271**
KeyMarc Electronics, Inc., Torrance, CA 90501, 310-212-7724	**C•1598**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1273-1274**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751**	**B•1278,1290**
Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622	**B•1293**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	**B•1298**
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294-1295, D•2316**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299,1301**
NMB Technologies Inc., Chatsworth, CA 91311, 818-341-3355	**C•1631**
Papst Mechatronic Corp., Newport, RI 02840, 401-849-8810	**C•1633**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1304**
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454	**C•1640**
† **Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300**	**B•1307**
§ **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**B•1308**
Synektron Corporation, Portland, OR 97223, 503-684-3090	**B•1310**
TELCO Intercontinental Corp., TECO, Houston, TX 77095, 713-855-2218	**B•1311**
§ **TS Products, Inc., Arleta, CA 91331-3429, 818-896-6676**	**D•2317**
TUS Electronics, Mission Viejo, CA 92691, 714-458-1155	**C•1649-1650**
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
Advanced Technology Company, Vista, CA 92083	619-727-7430
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
† Anorad Corp., Hauppauge, NY 11788	516-231-1995
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astro Dynamics, Inc., Woburn, MA 01801	617-935-4944
† Astromec, Inc., Carson City, NV 89706	702-883-9226
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065	805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070, 908-572-0500
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
Bodine Electric Company, Chicago, IL 60618	312-478-3515
Bosch, Robert, Corp., Broadview, IL 60153	708-865-5301
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
† Brailsford & Co., Inc., Rye, NY 10580	914-967-1820
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
Copal (USA), Inc., Torrance, CA 90501	310-618-0225
§ Custom Servo Motors, New Ulm, MN 56073	507-354-1616
Digital Motor, Inc., Portland, OR 97229-5501	503-629-9692
ECM Motor Company, Elkhorn, WI 53121	414-723-6400
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§† Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§ Gettys Corporation, an AEG Company, Racine, WI 53404	414-637-6591
† Globe Motors, Dayton, OH 45404	513-228-3171
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
H D Systems, Inc., Hauppauge, NY 11788	516-231-6630
Hitachi America, Ltd., Tarrytown, NY 10591	914-631-0600
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
† Inertial Motors, Doylestown, PA 18901	215-345-1010
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
† Lamb Electric Division, A Subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621	714-671-4500
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
Motor-Tronics, Inc., Vista, CA 92083	619-727-7425
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
† NIDEC Corporation, Torrington, CT 06790	203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532	914-345-5150
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
§ PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
§ Powertec Industrial Corp., Rock Hill, SC 29732	803-328-1888
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210	704-525-8962
§† Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404	310-393-0401

Motors, Clock & Timing-3500

§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600**	**B•1244**
Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622	**B•1293**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•2316**
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§† Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
Hurst Manufacturing Div., Princeton, IN 47670	812-385-2564
Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
Mallory Controls, Emerson Electric, Indianapolis, IN 46214	317-328-4010
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
§ Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400

Motors, Control-3500

Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771	**B•1240**
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830, 908-283-4925	**D•1142**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299-1301**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1305**
§† **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**B•1308**
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
Advanced Technology Company, Vista, CA 92083	619-727-7430
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Anaheim Automation, Anaheim, CA 92801	714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065	805-527-0900
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
§ Berkeley Process Control, Inc., Richmond, CA 94804	510-236-3333
Bertsch U.S., Vista, CA 92083	619-727-7420
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
§ Carter Motor, Warren, IL 61087-0647	815-745-2100
§ Centent Co., Santa Ana, CA 92707	714-979-6491
§† Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
Cross Electronics, Warrendale, PA 15086	412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§† Electrol Co., York, PA 17405	717-848-1722
Electronic Innovations Corp. (E.I.C.), Lakewood, CO 80227	303-987-2441
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
† Globe Motors, Dayton, OH 45404	513-228-3171
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441

Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408	1-800-328-5111
Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
§ Hurst Manufacturing Div., Princeton, IN 47670	812-385-2564
§ Industrial Indexing Systems, Inc., Victor, NY 14564	716-924-9181
Inertial Motors, Doylestown, PA 18901	215-345-1010
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
§ Klockner Moeller, Franklin, MA 02038	508-520-7080
Lincoln Laser Co., Phoenix, AZ 85004	602-257-0407
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Mallory Controls, Emerson Electric, Indianapolis, IN 46214	317-328-4010
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
Motor-Tronics, Inc., Vista, CA 92083	619-727-7425
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
§ Pacific Scientific Co., Rockford, IL 61109	815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532	914-345-5150
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
§ Powertec Industrial Corp., Rock Hill, SC 29732	803-328-1888
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
Servo-Tek Products Co., Hawthorne, NJ 07506	201-427-3100
† Shinano Kenshi Corp. (SKC), Culver City, CA 90230	310-915-7300
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697	407-848-4311
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
§ Westinghouse Electric Corp., Control Division, Oldsmar, FL 34667	813-855-4621

Motors, DC Timing-3500

Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•2316**
† **Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300**	**B•1307**
Bertsch U.S., Vista, CA 92083	619-727-7420
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
§ Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
§ Powertec Industrial Corp., Rock Hill, SC 29732	803-328-1888
Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400

Motors, Fractional Horsepower-3500

Advanced Technology Company, Vista, CA 92083, 619-727-7430	**C•1563-1573**
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
† **BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671**	**B•1917**
Bertsch U.S., Vista, CA 92083, 619-727-7420	**B•1242-1243**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1247**
§# **ebm Industries, Inc., Farmington, CT 06034, 203-674-1515**	**C•1579**
Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564	**B•1270**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1273-1275,1277**
§ **Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622**	**B•1293**
† **McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550, 609-799-0100**	**C•1606-1607**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151	**B•1298**
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294-1295**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299-1301**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1304-1305**
Synektron Corporation, Portland, OR 97223, 503-684-3090	**B•1310**
TELCO Intercontinental Corp., TECO, Houston, TX 77095, 713-855-2218	**B•1311**
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
† Astromec, Inc., Carson City, NV 89706	702-883-9226
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065	805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089	708-215-9600
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
§ Carter Motor, Warren, IL 61087-0647	815-745-2100
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
Digital Motor, Inc., Portland, OR 97229-5501	503-629-9692
# Douglas International, Inc., Geneva, IL 60134-0761	708-232-7419
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141	414-656-4011; 800-356-5077
ECM Motor Company, Elkhorn, WI 53121	414-723-6400
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§† Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081	201-467-8100
§ Electrol Co., York, PA 17405	717-848-1722
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§† Globe Motors, Dayton, OH 45404	513-228-3171
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Hankscraft Motors, Sub of Gerber Prod. Co., Reedsburg, WI 53959	608-524-4341
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
† Hertner Div.:Exide Corp., Cleveland, OH 44111	216-252-4242
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
† Inertial Motors, Doylestown, PA 18901	215-345-1010
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
ISKRA Electronics, Inc., Plainview, NY 11803	516-349-0222
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
† Merrill, Inc., Bonita Springs, FL 33959	813-591-1626
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
Motor-Tronics, Inc., Vista, CA 92083	619-727-7425
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662	201-368-0123
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
Papst Mechatronic Corp., Newport, RI 02840	401-849-8810
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532	914-345-5150
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
§ Powertec Industrial Corp., Rock Hill, SC 29732	803-328-1888
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210	704-525-8962
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
§ Shinano Kenshi Corp. (SKC), Culver City, CA 90230	310-915-7300
† Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
§ Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
Vasak Inds., Inc., El Segundo, CA 90245	1-800-67-VASAK
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Motors, Gearhead-3500

Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
Bertsch U.S., Vista, CA 92083, 619-727-7420	**B•1242-1243**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1246-1247**
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330**	**B•1249**
§† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564**	**B•1266-1268**
Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO	**B•1275,1277**
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294-1296**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299,1301**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1304-1305**

† Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300	**B•1307**
§ Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561	**B•1308**
Advanced Technology Company, Vista, CA 92083	619-727-7430
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
† Astromec, Inc., Carson City, NV 89706	702-883-9226
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089	708-215-9600
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
§ Carter Motor, Warren, IL 61087-0647	815-745-2100
Copal (USA), Inc., Torrance, CA 90501	310-618-0225
§† Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§ Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
§ Electrol Co., York, PA 17405	717-848-1722
§ Empire Magnetics, Rohnert Park, CA 94928	707-584-2801
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
Glentek, Inc., El Segundo, CA 90245	310-322-3026
§† Globe Motors, Dayton, OH 45404	513-228-3171
Hankscraft Motors, Sub of Gerber Prod. Co., Reedsburg, WI 53959	608-524-4341
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621	714-671-4500
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779	516-467-5151
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
Motor-Tronics, Inc., Vista, CA 92083	619-727-7425
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662	201-368-0123
NIDEC Corporation, Torrington, CT 06790	203-482-4422
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
† Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
Servo-Tek Products Co., Hawthorne, NJ 07506	201-427-3100
Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Motors, Hysteresis-3500

† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330	**B•1249**
§† Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564	**B•1268**
† Aeroflex Laboratories Inc., ARX. Inc., Plainview, NY 11803	516-694-6700
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§ Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§† Globe Motors, Dayton, OH 45404	513-228-3171
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
† Island Components Group, Bohemia, NY 11716	516-563-4224
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
Lincoln Laser Co., Phoenix, AZ 85004	602-257-0407
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550	609-799-0100
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
† NIDEC Corporation, Torrington, CT 06790	203-482-4422
Papst Mechatronic Corp., Newport, RI 02840	401-849-8810
Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
† Shinano Kenshi Corp. (SKC), Culver City, CA 90230	310-915-7300
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

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Motors, Induction-3500

† Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330	**B•1249**
† Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300	**B•1307**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
Anorad Corp., Hauppauge, NY 11788	516-231-1995
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astro Dynamics, Inc., Woburn, MA 01801	617-935-4944
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
† Astromec, Inc., Carson City, NV 89706	702-883-9226
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065	805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§# Drivecon Corporation, Libertyville, IL 60048	708-918-1406
§ Eaton Corporation, Industrial Controls Division, Kenosha, WI 53141	414-656-4011; 800-356-5077
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§ Electrol Co., York, PA 17405	717-848-1722
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§† Globe Motors, Dayton, OH 45404	513-228-3171
† Hertner Div.:Exide Corp., Cleveland, OH 44111	216-252-4242
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
§† Hurst Manufacturing Div., Princeton, IN 47670	812-385-2564
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621	714-671-4500
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550	609-799-0100
† Merrill, Inc., Bonita Springs, FL 33959	813-591-1626
Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
NIDEC Corporation, Torrington, CT 06790	203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
Papst Mechatronic Corp., Newport, RI 02840	401-849-8810
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Motors, Linear-3500

† Anorad Corp., Hauppauge, NY 11788	516-231-1995
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§† Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
§ Empire Magnetics, Rohnert Park, CA 94928	707-584-2801
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
Motion Science Inc., San Jose, CA 95112	408-993-0300
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
§ ServoByte Inc., Millbury, MA 01527	508-865-0225
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300

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Motors, Permanent Magnet-3500

Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
† BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671	**B•1917**
Bertsch U.S., Vista, CA 92083, 619-727-7420	**B•1242-1243**
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600	**B•1244**
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**B•1246**
Glentek, Inc., El Segundo, CA 90245, 310-322-3026	**B•1263-1264**
§† Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564	**B•1267**
§† Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO	**B•1274**

† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751**	**B•1290**
§ **Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622**	**B•1293**
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294-1295**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299-1301**
NMB Technologies Inc., Chatsworth, CA 91311, 818-341-3355	**B•1303**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1304-1305**
† **Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300**	**B•1307**
§† **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**B•1308**
Advanced Motion Controls, Inc., Princeton, WI 54968	414-295-3500
Advanced Technology Company, Vista, CA 92083	619-727-7430
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
† Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
§ Anaheim Automation, Anaheim, CA 92801	714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
† Astromec, Inc., Carson City, NV 89706	702-883-9226
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065	805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
§ Carter Motor, Warren, IL 61087-0647	815-745-2100
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
§† Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
Digital Motor, Inc., Portland, OR 97229-5501	503-629-9692
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
ECM Motor Company, Elkhorn, WI 53121	414-723-6400
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§ Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
§ Electrol Co., York, PA 17405	717-848-1722
Eltrol Corporation, Canoga Park, CA 91304	818-709-0131
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§ Gettys Corporation, an AEG Company, Racine, WI 53404	414-637-6591
§† Globe Motors, Dayton, OH 45404	513-228-3171
† GME Systems, Inc., Pittsburgh, PA 15090	412-935-0440
Hankscraft Motors, Sub of Gerber Prod. Co., Reedsburg, WI 53959	608-524-4341
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
† Inertial Motors, Doylestown, PA 18901	215-345-1010
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
ISKRA Electronics, Inc., Plainview, NY 11803	516-349-0222
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
† Lamb Electric Division, A Subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621	714-671-4500
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Mallory Controls, Emerson Electric, Indianapolis, IN 46214	317-328-4010
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779	516-467-5151
Micronel U.S., Vista, CA 92083	619-727-7400
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
† Moore Reed & Co. Ltd., Andover, HAMPSHIRE SP 105AB	0264-324155
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662	201-368-0123
NIDEC Corporation, Torrington, CT 06790	203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
Ormec Systems Corp., Rochester, NY 14625	716-385-3520
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
Papst Mechatronic Corp., Newport, RI 02840	401-849-8810
Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
† Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
Servo-Tek Products Co., Hawthorne, NJ 07506	201-427-3100
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100
§ Westamp, Santa Monica, CA 90404	310-393-0401

Motors, Selsyn — See Motors, Synchronous (Vol. B)

Motors, Servo-4900 — ***See Vol. D***

Motors, Squirrel Cage-3500

§# **ebm Industries, Inc., Farmington, CT 06034, 203-674-1515**	**C•1579**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
† Eastern Air Devices, Inc., Dover, NH 03820	603-742-3330
† EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
† Hertner Div.:Exide Corp., Cleveland, OH 44111	216-252-4242
§ Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
Indramat, The Rexroth Corp., Wood Dale, IL 60191	708-860-1010
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621	714-671-4500
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550	609-799-0100
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
† Shinano Kenshi Corp. (SKC), Culver City, CA 90230	310-915-7300
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Motors, Stepping-3500

§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600**	**B•1244-1245**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1247**
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330**	**B•1249**
§† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564**	**B•1266-1269**
Infranor, Naugatuck, CT 06770, 203-729-8258;800-BE-SERVO	**B•1271**
Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO	**B•1276-1277**
NMB Technologies Inc., Chatsworth, CA 91311, 818-341-3355	**B•1303, C•1631**
† **Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300**	**B•1307**
§† **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**B•1308-1309**
§† **TELCO Intercontinental Corp., TECO, Houston, TX 77095, 713-855-2218**	**B•1311**
† Abrams Instrument Corp., Lansing, MI 48910-3688	517-882-7211
† ADVANCED MICRO SYSTEMS, INC., Nashua, NH 03063-1277	603-882-1447
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Aerotech, Inc., Pittsburgh, PA 15238	412-963-7470
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
§ Anaheim Automation, Anaheim, CA 92801	714-992-6990
Anorad Corp., Hauppauge, NY 11788	516-231-1995
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
Biomedical Technology, Triangle Biomedical Sciences, Inc., Durham, NC 27705	919-471-2237
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
Copal (USA), Inc., Torrance, CA 90501	310-618-0225
Cyberpak Co., Romeoville, IL 60441	708-972-0707
Digital Motor, Inc., Portland, OR 97229-5501	503-629-9692
ECM Motor Company, Elkhorn, WI 53121	414-723-6400
† Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
§ Empire Magnetics, Rohnert Park, CA 94928	707-584-2801
Epson America Inc., Component Sales Dept., Torrance, CA 90503	310-782-5318
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134	408-432-8331
† GAP Instrument Corp., Hauppauge, NY 11788	516-273-0909
General Controls Electronics Inc., Elk Grove Village, IL 60007	708-595-2152
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Island Components Group, Bohemia, NY 11716	516-563-4224
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Mesur-Matic Elctrns., Peabody, MA 01960	508-745-7000
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
† New England Affiliated Technologies, Instrument Industries, Lawrence, MA 01841	508-685-4900
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
§ Parker Hannifin Corp., Daedal Div., Harrison City, PA 15636	412-744-4451
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
Portescap U.S., Inc., Hauppauge, NY 11788	516-234-3900
† Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
§ ServoByte Inc., Millbury, MA 01527	508-865-0225

SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
† Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
United Motion Technology, Santa Clara, CA 95054	408-970-9742;1-800-424-STEP
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

Motors, Synchronous-3500

§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600**	**B•1244-1245**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1246**
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330**	**B•1249**
§† **Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564**	**B•1266-1268**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•2316**
† **Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300**	**B•1307**
§† **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561**	**B•1308**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
Anaheim Automation, Anaheim, CA 92801	714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788-4764	516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
§† Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
ECM Motor Company, Elkhorn, WI 53121	414-723-6400
EEMCO, Datron, Inc., Los Angeles, CA 90039	818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§ Electric Motor Engineering, Inc., Mission Viejo, CA 92691	714-583-9802
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§† Globe Motors, Dayton, OH 45404	513-228-3171
Hansen Corp., Princeton, IN 47670-0023	812-385-3415
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
ISKRA Electronics, Inc., Plainview, NY 11803	516-349-0222
† Island Components Group, Bohemia, NY 11716	516-563-4224
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
§† Kollmorgen Motion Technologies Group, Radford, VA 24141	800-77-SERVO
Lincoln Laser Co., Phoenix, AZ 85004	602-257-0407
Mallory Controls, Emerson Electric, Indianapolis, IN 46214	317-328-4010
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550	609-799-0100
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
† NIDEC Corporation, Torrington, CT 06790	203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
§† Pacific Scientific Co., Rockford, IL 61109	815-226-3100
Papst Mechatronic Corp., Newport, RI 02840	401-849-8810
§ Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
† Rapidsyn Division, American Precison Industries, Oceanside, CA 92054	619-439-7500
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
Reliance Motion Control, Reliance Electric, Eden Prairie, MN 55344	612-942-3600
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729	516-586-5100

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Motors, Timing — See Motors, Clock & Timing (Vol. B)

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BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671	**B•1917**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1246-1247**
† **Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330**	**B•1249**
Hurst Manufacturing Div., Princeton, IN 47670, 812-385-2564	**B•1266-1268, 1270**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751**	**B•1278,1290,1292**
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529**	**B•1294, D•2316**
Motor Technology, Inc., Dayton, OH 45429, 513-294-1041	**B•1299-1301**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601	**B•1305**
Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300	**B•1307**
Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561	**B•1308**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065	805-527-0900
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
Buehler Products, Inc., Raleigh, NC 27636	919-469-8522
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042	516-488-6700
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
† Globe Motors, Dayton, OH 45404	513-228-3171
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
Howard Industries, Inc./Brevel Motors, Milford, IL 60953	815-889-4105
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523	914-592-8880
§† Kollmorgen Motion Technologies Group, Radford, VA 24141	800-77-SERVO
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
† Maxon Precision Motors, Inc., Burlingame, CA 94010	415-697-9614
MFE Instruments, Stocker & Yale, Inc., Beverly, MA 01915-0490	508-921-9104; 800-472-4633
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779	516-467-5151
Micronel U.S., Vista, CA 92083	619-727-7400
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
† NIDEC Corporation, Torrington, CT 06790	203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406	818-997-8675
§ Oriental Motor USA Corp., Torrance, CA 90505-5217	310-515-2264
§ Pacific Scientific Co., Rockford, IL 61109	815-226-3100
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532	914-345-5150
Philips Technologies, Airpax Mechatronics Group, Cheshire, CT 06410	203-271-6000
PMI Motion Technologies, Kollmorgen Corporation, Commack, NY 11725-5703	516-864-1000
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400

Motors, Universal, AC or DC Operation-3500

Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940, 815-637-3000	**B•1241**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**D•2316**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299-1301**
Shinano Kenshi Corp. (SKC), Culver City, CA 90230, 310-915-7300	**B•1307**
† Lamb Electric Division, A subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Ametek, Inc., Technical Motor Div., Kent, OH 44240	216-673-3452
§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040	815-397-7400
§ Bodine Electric Company, Chicago, IL 60618	312-478-3515
§ Carter Motor, Warren, IL 61087-0647	815-745-2100
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697	714-540-1000
ECM Motor Company, Elkhorn, WI 53121	414-723-6400
† Electric Indicator Company Inc., Norwalk, CT 06851	203-847-5861
§† Globe Motors, Dayton, OH 45404	513-228-3171
ISKRA Electronics, Inc., Plainview, NY 11803	516-349-0222
† Lamb Electric Division, A Subsidiary of Ametek Inc., Kent, OH 44240	216-673-3451
Molon Motor & Coil Corporation, Rolling Meadows, IL 60008	708-253-6000
Parvex Servo Systems, GEC Alsthom International, Inc., Hawthorne, NY 10532	914-345-5150
§ Reliance Electric Co., Cleveland, OH 44117	800-245-4501
† Valley Electromagnetics, ECM Motor Co., Elkhorn, WI 53121	414-723-6400

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BEI Motion Systems Company, Kimco Magnetics Div., San Marcos, CA 92069, 619-744-5671	**B•1917**
§† **Kollmorgen Motion Technologies Group, Radford, VA 24141, 800-77-SERVO**	**B•1274,1276**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041**	**B•1299,1301**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† Ashland Elec. Prods., Inc., Rochester, NH 03867	603-335-1100
† Astromec, Inc., Carson City, NV 89706	702-883-9226
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018	215-622-1000
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
† Hertner Div.:Exide Corp., Cleveland, OH 44111	216-252-4242
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621	714-671-4500
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
† Sierracin/Magnedyne, Carlsbad, CA 92008	619-438-3321
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400

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Multiplexers, Digital-2325 — *See Vol. D*

Multiplexers, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... B•1209, C•1163
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1218-1219
† Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 .... B•1223-1227
§ S.I. Tech, Batavia, IL 60510, 708-232-8640 .... B•1229
T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227 .... B•1814
# Accu-Tech Corporation, Roswell, GA 30076-3890 .... 404-751-9473;800-221-4767
AOFR, Inc., Richardson, TX 75081 214-644-1394
Atlantic Scientific Corporation, W. Melbourne, FL 32904 1-800-544-4737
Aydin Corp., Horsham, PA 19044 215-657-7510
BT & D Technologies, Kennett Square, PA 19348 .... 215-444-6888;800-545-4306
§† Canoga-Perkins Corp., Inductotherm Industries, Chatsworth, CA 91311 818-718-6300
† CATEL Telecommunications, Fremont, CA 94537 510-659-8988
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
§† Dataproducts New England, Inc., Wallingford, CT 06492 203-265-7151
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6 613-226-4000
§# Fibronics International Inc., Communications Way, Pembroke, MA 02359 617-826-0099
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550 508-347-9191
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
H & L Instruments, Burlingame, CA 94010 415-342-7850
ICS Electronics Corp., Milpitas, CA 95035-5545 .... 408-263-5500;1-800-952-4499
† Interoptics, Purdy Group, Burlingame, CA 94010 415-347-7727
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7 604-421-8733
† Lightwave Communications, Inc., Milford, CT 06460 203-878-9838
3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 310-828-7496
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
§ Racal-Datacom, Sunrise, FL 33323-2899 .... 305-846-1601;1-800-RACAL-55
RE America, Westlake, OH 44145 216-871-7617
§ SC Technology, Inc., Livermore, CA 94550 510-373-9230
§† Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 512-388-2522

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§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 .... A•1869-1873
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 .... A•1910
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 .... A•1932-1933
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 .... A•1993
† Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424 .... A•1712
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 .... A•2001,2003
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 .... A•2013
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 .... A•1916
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 .... A•2034
Vishay Resistors, Malvern, PA 19355, 215-644-1300 .... A•2041
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
CTS Corp., Resistor Networks, Berne, IN 46711 219-589-3111
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Sprague, Hudson, NH 03051 .... 603-881-7200; 603-883-9774 (Mktg)

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Nuclear EMP (NEMP) Protectors-4300

§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170 .... B•1379
# Electrostatic Consulting Assocs., Groton, MA 01450 508-448-5485
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
†Φ Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Joslyn Electronic Systems Corp., Goleta, CA 93116 .... 800-752-8068; 805-968-3551
Kestrel Systems Co., Leucadia, CA 92024 619-944-2957

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§† Data Display Products. El Segundo, CA 90245-4630, 310-640-0442;800-421-6815 .... B•1136
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§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
† CELCO, Mahwah, NJ 07430 201-327-1123
† Cleveland Crystals, Cleveland, OH 44110 216-486-6100
† Diversified Optical Products, Inc., Salem, NH 03079 603-898-1880
Ealing Electro-Optics, Holliston, MA 01746 .... 508-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 516-758-0700
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701 516-226-8950
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
Noll, J. A. Co., Monroeville, PA 15146 412-856-7566

§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110 408-453-7373
† Pomfret Research Optics, Orange, VA 22960 703-854-4350
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Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§† Isocom Inc., Campbell, CA 95008 408-370-2212
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lutze, Inc., Charlotte, NC 28217-9805 .... 704-357-8835;800-447-2371
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Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§† Quality Technologies, Sunnyvale, CA 94086 408-720-1440
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910

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† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 .... A•1414-1415
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Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 .... 708-932-9380;800-468-6009
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
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† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 804-977-8050
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Raltron Electronics, Miami, FL 33172 305-593-6033
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 .... 305-563-1333;800-359-5400
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
† ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188 617-337-4200
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
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† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
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Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
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CTS Corp., Frequency Controls, Sandwich, IL 60548 815-786-8411
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FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544

† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
Luff Research, Inc., Floral Park, NY 11001	516-358-2880
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Magnum Microwave Corp., Fremont, CA 94538	510-657-9898
MF Elctrns. Corp., New Rochelle, NY 10801	914-576-6570
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† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
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† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901	804-977-8050
† Piezo Technology Inc., Orlando, FL 32804	407-298-2000
† Pro-Comm, Inc., Brick, NJ 08724	908-206-0660
Raltron Electronics, Miami, FL 33172	305-593-6033
† RF Monolithics, Inc., Dallas, TX 75244	214-233-2903
Sivers IMA AB, Culver City, CA 90230	213-306-4248
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
§† Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
TOYOCOM USA INC., Arlington Heights, IL 60005	708-593-8780/1-800-TOYOCOM
† TRM, Inc., Manchester, NH 03110	603-627-6000
† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748	508-435-6831
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§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62**	**B•1386**
† Accurate Electronics Corp., Elyria, OH 44036	216-366-6330;1-800-334-5904
Augat/RDI, Carol Stream, IL 60188	708-682-4100
Connector Corp., Chicago, IL 60646	312-539-3108
Doran Manufacturing Co., Cincinnati, OH 45225	513-681-5424
Elgin Electronics, Erie, PA 16509-3570	814-864-4921
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
Ferraz Corporation, Parsippany, NJ 07054	201-428-8400;800-526-9067
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
Marway Prods. Inc., Santa Ana, CA 92703	714-973-1800
§† Meco Precision/Inds. Inc., Bridgeport, CT 06607	203-333-4900
† Ratelco, Power Systems, Seattle, WA 98109-5589	206-624-7770
§ San-O Industrial Corp., Holbrook, NY 11741	516-472-6666
† Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
§ Trimm Inc., Libertyville, IL 60048	708-362-3700
§ USD Products , Div. of Bussmann, Chicago, IL 60656	708-867-4600

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§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782**	**B•1332**
Aborn Electronics Inc., San Jose, CA 95131	408-436-5444
† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702	805-499-5902
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
Gilway Technical Lamp, Woburn, MA 01801	617-935-4442
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014	408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400

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† **Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902**	**B•1312-1314**

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† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
§ BEA electro-optics, inc., Des Plaines, IL 60016	708-298-1420
BKC Semiconductors Incorporated., Lawrence, MA 01841	508-681-0392
Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
† EG & G Judson, Montgomeryville, PA 18936	215-368-6900
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
§ Ercona, Patchogue, NY 11772	516-758-0700
Gilway Technical Lamp, Woburn, MA 01801	617-935-4442
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
† Texas Optoelectronics, Inc., Garland, TX 75042	214-487-0085
Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511	201-812-9000
§ Three-Five Sys., Inc., Phoenix, AZ 85044	602-496-0035

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Gilway Technical Lamp, Woburn, MA 01801	617-935-4442
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
Silonex Inc., Plattsburgh, NY 12901	518-561-3160

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Texas Instruments, Connector Systems, Attleboro, MA 02703, 508-699-5269;508-699-3450	**C•1493-1497**
† ADC Telecommunications, Inc., Minneapolis, MN 55435	612-938-8080
§ Circuit Assembly Corp., Irvine, CA 92718-2703	714-855-7887
Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647	201-768-5400
† Direct Sound Corporation, Boston, MA 02116	1-800-372-1616
† Lynn Electronics, Feasterville, PA 19053	215-355-8200;800-523-6075
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101	617-890-4750
§ Northern Technologies Inc., Markham, Ont., CAN L3R 8N4	416-475-9320; 1-800-456-1875
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584	309-693-3300
† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047	818-707-2020
† Tru-Connector Corp., Peabody, MA 01960	508-532-0775;1-800-262-9787; 1-800-COAXTRU
U.S. Terminals Inc., Cincinnati, OH 45243	513-561-8145

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Polarizers-3700

† Cleveland Crystals, Cleveland, OH 44110	216-486-6100
Eastern Marking Machines, Hempstead, NY 11550	800-835-2393
Flann Microwave Inc., Cambridge, MA 02139	1-800-937-3772
International Polarizer, Inc., Marlborough, MA 01752	508-481-7495
† Marks Polarized Corp., Hauppauge, NY 11788	516-273-8900
Oriel Corp., Stratford, CT 06497-0872	203-377-8282

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§† **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 .... A•2058-2059,2062**
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 .... A•2079
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1269
JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608 ... A•2088-2090
§ **Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 .... A•2092-2093**
Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .... A•2095-2096
Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 .... A•2106, B•1771
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ...... A•2111
† **Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ...... A•2116**
§† **Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 .... A•2124,2126**
§† **Vishay Resistors, Malvern, PA 19355, 215-644-1300 .... A•2127**
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 .... A•2129**
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ...... 214-422-1844; 1-800-872-0044
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
§† Varnistor Corp., Sevierville, TN 37862 615-453-0001
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Power Supplies, 150 to 400 W Output – See Power Supplies, Greater Than 300 W Output (Vol. D)

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Power Supplies, 1000 to 1500 W Output – See Power Supplies, Greater Than 300 W Output (Vol. D)

Power Supplies, 1500 to 3000 W Output – See Power Supplies, Greater Than 300 W Output (Vol. D)

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Power Supplies, Constant Voltage/Constant Current-4000 – *See Vol. D*

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Power Supplies, Welding, Electroplating – See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. D)

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† Abbott Electronics, Los Angeles, CA 90034, 310-202-8820	**D•1491**
§ Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200	**D•1512,1515**
† Acopian Technical Company, Easton, PA 18044, 215-258-5441	**D•1517**
† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	**D•2230**
† Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930	**D•2067**
Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355	**D•1573**
† Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500	**D•1574-1577**
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	**D•1585-1586,1588,1590**
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3, 905-660-9819	**D•1592-1594**
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500	**D•2232-2234**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2249**
Condor D.C. Power Supplies, Inc., Oxnard, CA 93033, 805-486-4565;	**D•1637-1639,1642,1644-1645**
† Custom Power Systems, Ronkonkoma, NY 11779-9998, 516-467-5328	**D•2082**
† D & B Power, Inc., Bayshore, NY 11706, 516-586-5955	**D•1655**
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600	**D•1656,1659**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462	**D•1661**
† EG & G Power Systems, Inc., Covina, CA 91724, 818-967-9521	**D•1670-1671**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•1684,2258-2259**
HC Power Inc., Irvine, CA 92714-5716, 714-261-2200	**D•1739**
Interelectronics Corp., Congers, NY 10920, 914-EL8-8000	**D•1750**
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100	**D•2112**
Kepco, Inc., Flushing, NY 11352, 718-461-7000	**D•1777**
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816-1817,2130**
† Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800	**D•1015**
Melcher, Inc., Melcher AG, Chelmsford, MA 01824, 800-828-9712	**D•2131-2132**
Mid-Eastern Industries, Technology Dynamics Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•1834-1835**
† Modular Devices, Shirley, NY 11967, 516-345-3100	**D•1837-1838,1840-1844,2136**
Nova Electric Corp., Technology Dynamics, Inc., Bergenfield, NJ 07621-2915, 201-385-0500	**D•2284**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300	**D•1851**
Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2287**
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521	**D•1857**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
Pillar Industries, Inc., Duarte, CA 91010, 818-358-1337	**D•1874**
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500	**D•2186,2192-2195**
Power-One, Inc., Camarillo, CA 93012, 805-987-8741	**D•1886-1887**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1896-1897**
† Power Ten, Inc., Sunnyvale, CA 94086, 408-738-5959	**D•1907**
† Rantec Microwave & Elctrns., Inc., Subsidiary of Esco Electronics Corp., Los Osos, CA 93402, 805-528-5858	**D•1908-1909,1911**
§ Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616	**D•1913**
† RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450	**D•1916,2202**
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270	**D•1945,1951**
† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	**A•2565, D•1958**
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5, 416-630-8108	**D•1960,1962**
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	**D•1967**
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	**D•2004**
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 310-316-9984	**D•1913**
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001	**D•2045**
§† ACME-URDC, Inc., West Jordan, UT 84084	801-561-9385
† Adtech Power Inc., Anaheim, CA 92806	714-634-9211
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† ATC Power Systems, Inc., Merrimack, NH 03054	603-429-0391
Autronics Corp., Arcadia, CA 91006	818-445-5470
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
# BEC Inc. Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
† Brandt Electronics, Inc., Mountain View, CA 94043	415-967-4944
† Cal Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
† Christie Electric Corp., Gardena, CA 90248	310-715-1402
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
§† CPS, Lake Oswego, OR 97035	503-684-8026
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
† Electronic Development Associates, Dix Hills, NEW YORK 11746	516-673-3881
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
† EMCO High Voltage Co., Sutter Creek, CA 95685	209-223-3626;800-546-3680
† E M S Development Corp., Farmingdale, NY 11735	516-293-7900
† Engineered Magnetics, Inc., Rancho Dominguez, CA 90221	310-635-9555
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735	516-293-4100
§ Global Specialties, Interplex Electronics, Inc., New Haven, CT 06509	203-624-3103
§ HBS Equipment Corporation, Los Angeles, CA 90040	213-726-3033
High Voltage Technology Inc., Yonkers, NY 10701	914-423-6636
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
International Power DC Power Supplies, Inc., Oxnard, CA 93030-5167	805-981-1188
JMK, Inc., Amherst, NH 03031	603-886-4100
† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
† Litton Electron Devices, San Carlos, CA 94070	415-591-8411
† Mep Controls, Bordentown, NJ 08505	609-298-7300
MIL Electronics, Inc., Nashua, NH 03060	603-882-3200
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† Oeco Corp., Milwaukie, OR 97222	503-659-7932
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
Performance Controls, Inc., Horsham, PA 19044	215-675-6500
† Plastic Capacitors, Inc., Chicago, IL 60639	312-489-2229
† Power Functions Engineering, Garland, TX 75042	214-278-0996
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861	908-826-4700
Power Star, Inc., Irvine, CA 92713	714-261-5377;800-854-9420
Power Switch Corporation, Lodi, NJ 07644	201-478-5788
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
Pylon Electronics Inc., Lachine, PQ, CANADA H8S 1Z3	514-637-1186
† QPS Inc., Salem, NH 03079	603-893-5100
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302	818-591-8189
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
Schott Corp., Wayzata, MN 55391	612-475-1173
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
Sola, Elk Grove Village, IL 60007-5666	708-439-2800
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Technology Dynamics Inc., Bergenfield, NJ 07621	201-385-0500
† Tecnetics Inc., Boulder, CO 80303	303-442-3837
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Urban Electronics, Dover, MA 02030	617-329-4068
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636
† Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054	408-496-6273
§† Vicor Corp., Andover, MA 01810	508-470-2900
§ Wall Industries, Exeter, NH 03833	603-778-2300
† Westcor Corporation, Los Gatos, CA 95032	408-395-7050

Power Supplies (MIL), AC-2440

† Advance Conversion Devices Co.Unit of Transitor Dvcs., Inc., Cedar Knolls, NJ 07927, 201-267-1900	**D•2230-2231**
† Arnold Magnetics, Camarillo, CA 93012, 805-484-4221	**D•1585-1586**
† Avionic Instruments, REA International Inc., Avenel, NJ 07001, 908-388-3500	**D•2232-2234,2237**
† Avtel/Unitron, Dallas, TX 75238, 214-340-8600	**D•2241**
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003, 805-642-0660	**D•2244-2247**
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2253**
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2259**
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**D•1816,2130**
† Modular Devices, Shirley, NY 11967, 516-345-3100	**D•1837,1843,2136**
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521	**D•1857**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	**D•1859,2137**
† Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1896-1897**
† Advanced Conversion Tech., Middletown, PA 17057	717-939-2300
† B C Systems, Inc., Setauket, NY 11733	516-751-9370
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042	516-328-1600
† Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5672
† CEC Electronics Corp., Hauppauge, NY 11788	516-582-4422
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423	716-538-4421
Computer Power Supplies (CPS), Lake Oswego, OR 97035	503-684-8026
Criterion Instrs., Ltd., Scarborough, Ont., CAN M1P4W8	416-299-6666
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9	416-826-1141
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012	605-296-3462
§ EFI Electronics Corp., Salt Lake City, UT 84119	801-977-9009;800-877-1174
† Hyperion Industries Corp., Watertown, MA 02172	617-926-0140
† Lambda Electronics Inc., Melville, NY 11747-3700	516-694-4200
Litton Electron Devices, San Carlos, CA 94070	415-591-8411

† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
† QPS Inc., Salem, NH 03079	603-893-5100
Schott Corp., Wayzata, MN 55391	612-475-1173
† Sierra West Power Systems, Las Cruces, NM 88001	505-522-8828
† ST Keltec Corp., Subsidiary of Signal Technology Corp., Ft. Walton Beach, FL 32548	904-244-0043
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
† Tecnetics Inc., Boulder, CO 80303	303-442-3837
† Transchem, Jetronics Industries, Inc., Corona, CA 91718	909-371-5751
Urban Electronics, Dover, MA 02030	617-329-4068
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636
§† Vicor Corp., Andover, MA 01810	508-470-2900
§ Wall Industries, Exeter, NH 03833	603-778-2300

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§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	**B•1825**
Interpoint Corporation, Redmond, WA 98052, 206-882-3100	**A•1706-1707**
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629	**C•1137**
AMP-AKZO Corporation, Chadds Ford, PA 19317	215-459-2800
# Applied Design Company, Minneapolis, MN 55413	612-378-0094
Associated Circuits Inc., Menlo Park, CA 94025	415-329-0478
Berg Electronics, Camp Hill, PA 17011	800-237-2374
Circuit Works, Neptune City, NJ 07753	908-774-1811
Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
† Diversified Systems, Inc., Indianapolis, IN 46268	317-299-9547
† Electrohome Limited, Kitchener, Ontario, CANADA N2G 4J6	519-744-7111
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617 267 8600
Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
GlobTek, Inc., Northvale, NJ 07647	201-784-1000
W.L. Gore & Assocs., Newark, DE 19714	302-738-4880
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
IDM (International Design Modeling), Bedford, NH 03110	603-472-7068
§† Injectorall Electronics (Woman Owned), Bohemia, NY 11716	516-563-3388
† Logic Technology, Inc., Mtn. View, CA 94043	415-967-1007
Master Circuits Inc., Kokomo, IN 46901	317-457-6605
† Metro Circuits, PJC Technologies, Inc., Rochester, NY 14613	716-254-2980
Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762	508-695-2000
† North Texas Circuit Board, Grand Prairie, TX 75050	214-790-7610
† Parlex Corporation, Methuen, MA 01844	508-685-4341
P.C. Boards, Inc., Chanute, KS 66720	316-431-0406
PCI Ltd., San Jose, CA 95128	408-282-0200
† Precision Graphics Inc., Raritan, NJ 08869	908-707-8880
† Precision Prototypes, Inc., Garfield, NJ 07026	201-546-6737
† QMS Circuits, Inc., QMS, Ft. Walton Bch., FL 32548	904-244-6191
§ Regulus Systems, Nevada City, CA 95959	415-593-4197
† Rogers Corporation, Flexible Interconnections Div., Chandler, AZ 85244	602-963-4584
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081	201-379-7778
† Sheldahl, Inc., Northfield, MN 55057	507-663-8000
Shipley Company, Inc., Newton, MA 02162	617-969-5500
† Solaoyne Division, Rogers Corporation, San Diego, CA 92111	619 279-7872
† Speedy Circuits, PJC Technologies, Inc., Huntington Bch., CA 92649	714-898-4901
Tadiran Electronic Industries, Inc., Port Washington, NY 11050	516-621-4980
† Teradyne Connection Sys., Teradyne, Inc., Nashua, NH 03060	603-889-5156
Unitrack Industries, Inc., Milford, DE 19963	302-424-5050
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Vern Kiebler Electronics, Inc., Wheaton, IL 60187	708-668-5407

Printers, Bar Code Label-2000 – ***See Vol. D***

Printers, Daisywheel-2000 – ***See Vol. D***

Printers, Digital-2000 – ***See Vol. D***

Printers, Dot Matrix Impact-2000 – ***See Vol. D***

Printers, Event-3000 – ***See Vol. D***

Printers, Ink Jet/Bubble-2000 – ***See Vol. D***

Printers, Laser-2000 – ***See Vol. D***

Printers, Line – See Printers, Digital (Vol. D)

Printers, Page-2000 – ***See Vol. D***

Printers, Screen, Stencil-4100 – ***See Vol. D***

Printers, Solder, Paste, Surface Mount-4100 – ***See Vol. D***

Printers, Thermal-2000 – ***See Vol. D***

Printing, Dry Transfer – See Kits, Marking (Vol. C)

Probe Cards, Semiconductor Testing-4100 – ***See Vol. D***

Probes, Hall-4800 – ***See Vol. A***

Probes, High Voltage (1,000 Volts & Over)-2900 – ***See Vol. D***

Probes, IC-2900 – ***See Vol. D***

Probes, Logic Test-2900 – ***See Vol. D***

Probes, Microwave-3450 – ***See Vol. A***

Probes, Oscilloscopes-2975 – ***See Vol. D***

Probes, RF-2900 – ***See Vol. D***

Probes, Temperature-2900 – ***See Vol. D***

Probes, Test Lead-2900 – ***See Vol. D***

Process Control Systems-2200 – ***See Vol. D***

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Processors, Communications, Front End-1900 – ***See Vol. D***

Processors, Communications, Message Switching-1900 – ***See Vol. D***

Processors, Communications, Network Node-1900 – ***See Vol. D***

Processors, Communications, Standalone-1900 – ***See Vol. D***

Processors, Display-2000 – ***See Vol. D***

Processors, Image-2000 – ***See Vol. D***

Processors, Video Signal-1900 – ***See Vol. D***

Production Equipment, Extenders – See Extender Boards (Vol. D)

Program Board Connectors – See Connectors, Plug-in, Program Board (Vol. C)

Programmers, Cam & Drum-2200 – ***See Vol. D***

Programmers, Matrix Boards – See Boards, Programming (Vol. C)

Programmers, Power-2200 – ***See Vol. D***

Programmers, Power Supply-4000 – ***See Vol. D***

Programmers, PROM & Logic Array-3130 – ***See Vol. A***

PROM Programmers – See Programmers, PROM & Logic Array (Vol. A)

Protectors, Brownout-4300

† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	**D•2253-2254**
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	**D•2259**
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525	**D•2267**
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170	**B•1379**
Abacus Controls Inc., Somerville, NJ 08876	908-526-6010
Active Control Instrumentation, Key Largo, FL 33037	305-451-1000
Albar, Inc., Lynnwood, WA 98036	206-771-4006;800-822-5227
§† Brooks Power Systems, Bensalem, PA 19020	215-244-0264;1-800-523-1551
§ Control Cable, Inc., Baltimore, MD 21244	410-298-4411
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627	714-557-1636
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
§ GlobTek, Inc., Northvale, NJ 07647	201-784-1000
Hipotronics Inc., Brewster, NY 10509	914-279-8091
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7	604-421-8733
† Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
§ Perma Power Elctrns., Niles, IL 60714	312-763-0763
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400

§SL Waber, Inc., Mt. Laurel, NJ 08054	609-866-8888;800-257-8384
§Sola, Elk Grove Village, IL 60007-5666	708-439-2800
§SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§† Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220

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Protocol Converters-1900 — ***See Vol. D***

Prototype Boards, Extenders — See Extender Boards (Vol. D)

Prototyping Equipment, Circuit Board-4200 — ***See Vol. C***

Proximity Transducers — See Current Sensors (Vol. D), Transducers, Volt, etc. (Vol. B)

Public Address Systems-1300 — ***See Vol. D***

Pullers, Circuit Board-5400 — ***See Vol. C***

Pullers, Tube-5400 — ***See Vol. C***

Pulleys-2500 — ***See Vol. C***

Pulsers, Diode — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. D)

Pulsers, Logic Test-2900 — ***See Vol. D***

Pumps, Vacuum-4100 — ***See Vol. D***

Punches, Chassis-5400 — ***See Vol. C***

Pyrometers, Infrared-2900 — ***See Vol. D***

Pyrometers, Optical, Noninfrared-5300

Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1363**
† Aerospace Products Div, A Subsidiary of Ametek, Inc., Wilmington, MA 01887	508-988-4947
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
Beede Electrical Instrument Co., Inc., Penacook, NH 03303	603-753-6362
§Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Control Components & Systems, Inc., Pittsburgh, PA 15235	412-371-1111
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§Epic, Inc., New York, NY 10038	212-349-2470
Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
J-B-T Instruments, Inc., New Haven, CT 06508-1818	203-776-1111
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§Syscon Intl., Inc., So. Bend, IN 46601-3796	219-232-3900
Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476	707-938-2121

Pyrometers, Recording-2900 — ***See Vol. D***

Q Bus Cards — See Board Computers & Subassemblies (Vol. D)

Quartz, Fused-2300 — ***See Vol. A***

Quartz, Raw — See Crystals, Quartz (Vol. A)

Racks, Aging — See Ovens, Aging, Burn-in, Life Test (Vol. D)

Racks, Cabinet — See Enclosures, Equipment & Panel Mounting (Vol. C)

Racks, Circuit Board — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Racks, Desk & Console — See Enclosures, Equipment & Panel Mounting (Vol. C)

Racks, Module — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Racks, Relay & Mounting — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Radar Systems (MIL)-2440

† AEROCOM, Miami, FL 33133	305-448-6503
Alpha Industries, Inc., Woburn, MA 01801	617-935-5150
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925	516-921-7300
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
† Electronic Space Systems Corp., Concord, MA 01742	508-369-7200
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
† ITT Gilfillan, ITT Defense Inc., Van Nuys, CA 91409	818-988-2600
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
TIW Systems, Inc., Sunnyvale, CA 94089	408-734-3900

Radar System Components-3450 — ***See Vol. A***

Radio Communications Systems — See Communications Systems (Vol. D)

Radiographic Equip. — See X-ray Inspection Equip. (Vol. D)

Radiometers-2900 — ***See Vol. D***

Radomes & Windows, Microwave-3450 — ***See Vol. A***

Reactors, Charging-5600 — ***See Vol. A***

Reactors, Epitaxial — See Machines & Accessories, Semiconductor Manufacturing (Vol. D)

Reactors, Filter-5600 — ***See Vol. A***

Reactors (MIL)-2440

Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525	**A•2361**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300	**A•2437, D•1851**
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314	**A•2594**
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716	516-244-7393
† Del Electronics Corp., Valhalla, NY 10595	914-686-3600
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037	213-234-9091
† Haueg Division, A Subsidiary of Ametek Inc., Wilmington, DE 19808	302-995-0400; 800-441-7777
† KIP Transformers Inc., Wolcott, CT 06716	203-758-7085
§† Microtran Co. Inc., Valley Stream, NY 11582-0236	516-561-6050
† MTE Corp., Menomonee Falls, WI 53051	414-253-8200
† Standard Magnetic Corp., Garden Grove, CA 92641	714-379-5671
† Wirebenders, Inc., Phoenix, AZ 85021-2824	602-861-1856

Readers, Badge-2000 — ***See Vol. D***

Readers, Bar Code-2000 — ***See Vol. D***

Readers, Character-2000 — ***See Vol. D***

Readers, Magnetic Card-2000 — ***See Vol. D***

Readers, Magnetic Stripe Card-2000 — ***See Vol. D***

Readers, Punched Card-2000 — ***See Vol. D***

Readers, Punched Tape-2000 — ***See Vol. D***

Readers, Static Card-2000 — ***See Vol. D***

Readers, Time Code-2000 — ***See Vol. D***

Readouts — See Tubes, Readout (Vol. A)

Reamers-5400 — ***See Vol. C***

Receivers, AM/FM (Incl. Precision Test)-2900 — ***See Vol. D***

Receivers, Communication-1900 — ***See Vol. D***

Receivers, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1208, C•1163**
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1218**
† Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1223-1224,1226-1227**
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621	**B•1228, D•1319**
§S.I. Tech, Batavia, IL 60510, 708-232-8640	**B•1229**
#Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
† Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
CATEL Telecommunications, Fremont, CA 94537	510-659-8988
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§Codenoll Technology Corp., Yonkers, NY 10701	914-965-6300
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Dymec Inc., Winchester, MA 01890	617-729-7870
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
§EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6	613-226-4000
§† Force, Inc., Christiansburg, VA 24073	703-382-0462
H & L Instruments, Burlingame, CA 94010	415-342-7850
§Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Honeywell Microswitch Div., Richardson, TX 75081	214-470-4271
Interoptics, Purdy Group, Burlingame, CA 94010	415-347-7727
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820	908-549-9001
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014	413-592-9123
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701	516-226-8950
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
§NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900

§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
† Ortel Corp., Alhambra, CA 91803	818-281-3636
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§† Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Receivers, Field Intensity, Microwave — See Receivers, Microwave (Vol. D)

Receivers, Fixed Frequency-2900 — *See Vol. D*

Receivers, Frequency Shift-1900 — *See Vol. D*

Receivers, Global Positioning Satellite (GPS)-1900 — *See Vol. D*

Receivers, Headphone — See Handsets, etc. (Vol. D)

Receivers, Laser-1900 — *See Vol. D*

Receivers, Loran & Omega-1900 — *See Vol. D*

Receivers, Microwave-3450 — *See Vol. A*

Receivers, Monitoring, Communications-1900 — *See Vol. D*

Receivers, NBS-2900 — *See Vol. D*

Receivers, Telemetry-1900 — *See Vol. D*

Receivers, Tone-1900 — *See Vol. D*

Receivers, TV — See Monitors, Video (Vol. D)

Receivers (MIL)-2440

† Datum Timing, Datum Inc., Anaheim, CA 92806-5790, 714-533-6333	**D•1186,1188**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915	508-927-8220
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291

Receivers (MIL), Elint-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
MACOM, Inc., Lowell, MA 01851	617-272-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receivers (MIL), ESM-2440

† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receivers (MIL), Fiber Optic-2440

§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001	**B•1213,1215**
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200

Receivers (MIL), Radio-2440

ARS Inc., Orlando, FL 32809	1-800-950-5633
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† Gorman-Redlich Mfg. Co., Athens, OH 45701	614-593-3150
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
§ Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226	317-545-4281
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receivers (MIL), Surveillance-2440

† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† LNR Communications, Inc., Hauppauge, NY 11788	516-273-7111
MACOM, Inc., Lowell, MA 01851	617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
† NAVAN Corporation, Media, PA 19063	215-352-8464
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729	516-242-1100
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Stanford Telecommunications, Inc., Santa Clara, CA 95056	408-748-1010
Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Receptacles — See Connectors (Vol. C), Jacks (Vol.), Sockets

Receptacles, Power — See Sockets, Power (Vol. C)

Recognition & Response Equipment, Speech-2000 — *See Vol. D*

Recorders, Cartridge, Bubble Memory-2000 — *See Vol. D*

Recorders, Cassette, Data-4000 — *See Vol. D*

Recorders, Computer Data-2000 — *See Vol. D*

Recorders, Electrostatic-3000 — *See Vol. D*

Recorders, Event/Multievent-3000 — *See Vol. D*

Recorders, FM — See Recorders, Magnetic Tape (Vol. D)

Recorders, Graphic-2900 — *See Vol. D*

Recorders, Hard Disk-2000 — *See Vol. D*

Recorders, Magnetic Tape-2000 — *See Vol. D*

Recorders, Polar-3000 — *See Vol. D*

Recorders, Program Loading-2000 — *See Vol. D*

Recorders, Pyrometer — See Pyrometers, Recording (Vol. D)

Recorders, Sound Level-1300 — *See Vol. D*

Recorders, Strip Chart-3000 — *See Vol. D*

Recorders, Thermal Array-3000 — *See Vol. D*

Recorders, Vibration-3000 — *See Vol. D*

Recorders, Video-1900 — *See Vol. D*

Recorders, X-Y — See Plotters X-Y (Vol. D)

Recorders (MIL), Magnetic Tape-2440

† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811
† Pacer Systems, Inc., Billercia, MA 01821	508-667-8800
Penny & Giles Data Systems, Inc., Roswell, GA 30076	404-740-0415
Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
† Reproduction Technologies Inc., Bristol, IN 46507-0790	219-848-5233
†# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234	310-921-7775

Recorders (MIL), RHAW-2440

† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
† Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811

Recording Systems (MIL)-2440

† Rustrak Instruments, Mark IV Industries, E. Greenwich, RI 02818, 401-884-6800;800-332-3202	**D•1416**
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33410	407-622-3715
† Astro-Med, Inc., W. Warwick, RI 02893	401-828-4000
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§Φ Electronic Tele-Communications, Inc., Atlanta, GA 30340-2178	404-457-5600
Gulton Graphic Instruments Div., A Mark IV Company, E. Greenwich, RI 02818	800-343-7929;401-884-6800
† Image Graphics, Inc., Shelton, CT 06484	203-926-0100
† Loral Data Systems, Data Recorders, Sarasota, FL 34230	813-371-0811
† Pacer Systems, Inc., Billercia, MA 01821	508-667-8800

Phi Technologies, Inc., Oklahoma City, OK 73105	405-521-9000
† Reproduction Technologies Inc., Bristol, IN 46507-0790	219-848-5233
§† Saylor Electronics Int'l, Inc., Carson City, NV 89706	702-883-4184
†# Sekai Electronics of America, Inc., Santa Fe Springs, CA 90670-5234	310-921-7775
Φ Western Graphtec, Inc., Irvine, CA 92718-2067	714-770-6010;800-854-8385

Rectifiers, Bridges & Assemblies-4800 — *See Vol. A*

Rectifiers, Copper Oxide-4800 — *See Vol. A*

Rectifiers, Electron Tube — See Tubes, Rectifying (Vol. A)

Rectifiers, General Purpose, Surface Mount-4800 — *See Vol. A*

Rectifiers, Germanium-4800 — *See Vol. A*

Rectifiers, Schottky, Surface Mount-4800 — *See Vol. A*

Rectifiers, Selenium-4800 — *See Vol. A*

Rectifiers, Silicon-4800 — *See Vol. A*

Rectifiers, Silicon Controlled — See Thyristors (Vol. A)

Rectifiers, Surface Mount-4800 — *See Vol. A*

Rectifiers, Ultrafast-4800 — *See Vol. A*

Rectifiers (MIL), Semiconductor-2440

§† **BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392**	**A•2132**
§ **Semtech Corporation, Newbury Park, CA 91320, 805-498-2111**	**A•2180**
Edal Industries, East Haven, CT 06512	203-467-2591
§† International Rectifier Corp., El Segundo, CA 90245	310-322-3331
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805	714-956-9200
§† Microsemi Corp., Santa Ana, CA 92799-6890	714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390	602-941-6300
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
† NWL Transformers, Bordentown, NJ 08505	609-298-7300
§ Sanyo Semiconductor Corp., Allendale, NJ 07401	201-825-8080
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729	516-586-7600
† Voltage Multipliers, Inc., Visalia, CA 93291	209-651-1402

Reducers, Speed — See Gear Heads & Speed Reducers (Vol. B)

Reels, Tape — See Tape Recording Accessories (Vol. D)

Reference Books — See Technical Books (Vol. D)

References, DC Voltage-2900 — *See Vol. D*

Refrigerants, Spray-1600 — *See Vol. C*

Refrigerated Cooling Equipment — See Air Conditioners (Vol. C)

Refrigerators, Environmental Test-2550 — *See Vol. D*

Regulators, Current-4000 — *See Vol. D*

Regulators, Frequency-4050 — *See Vol. D*

Regulators & References, Silicon-Also See Diodes, Zener & Stabistors-4800 — *See Vol. A*

Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 — *See Vol. D*

Regulators, Pulse Width-3130 — *See Vol. A*

Regulators, Voltage, Surface Mount-4800 — *See Vol. A*

Relays, Antenna — See Relays, RF (Incl. Antenna & Coaxial) (Vol. B)

Relays, Audio Operated — See Relays, Frequency Selective (Vol. B)

Relays, Coaxial — See Relays, RF (Vol. B)

Relays, Contact — See Relays, Power (Vol. B)

Relays, Cradle-4500

§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1418**
§ Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
§ Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
§ American Zettler, Aliso Viejo, CA 92656	714-831-5000
§ Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001	812-386-1000
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330

Relays, Crystal Can, 1/2 Crystal Can-4500

§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711**	**B•1438-1441**
† **Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000**	**B•1484**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471**	**B•1010-1011,1500-1501**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606,1610-1611**
† Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
† Babcock, Inc., Orange, CA 92667	714-633-3700
Brill Electronics, Los Angeles, CA 90025	310-452-8002
† Computer Components, Inc., East Granby, CT 06026	203-653-9909
§† Leach Corporation, Buena Pk., CA 90622-5032	714-739-0770
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
National Manufacturing Co., Inc., Chatham, NJ 07928	201-635-8846
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Wall, A. T., Co., Warwick, RI 02886	401-739-0740

Relays, Current Sensing-4500

† **American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100**	**B•1914-1915**
§ **American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447**	**B•1407-1411**
§ **American Zettler, Aliso Viejo, CA 92656, 714-831-5000**	**B•1412-1415**
Amperite Co., Inc., Union City, NJ 07087, 201-864-9503	**B•1417**
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1418-1420,1431**
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700**	**B•1436**
§ **Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564**	**B•1450**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907; 401-943-2686**	**B•1451**
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309, B•1455,1927**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1456**
Electronic Applications Co., El Monte, CA 91734, 818-442-3212	**B•1483**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1486**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471**	**B•1011,1500-1502**
Gentron Corporation, Scottsdale, AZ 85260, 602-443-1288	**B•1505**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060	**B•1403**
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000**	**B•1513**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514**
§† **Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800, 609-896-0009**	**B•1360-1363**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770**	**B•1548,1554**
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	**B•1556**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1577,1579**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606**
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529	**B•1625**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§ American Electronic Components, Elkhart, IN 46514	219-264-1116
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
† Babcock, Inc., Orange, CA 92667	714-633-3700
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Computer Components, Inc., East Granby, CT 06026	203-653-9909
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551	414-648-3000
Electronic Innovations Corp. (E.I.C.), Lakewood, CO 80227	303-987-2441
§ Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235	614-889-6152
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§† Gunther, W., GmbH, D 8500 Nurnberg 82 GERMANY	(0)911/65521 or 65520
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551	414-648-3000
† INRESCO, Inc., Manasquan, NJ 08736	908-223-6330
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101	708-543-6200
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
† Joslyn Jennings Corporation, San Jose, CA 95122-2696	408-292-4025
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
Liberty Controls, Shorewood, IL 60435	815-725-2241
§† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
§ Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ R-K Electronics, Cincinnati, OH 45249	513-489-4060
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161	414-421-4380;1-800-803-0444
Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330
§† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831	510-471-9717;800-221-7060

§ Square D Co., Palatine, IL 60067	708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
Wieland Inc., Burgaw, NC 28425	919-259-5050
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Relays, Differential-4500

§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700**	**B•1436**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514**
§ **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§† Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Computer Components, Inc., East Granby, CT 06026	203-653-9909
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
Fifth Dimension, Inc., Trenton, NJ 08638	609-393-8350
Genicom Corp., Waynesboro, VA 22980	703-949-1471
§ Larson-Metercraft, El Cajon, CA 92020	619-258-8990
Leach Corporation, Buena Pk., CA 90622-5032	714-739-0770
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Relays, Frequency Selective-4500

† **Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000**	**B•1484**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301	**B•1562,1564**
§† Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ Coto Wabash, A Kearney National Company, Providence, RI 02907	401-943-2686
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
Electronic Applications Co., El Monte, CA 91734	818-442-3212
§† Leach Corporation, Buena Pk., CA 90622-5032	714-739-0770
§† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Metermaster, Tempe, AZ 85282	602-431-0015
MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
§ R-K Electronics, Cincinnati, OH 45249	513-489-4060
Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
† Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Relays, General Purpose-4500

§ **American Electronic Components, Elkhart, IN 46514, 219-264-1116**	**B•1711**
§ **American Zettler, Aliso Viejo, CA 92656, 714-831-5000**	**B•1412-1414**
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1418,1421,1426-1427**
§ **Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5301**	**B•1435**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711**	**B•1438-1447**
§ **Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564**	**B•1450**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686**	**B•1451**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1456**
Crydom Company, Long Beach, CA 90805, 310-865-3536	**B•1466**
§ **Deltrol Controls, Milwaukee, WI 53215, 414-671-6800**	**B•1480-1481**
Electronic Applications Co., El Monte, CA 91734, 818-442-3212	**B•1483**
† **Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000**	**B•1484-1485**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1486**
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000	**B•1490-1498**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471**	**B•1011,1500,1502-1503**
§ **GlobTek, Inc., Northvale, NJ 07647, 201-784-1000**	**C•1340**
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1458-1459,1463**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1507**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060	**B•1403**
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000**	**B•1513**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1522-1523**
International Rectifier Corp., El Segundo, CA 90245, 310-322-3331	**B•1526**
§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001**	**B•1527-1529,1531-1535**
Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025	**B•1536**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770**	**B•1548**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336	**B•1558-1560**
§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782**	**B•1566,1568**
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089	**A•2149**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1577-1581**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244**	**B•1602-1604**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606-1607**
§ **T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227**	**B•1814**
§† **Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077**	**B•1616,1618-1620,1622**
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529	**B•1625**
ACC Relays, Echlin Inc., Independence, KS 67301-0778	316-331-1000
§ Action Instruments, San Diego, CA 92123	619-279-5726
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
† Babcock, Inc., Orange, CA 92667	714-633-3700
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5	306-975-1080
§ Brentek International, Inc., York, PA 17406	717-755-8000
Brill Electronics, Los Angeles, CA 90025	310-452-8002
§ Amerace Electronic Components, Punta Gorda, FL 33950	813-575-8400
Cardinal Control Co., Kensington, CT 06037	203-828-6379
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470	201-694-8600
Deutsch Relays, Inc., East Northport, NY 11731	516-499-6000
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
Eichhoff Electronics, Warwick, RI 02886	401-738-1440;800-678-1040
§ Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ ERNI Components, Richmond, VA 23236	804-794-6367
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135	408-922-9000
§ Furnas Elec., Batavia, IL 60510	708-879-6000
Gentron Corporation, Scottsdale, AZ 85260	602-443-1288
§ Global Components & Controls, Wanamassa, NJ 07712-4010	908-389-1470
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Hold-Heet Products Corp., Chicago, IL 60640	312-728-4454;312-728-4455
§ Inmark Corp., Norwalk, CT 06850	203-866-8474
International Microelectronics, Arlington, TX 76003	817-473-1730
§ ISKRA Electronics, Inc., Plainview, NY 11803	516-349-0222
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
§† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
§ Nedco Electronics, Inc., Morton Grove, IL 60053	708-967-0500
§ Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
Opto 22, Temecula, CA 92590	714-695-9299
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846	908-271-5770
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Relay Service Co., Chicago, IL 60651	312-252-2700
† Relay Specialties, Oakland, NJ 07436	201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
Sandman Electric Co., Inc., Braintree, MA 02184	617-848-2111
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788	516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Square D Co., Palatine, IL 60067	708-397-2600
Stetron International, Inc., Buffalo, NY 14203	716-854-3443
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Tane Alarm Products, Floral Park, NY 11001	516-328-3351
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
V R Industries, Inc., Warwick, RI 02886	401-732-6800

Relays, High Voltage (500 Volts & Over)-4500

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1405**
§ **American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447**	**B•1407-1408,1411**
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550	**B•1419-1420,1424,1434**
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700	**B•1436**
§ **Comus International, Nutley, NJ 07110, 201-667-6200;1-800-35-COMUS**	**B•1449**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686**	**B•1451-1453**

§ **Crydom Company, Long Beach, CA 90805, 310-865-3536**	**B•1464,1466**
Deltrol Controls, Milwaukee, WI 53215, 414-671-6800	**B•1480**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075	**B•1475,1478**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1487**
Gentron Corporation, Scottsdale, AZ 85260, 602-443-1288	**B•1504-1505**
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1462-1463**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060	**B•1403**
Hamlin Inc., Lake Mills, WI 53551, 414-648-3000	**B•1513**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514,1520**
International Rectifier Corp., El Segundo, CA 90245, 310-322-3331	**B•1526**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**B•1536-1537**
† **Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560**	**B•1540-1545**
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1567-1569**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1592-1594**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606,1608**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
American Electronic Components, Elkhart, IN 46514	219-264-1116
Brill Electronics, Los Angeles, CA 90025	310-452-8002
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Computer Components, Inc., East Granby, CT 06026	203-653-9909
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
Electronic Applications Co., El Monte, CA 91734	818-442-3212
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188	617-335-5200
GlobTek, Inc., Northvale, NJ 07647	201-784-1000
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001	812-386-1000
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
§ Square D Co., Palatine, IL 60067	708-397-2600
Standex Electronics, Standex International, Cincinnati, OH 45209	513-871-3777
Trindge Corp., Pittsburgh, PA 15231	412-899-2288;800-537-3529
Universal Semiconductor Inc., San Jose, CA 95112	408-436-1906

Relays, Hybrid-4500

§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1428,1434**
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700	**B•1436**
Electronic Applications Co., El Monte, CA 91734, 818-442-3212	**B•1483**
Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000	**B•1485**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471**	**B•1010-1011,1500-1501**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1522-1523**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336	**B•1559**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606**
§† **Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077**	**B•1622**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
† Babcock, Inc., Orange, CA 92667	714-633-3700
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
Control Engrg., Inc., West Springfield, MA 01089	413-781-1330
§ Coto Wabash, A Kearney National Company, Providence, RI 02907	401-943-2686
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ ERNI Components, Richmond, VA 23236	804-794-6367
† Film Microelectronics Inc., Peabody, MA 01960	508-532-9913
Gentron Corporation, Scottsdale, AZ 85260	602-443-1288
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
† Kilovac Corp., Santa Barbara, CA 93140-4422	805-684-4560;App. Hot Line 800-253-4560
§† Leach Corporation, Buena Pk., CA 90622-5032	714-739-0770
† Logitek, Inc., Ronkonkoma, NY 11779	516-467-4200
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001	812-386-1000
Relay Service Co., Chicago, IL 60651	312-252-2700
Smart Relay Technology, Inc., Commack, NY 11725	516-543-7161
§ Square D Co., Palatine, IL 60067	708-397-2600
§ T-Bar Data Switch Corp., Orange, CT 06477	203-795-0739;800-726-8227
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248

Relays, Impulse – See Relays, Stepping (Vol. B)

Relays, I/O Modules – See Modules, I/O Relays (Vol. A)

Relays, Latching-4500

§ **American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447**	**B•1410**
§ **American Zettler, Aliso Viejo, CA 92656, 714-831-5000**	**B•1412-1414**
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1418,1420-1423,1426**
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700**	**B•1436**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711**	**B•1438-1439,1444,1446**
§ **Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564**	**B•1450**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686**	**B•1451**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1456**
§ **Deltrol Controls, Milwaukee, WI 53215, 414-671-6800**	**B•1480**
† **Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000**	**B•1484**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1486**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471**	**B•1010-1011,1500-1501**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060	**B•1403**
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000**	**B•1513**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514-1515**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1522-1523**
§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001**	**B•1528-1531,1533**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**B•1537-1538**
† **Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560**	**B•1540**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770**	**B•1547-1548,1550-1551**
Liberty Controls, Shorewood, IL 60435, 815-725-2241	**B•1645**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336	**B•1559**
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1566-1568**
§ **NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089**	**B•1572-1573**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1577,1582,1590**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1592-1594**
§ **T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227**	**B•1814**
§† **Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077**	**B•1616-1617,1619-1620**
§ Action Instruments, San Diego, CA 92123	619-279-5726
† Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
† Babcock, Inc., Orange, CA 92667	714-633-3700
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Computer Components, Inc., East Granby, CT 06026	203-653-9909
Control Engrg., Inc., West Springfield, MA 01089	413-781-1330
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470	201-694-8600
§† Deutsch Relays, Inc., East Northport, NY 11731	516-499-6000
§ Douglas Randall, Pawcatuck, CT 06379	203-599-2075
† Dow-Key Microwave Corporation, Ventura, CA 93003	805-650-0260
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
Eichhoff Electronics, Warwick, RI 02886	401-738-1440;800-678-1040
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551	414-648-3000
Electronic Applications Co., El Monte, CA 91734	818-442-3212
§ Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188	617-335-5200
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198	203-747-3000
§ Global Components & Controls, Wanamassa, NJ 07712-4010	908-389-1470
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551	414-648-3000
§ Inmark Corp., Norwalk, CT 06850	203-866-8474
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
§† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
Matrix Systems Corp., Calabasas, CA 91302	818-222-2301
Micronetics, Hudson, NH 03051	603-883-2900
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
† Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
Original Electric Mfg. Co., Inc., Middlesex, NJ 08846	908-271-5770
Relay Service Co., Chicago, IL 60651	312-252-2700
† Relay Specialties, Oakland, NJ 07436	201-337-1000
† Sage Laboratories, Inc., Natick, MA 01760	508-653-0844
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Square D Co., Palatine, IL 60067	708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
Standex Electronics, Standex International, Cincinnati, OH 45209	513-871-3777
Stetron International, Inc., Buffalo, NY 14203	716-854-3443
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500

§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Triridge Corp., Pittsburgh, PA 15231 .... 412-899-2288;800-537-3529
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580

Relays, Mercury-Wetted Contacts-4500

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1404
§ **American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711**
§ **American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447 .... B•1407-1408,1411**
§† **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1436-1437**
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1445
§ **Comus International, Nutley, NJ 07110, 201-667-6200;1-800-35-COMUS .... B•1449**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451,1453**
§ **EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 .... B•1482**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 .... B•1486-1487
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1462-1463**
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1513**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .. B•1558,1560
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1564
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1582**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1608**
† Babcock, Inc., Orange, CA 92667 714-633-3700
§† C.P. Clare Corp., Chicago, IL 60645 312-262-7700
† Computer Components, Inc., East Granby, CT 06026 203-653-9909
§ Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Graphics Microsystems, Inc., Dallas, TX 75225 .... 214-340-4584;800-527-1207
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000
Hasco Components International Co., Bellrose Village, NY 11001 516-328-9292
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Triridge Corp., Pittsburgh, PA 15231 .... 412-899-2288;800-537-3529

Relays, Meter-4500

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1386-1387
Laurel Electronics, Inc., Newport Beach, CA 92663, 714-646-6846 .. D•1355-1357
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .... B•1558
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... D•1360**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1364**
Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 .... D•1370
§ **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1606**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1386-1387
§ **Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1400**
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
§ Coto Wabash, A Kearney National Company, Providence, RI 02907 401-943-2686
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
§ E.I.L. Instruments, Inc., Hunt Valley, MD 21031-1320 410-584-7400
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
§† International Instruments, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§ International Microtronics, Tucson, AZ 85714 602-748-7900
§ LFE Instruments, Mark IV Industries, Inc., Clinton, MA 01510-3099 508-365-3400
§ Martel Electronics, Windham, NH 03087 603-893-0886
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260

Relays, Motor Start-4500

§ **American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711**
American Zettler, Aliso Viejo, CA 92656, 714-831-5000 .... B•1414
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1424-1428**
Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5301 .... B•1435
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1446
§ **Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 .... B•1450**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 .... B•1474-1475
Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 .... B•1485
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000 .... B•1495,1499
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1463**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060 .... B•1403
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1519
International Rectifier Corp., El Segundo, CA 90245, 310-322-3331 .... B•1526
§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .... B•1535**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .. B•1536**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1547-1549,1551**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .... B•1558
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1568
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 .... B•1575
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1580-1581,1584-1585,1590**
§ **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1606**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Flemington, NJ 08822-6000 908-806-9400
§ Arrow Hart Controls, Products Unlimited Corp., Sterling, IL 61081 815-626-0300
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
Brill Electronics, Los Angeles, CA 90025 310-452-8002
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§ Klockner Moeller, Franklin, MA 02038 508-520-7080
§ Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 908-271-5770
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ Stancor, White-Rodgers, Logansport, IN 46947 219-722-2244
Texas Instruments, Connector Systems, Attleboro, MA 02703 .... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800

Relays, Opto-isolated-4500

Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1429-1434
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 .... B•1474-1478, D•1155
Gentron Corporation, Scottsdale, AZ 85260, 602-443-1288 .... B•1504
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1458-1459**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1507**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1554-1555**
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 .... B•1574,1576
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .... B•1622-1623
Aleph International Corp., San Fernando, CA 91340 .... 818-365-9856;800-423-5622
Brill Electronics, Los Angeles, CA 90025 310-452-8002
Electronic Applications Co., El Monte, CA 91734 818-442-3212
§ Global Components & Controls, Wanamassa, NJ 07712-4010 908-389-1470
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 310-452-1336
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Smart Relay Technology, Inc., Commack, NY 11725 516-543-7161
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Universal Semiconductor Inc., San Jose, CA 95112 408-436-1906

Relays, Phase Sensing-4500

Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5301 .... B•1435
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 .... A•2309
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1551**
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 .... B•1556**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .. B•1558-1559
§† **Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060 .... B•1596**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1614**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Flemington, NJ 08822-6000 908-806-9400
§† Antex Electronics Corp., Gardena, CA 90248-2617 310-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Babcock, Inc., Orange, CA 92667 714-633-3700
Brill Electronics, Los Angeles, CA 90025 310-452-8002
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1

† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
† Electronic Specialty Corp., Vancouver, WA 98685	206-574-5000
§ Furnas Elec., Batavia, IL 60510	708-879-6000
Lark Electronics, Inc., New York, NY 10040	212-569-0430
§ Metermaster, Tempe, AZ 85282	602-431-0015
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ R-K Electronics, Cincinnati, OH 45249	513-489-4060
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161	414-421-4380;1-800-803-0444
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
† Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Relays, Plug-in-4500

§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1421-1428**
§ **Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5301**	**B•1435**
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700**	**B•1436**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711**	**B•1438-1441,1444,1447**
Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564	**B•1450**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1456**
§ **Deltrol Controls, Milwaukee, WI 53215, 414-671-6800**	**B•1480-1481**
Electronic Applications Co., El Monte, CA 91734, 818-442-3212	**B•1483**
† **Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000**	**B•1484**
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000	**B•1497-1498**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471**	**B•1010-1011,1500-1501**
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1459**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1507**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060	**B•1403**
Guardian Electronics, General Cable Corporation, Highland Heights, KY 41076, 606-572-8303	**B•1509-1511**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1522-1523**
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200	**B•1525**
§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001**	**B•1530,1535**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770**	**B•1551,1553**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336	**B•1558-1560**
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1568**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1577-1580,1583,1585,1587-1588**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244**	**B•1602-1604**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606-1607**
§ Action Instruments, San Diego, CA 92123	619-279-5726
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ American Zettler, Aliso Viejo, CA 92656	714-831-5000
§ Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
† Babcock, Inc., Orange, CA 92667	714-633-3700
§ Brentek International, Inc., York, PA 17406	717-755-8000
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Computer Components, Inc., East Granby, CT 06026	203-653-9909
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470	201-694-8600
§ Coto Wabash, A Kearney National Company, Providence, RI 02907	401-943-2686
§† Deutsch Relays, Inc., East Northport, NY 11731	516-499-6000
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551	414-648-3000
Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135	408-922-9000
§ Global Components & Controls, Wanamassa, NJ 07712-4010	908-389-1470
§ GlobTek, Inc., Northvale, NJ 07647	201-784-1000
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
Liberty Controls, Shorewood, IL 60435	815-725-2241
§† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
† Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
Opto 22, Temecula, CA 92590	714-695-9299
Original Electric Mfg. Co., Inc., Middlesex, NJ 08846	908-271-5770
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§† Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
§ V R Industries, Inc., Warwick, RI 02886	401-732-6800

Relays, Power-4500

§ **American Electronic Components, Elkhart, IN 46514, 219-264-1116**	**B•1711**
American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447	**B•1411**
§ **American Zettler, Aliso Viejo, CA 92656, 714-831-5000**	**B•1412-1415**
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1418-1428,1433**
§ **Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5301**	**B•1435**
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700**	**B•1436-1437**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711**	**B•1438-1441,1444-1446**
§ **Comus International, Nutley, NJ 07110, 201-667-6200;1-800-35-COMUS**	**B•1449**
§ **Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564**	**B•1450**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686**	**B•1451**
§ **Crydom Company, Long Beach, CA 90805, 310-865-3536**	**B•1464-1466**
§ **Deltrol Controls, Milwaukee, WI 53215, 414-671-6800**	**B•1480-1481**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075	**B•1473-1476**
Electronic Applications Co., El Monte, CA 91734, 818-442-3212	**B•1483**
Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000	**B•1485**
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000	**B•1495-1498**
§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471**	**B•1010-1011,1500-1503**
Gentron Corporation, Scottsdale, AZ 85260, 602-443-1288	**B•1504-1505**
§ **GlobTek, Inc., Northvale, NJ 07647, 201-784-1000**	**C•1340**
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1458-1459,1462**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1507**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060	**B•1403**
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000**	**B•1513**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1514-1515,1517-1520**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1522-1523**
International Rectifier Corp., El Segundo, CA 90245, 310-322-3331	**B•1526**
§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001**	**B•1528,1530,1534-1535**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**B•1536**
† **Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560**	**B•1540-1545**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770**	**B•1547,1549-1551,1555**
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200	**B•1556**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336	**B•1558-1560**
§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782**	**B•1568-1569**
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089	**A•2149**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1577-1585,1590**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1592-1594**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244**	**B•1602-1604**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606,1613**
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077	**B•1621-1623**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§† Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
Arrow Hart Controls, Products Unlimited Corp., Sterling, IL 61081	815-626-0300
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
† Babcock, Inc., Orange, CA 92667	714-633-3700
Brill Electronics, Los Angeles, CA 90025	310-452-8002
§ Amerace Electronic Components, Punta Gorda, FL 33950	813-575-8400
Cableform Inc., Troy, VA 22974	804-589-8224
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Compac, Holbrook, NY 11741	516-585-3400
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Cross Electronics, Warrendale, PA 15086	412-776-1591
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549	914-666-2971
§† Deutsch Relays, Inc., East Northport, NY 11731	516-499-6000
† Dow-Key Microwave Corporation, Ventura, CA 93003	805-650-0260
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300

§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
Eichhoff Electronics, Warwick, RI 02886 .... 401-738-1440;800-678-1040
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
§ ERNI Components, Richmond, VA 23236 804-794-6367
† Fasco Motors Group, Chesterfield, MO 63017 314-532-3505
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§ Opto 22, Temecula, CA 92590 714-695-9299
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 908-271-5770
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309 305-733-3330
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 .... 510-471-9717;800-221-7060
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
§† Teledyne Solid State, Hawthorne, CA 90250 213-777-0077
Wilmar Electronics, Inc., Torrance, CA 90505 310-326-6668

Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447 .... B•1407,1409-1410
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 .... B•1412-1415
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1418-1427,1429-1434
§ Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5301 .... B•1435
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1436
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1438-1441,1444,1447
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 .... B•1450
§ Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451-1453
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456
§ Crydom Company, Long Beach, CA 90805, 310-865-3536 .... B•1464-1471
Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 .... B•1484-1485
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 .... B•1486-1487
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000 .... B•1489-1499
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .... B•1011,1500-1502
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1459,1463
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1507
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060 .... B•1403
Guardian Electronics, General Cable Corporation, Highland Heights, KY 41076, 606-572-8303 .... B•1509-1511
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1513
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1514-1520
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1522-1523
International Rectifier Corp., El Segundo, CA 90245, 310-322-3331 .... B•1526
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1527-1535
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560 .... B•1541
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1553
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .. B•1558-1560
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .... B•1566-1568,1570
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ... B•1572-1573,1575
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1577-1580,1583-1584,1590
Solid State Optronics, San Jose, CA 95113-1201, 408-436-1390 .... B•1597-1601
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... B•1602-1604
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .... B•1616-1619,1621,1623
ACC Relays, Echlin Inc., Independence, KS 67301-0778 316-331-1000
§ Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Altech Corp., Flemington, NJ 08822-6000 908-806-9400
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
Antex Electronics Corp., Gardena, CA 90248-2617 310-532-3092
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
† Computer Components, Inc., East Granby, CT 06026 203-653-9909
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
Eichhoff Electronics, Warwick, RI 02886 .... 401-738-1440;800-678-1040
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
† Electro National Corp., Canton, MS 39046 601-859-5511
Electronic Applications Co., El Monte, CA 91734 818-442-3212
§ ERNI Components, Richmond, VA 23236 804-794-6367
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
§ Global Components & Controls, Wanamassa, NJ 07712-4010 908-389-1470
§ GlobTek, Inc., Northvale, NJ 07647 201-784-1000
§ Graphics Microsystems, Inc., Dallas, TX 75225 .... 214-340-4584;800-527-1207
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000
Hold-Heet Products Corp., Chicago, IL 60640 .... 312-728-4454;312-728-4455
§ Inmark Corp., Norwalk, CT 06850 203-866-8474
† INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
§ MORS Components, Wakefield, MA 01880-4444 617-246-1007
§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§ Opto 22, Temecula, CA 92590 714-695-9299
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 908-271-5770
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309 305-733-3330
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Solid State Relays, Oak Brook, IL 60521 708-932-1660
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
§† Teledyne Solid State, Hawthorne, CA 90250 213-777-0077
Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06708 203-757-4200
Triridge Corp., Pittsburgh, PA 15231 .... 412-899-2288;800-537-3529

Relays, Programmable-4500

Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ... B•1448
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .... B•1558
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1562
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 .... B•1574-1575
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1577-1578,1587
Solid State Optronics, San Jose, CA 95113-1201, 408-436-1390 .... B•1597-1601
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1606,1614
Altech Corp., Flemington, NJ 08822-6000 908-806-9400
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
CYTEC Corp., Penfield, NY 14526 .... 716-381-4740;800-346-3117
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
§ Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-747-3000
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Relays, RF (Incl. Antenna & Coaxial)-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447 .... B•1409
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1420-1421
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1436
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1438-1441,1444
§ Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451
† Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 .... B•1484
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 .... B•1486
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1010-1011,1500-1502

§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .... B•1531**

† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .... B•1536-1538**

† **Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560 .... B•1540-1541,1543**

NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1566

§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1611**

§† **Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .... B•1616-1617,1619**

Aleph International Corp., San Fernando, CA 91340 .... 818-365-9856;800-423-5622

# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808

Brill Electronics, Los Angeles, CA 90025 310-452-8002

§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700

Colorado Data Systems, Tektronix, Englewood, CO 80110 .... 303-762-1640; 800-237-2831

Compac, Holbrook, NY 11741 516-585-3400

† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143

§† Dow-Key Microwave Corporation, Ventura, CA 93003 805-650-0260

§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000

Electronic Applications Co., El Monte, CA 91734 818-442-3212

§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311

§ Graphics Microsystems, Inc., Dallas, TX 75225 .... 214-340-4584;800-527-1207

§† Gunther, W., GmbH, D 8500 Numberg 82, GERMANY .... (0)911/65521 or 65520

Hasco Components International Co., Bellrose Village, NY 11001 516-328-9292

† INRESCO, Inc., Manasquan, NJ 08736 908-223-6330

§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800

MarLee Switch Co., Upland, CA 91786 714-982-8988

Master Electronic Controls, Los Angeles, CA 90025 310-452-1336

Matrix Systems Corp., Calabasas, CA 91302 818-222-2301

Micronetics, Hudson, NH 03051 603-883-2900

Mouser Electronics, Santee, CA 92071 800-346-6873

Mouser Electronics, Mansfield, TX 76063 800-346-6873

Mouser Electronics, Gilroy, CA 95020 800-346-6873

§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766

† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334

Ross Engineering Corp., Campbell, CA 95008 408-377-4621

† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844

Signal Switch Company, Corona, CA 91720 909-736-5404

† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248

† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06708 203-757-4200

† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007

Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831

Relays, Reed-4500

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1404-1405

§ **American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447 .... B•1407-1408,1410-1411**

§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1419-1420,1422**

§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1436-1437**

§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451-1453**

§ **El & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 .... B•1482**

Electronic Applications Co., El Monte, CA 91734, 818-442-3212 .... B•1483

§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1462-1463**

§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1513**

Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1516

Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .... B•1560

Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1562

§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1570**

NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ... B•1572-1573,1575

§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1590**

§ **Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 .... B•1605**

Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 .... B•1625

§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478 716-265-1600

† Babcock, Inc., Orange, CA 92667 714-633-3700

§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400

Brill Electronics, Los Angeles, CA 90025 310-452-8002

§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700

† Computer Components, Inc., East Granby, CT 06026 203-653-9909

§ Continental Device India Limited, New Delhi, INDIA 110028 .... 536150-53 (4 lines)

Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111

§ Douglas Randall, Pawcatuck, CT 06379 203-599-2075

§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000

† Electro National Corp., Canton, MS 39046 601-859-5511

§ ERNI Components, Richmond, VA 23236 804-794-6367

Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350

Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000

§ Graphics Microsystems, Inc., Dallas, TX 75225 .... 214-340-4584;800-527-1207

§ GTE Supply, GTE, Irving, TX 75038 800-433-4837

§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520

§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000

† INRESCO, Inc., Manasquan, NJ 08736 908-223-6330

International Microelectronics, Arlington, TX 76003 817-473-1730

† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025

† Kilovac Corp., Santa Barbara, CA 93140-4422 .... 805-684-4560;App. Hot Line 800-253-4560

§† Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800

§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1

§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711

Mouser Electronics, Santee, CA 92071 800-346-6873

Mouser Electronics, Mansfield, TX 76063 800-346-6873

Mouser Electronics, Gilroy, CA 95020 800-346-6873

§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421

§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 908-271-5770

§ Relay Specialties, Oakland, NJ 07436 201-337-1000

Schrack Components, Inc., Ft. Lauderdale, FL 33309 305-733-3330

Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257

§ Solid State Relays, Oak Brook, IL 60521 708-932-1660

§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500

Tane Alarm Products, Floral Park, NY 11001 516-328-3351

† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06708 203-757-4200

Relays, Reed, Surface Mount-4500

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1404-1405

§ **American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447 .... B•1407-1408,1410-1411**

§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451**

El & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 .... B•1482

Electronic Applications Co., El Monte, CA 91734, 818-442-3212 .... B•1483

§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1463**

§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1513**

Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1516

§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1522-1523**

Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 .... B•1605

Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550

§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400

Brill Electronics, Los Angeles, CA 90025 310-452-8002

† Computer Components, Inc., East Granby, CT 06026 203-653-9909

§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000

§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000

§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000

International Microelectronics, Arlington, TX 76003 817-473-1730

Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800

Master Electronic Controls, Los Angeles, CA 90025 310-452-1336

Mouser Electronics, Santee, CA 92071 800-346-6873

Mouser Electronics, Mansfield, TX 76063 800-346-6873

Mouser Electronics, Gilroy, CA 95020 800-346-6873

Schrack Components, Inc., Ft. Lauderdale, FL 33309 305-733-3330

§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

Relays, Sealed(Hermetic)-4500

American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711

§ **American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447 .. B•1407-1411**

§ **American Zettler, Aliso Viejo, CA 92656, 714-831-5000 .... B•1412-1415**

Amperite Co., Inc., Union City, NJ 07087, 201-864-9503 .... B•1417

§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1418-1425,1427**

Bosch, Robert, Corp., Broadview, IL 60153, 708-865-5301 .... B•1435

§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1436-1437**

§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1438-1441,1444-1447**

§ **Comus International, Nutley, NJ 07110, 201-667-6200;1-800-35-COMUS .... B•1449**

§ **Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 .... B•1450**

§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686 .... B•1451**

§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456**

Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 .... B•1480-1481

Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 .... B•1474-1476

Electronic Applications Co., El Monte, CA 91734, 818-442-3212 .... B•1483

† **Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 .... B•1484**

Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 .... B•1486-1487

Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000 .... B•1490-1495,1497,1499

§† **Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .... B•1011,1500-1502**

Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1507

Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060 .... B•1403

Guardian Electronics, General Cable Corporation, Highland Heights, KY 41076, 606-572-8303 .... B•1509-1511

§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1513**

Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1514-1517,1519-1520

IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1522-1523

§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .... B•1527-1528,1535
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .... B•1537
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560 .... B•1540-1543
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1549,1551
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .... B•1559-1561
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .... B•1566-1570
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 .... B•1572-1573
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1577-1578,1580-1583
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060 .... B•1596
Solid State Optronics, San Jose, CA 95113-1201, 408-436-1390 .... B•1597-1601
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1606-1607,1609-1611
§ T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227 .... B•1814
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .... B•1616-1617,1619-1620,1622-1623
Triridge Corp., Pittsburgh, PA 15231, 412-899-2288;800-537-3529 .... B•1625
ACC Relays, Echlin Inc., Independence, KS 67301-0778 316-331-1000
† Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Brentek International, Inc., York, PA 17406 717-755-8000
Brill Electronics, Los Angeles, CA 90025 310-452-8002
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
† Computer Components, Inc., East Granby, CT 06026 203-653-9909
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
Eichhoff Electronics, Warwick, RI 02886 .... 401-738-1440;800-678-1040
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
§ Global Components & Controls, Wanamassa, NJ 07712-4010 908-389-1470
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506 .... 214-250-1647;1-800-677-5311
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000
§ Inmark Corp., Norwalk, CT 06850 203-866-8474
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
§† Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 908-271-5770
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309 305-733-3330
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
Thermosen, Inc., Allied Controls, Inc., Waterbury, CT 06708 203-757-4200

Relays, Solid State-4500

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1404
American Zettler, Aliso Viejo, CA 92656, 714-831-5000 .... B•1415
Amperite Co., Inc., Union City, NJ 07087, 201-864-9503 .... B•1417
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1418,1429-1433
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1437
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 .... B•1455
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456
§ Crydom Company, Long Beach, CA 90805, 310-865-3536 .... B•1464-1472
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 .... B•1473-1478, D•1155
§ EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 .... B•1482
§ Gentron Corporation, Scottsdale, AZ 85260, 602-443-1288 .... B•1504-1506
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1458-1459
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1507
Guardian Electronics, General Cable Corporation, Highland Heights, KY 41076, 606-572-8303 .... B•1509-1511
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1514
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1522-1523
§ International Rectifier Corp., El Segundo, CA 90245, 310-322-3331 .... B•1526
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1547,1554-1555
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 .... B•1556
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 .... B•1558-1561
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 .... B•1562
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 .... B•1574
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•1796, C•1792
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1577,1581,1584-1587,1590
Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060 .... B•1596
Solid State Optronics, San Jose, CA 95113-1201, 408-436-1390 .... B•1597-1601
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1606,1608-1610,1612-1613
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .... B•1620-1623
† TH Electronics, Tong Hsing Electronic Ind., Ltd., Tucson, AZ 85745-1443, 602-791-7825 .... B•1624
§ Action Instruments, San Diego, CA 92123 619-279-5726
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Alpha Dist. Corp., Richfield, OH 44286 .... 216-659-7100; 1-800-628-0841
§† Antex Electronics Corp., Gardena, CA 90248-2617 310-532-3092
† Applied Controls Co., Inc., Fairfield, NJ 07004 201-227-5454
§ AT&T Microelectronics, Allentown, PA 18103 .... 1-800-372-2447;In Can.:1-800-553-2448
† Babcock, Inc., Orange, CA 92667 714-633-3700
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
Brill Electronics, Los Angeles, CA 90025 310-452-8002
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
§ Coto Wabash, A Kearney National Company, Providence, RI 02907 401-943-2686
Cross Electronics, Warrendale, PA 15086 412-776-1591
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
† Dionics, Westbury, NY 11590 516-997-7474
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
§ EDL, Inc., Danville, VA 24540 .... 804-799-0807;1-800-DIAL EDL
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
Electronic Specialty Corp., Vancouver, WA 98685 206-574-5000
Enerco, Inc., Seattle, WA 98108 206-762-1422
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§ Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-747-3000
§ Global Components & Controls, Wanamassa, NJ 07712-4010 908-389-1470
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
International Microelectronics, Arlington, TX 76003 817-473-1730
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
Klockner Moeller, Franklin, MA 02038 508-520-7080
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062 708-205-2867
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
National Controls Corp., W. Chicago, IL 60185 708-231-5900
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§ Opto 22, Temecula, CA 92590 714-695-9299
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Princo Instruments, Inc., Southampton, PA 18966 215-355-1500
§ Regent Controls, Inc., Shelton, CT 06484-0767 203-924-2924
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 510-471-9717
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Solid State Relays, Oak Brook, IL 60521 708-932-1660
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
† Teledyne Microelectronics, Los Angeles, CA 90066 .... 310-822-8229;310-305-0248
§† Teledyne Solid State, Hawthorne, CA 90250 213-777-0077
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
Universal Semiconductor Inc., San Jose, CA 95112 408-436-1906
§ Wheelock, Inc., Long Branch, NJ 07740 908-222-6880
Wieland Inc., Burgaw, NC 28425 919-259-5050

Relays, Stepping-4500

§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1438
Guardian Electronics, General Cable Corporation, Highland Heights, KY 41076, 606-572-8303 .... B•1509-1511
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1606
§ Bellofram Corporation, Newell, WV 26050 .... 304-387-1200;1-800-733-2356
Brill Electronics, Los Angeles, CA 90025 310-452-8002
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427 513-898-3621
Master Electronic Controls, Los Angeles, CA 90025 310-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580

Relays, Telephone-4500

C.P. Clare Corp., Chicago, IL 60645, 312-262-7700	**B•1436**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711**	**B•1438-1444**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686**	**B•1451**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1577**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ American Relays, Inc., Santa Fe Springs, CA 90670	310-944-0447
§ American Zettler, Aliso Viejo, CA 92656	714-831-5000
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
Deltrol Controls, Milwaukee, WI 53215	414-671-6800
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551	414-648-3000
Electronic Applications Co., El Monte, CA 91734	818-442-3212
Fifth Dimension, Inc., Trenton, NJ 08638	609-393-8350
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551	414-648-3000
Hasco Components International Co., Bellrose Village, NY 11001	516-328-9292
§ ITT Components, ITT Corporation, Irvine, CA 92718	714-727-3001
§ ITT Schadow, Eden Prairie, MN 55344	612-934-4400
Liberty Controls, Shorewood, IL 60435	815-725-2241
§† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846	908-271-5770
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
Stetron International, Inc., Buffalo, NY 14203	716-854-3443
§ Wheelock, Inc., Long Branch, NJ 07740	908-222-6880

Relays, Thermal-4500

§† **Amperite Co., Inc., Union City, NJ 07087, 201-864-9503**	**B•1417**
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700	**B•1436**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686**	**B•1451-1452**
§ **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1607,1609**
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500	**B•1903**
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200	**B•1908**
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
Altech Corp., Flemington, NJ 08822-6000	908-806-9400
Brill Electronics, Los Angeles, CA 90025	310-452-8002
Cambridge Aeroflo, Inc., Shirley, MA 01464	508-425-2346
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
Electronic Applications Co., El Monte, CA 91734	818-442-3212
GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Hold-Heet Products Corp., Chicago, IL 60640	312-728-4454;312-728-4455
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Square D Co., Palatine, IL 60067	708-397-2600
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800

Relays, Time Delay-4500

§† **Amperite Co., Inc., Union City, NJ 07087, 201-864-9503**	**B•1417**
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1418**
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711	**B•1448**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1456-1457**
Crydom Company, Long Beach, CA 90805, 310-865-3536	**B•1465**
§ **Douglas Randall, Pawcatuck, CT 06379, 203-599-2075**	**B•1473**
† **Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000**	**B•1484**
Genicom Corp., Waynesboro, VA 22980, 703-949-1471	**B•1500**
Gruner, Advanced Components Industries, Inc., Torrance, CA 90501, 310-328-0060	**B•1403**
§ **Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800, 609-896-0009**	**B•1360-1363**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1522-1523**
§ **Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101, 708-543-6200**	**B•1524-1525**
§† **Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770**	**B•1547,1552-1553**
† **Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200**	**B•1556**
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336	**B•1558,1561**
NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089	**A•2149,** **B•1574-1575**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000**	**B•1587-1588,1590**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1592,1594**
† **Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060**	**B•1596**
§† **Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500**	**B•1606-1608,1612,1614**
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200	**B•1908**
§ Action Instruments, San Diego, CA 92123	619-279-5726
§ Air-O-Tronics, Pelco Electronics, Cazenovia, NY 13035	315-655-2387
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ American Electronic Components, Elkhart, IN 46514	219-264-1116
§† Antex Electronics Corp., Gardena, CA 90248-2617	310-532-3092
§ Artisan Controls Corp., Parsippany, NJ 07054	201-428-1770
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
† Babcock, Inc., Orange, CA 92667	714-633-3700
§ Brentek International, Inc., York, PA 17406	717-755-8000
Brill Electronics, Los Angeles, CA 90025	310-452-8002
§ Amerace Electronic Components, Punta Gorda, FL 33950	813-575-8400
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470	201-694-8600
§ Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Deltrol Controls, Milwaukee, WI 53215	414-671-6800
§† Deutsch Relays, Inc., East Northport, NY 11731	516-499-6000
§ Diversified Electronics, Inc., Evansville, IN 47706-1140	812-426-2806
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753	512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
Electronic Applications Co., El Monte, CA 91734	818-442-3212
Electronic Innovations Corp. (E.I.C.), Lakewood, CO 80227	303-987-2441
§ ERNI Components, Richmond, VA 23236	804-794-6367
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198	203-747-3000
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Hold-Heet Products Corp., Chicago, IL 60640	312-728-4454;312-728-4455
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
† Jettron Products Inc., E. Hanover, NJ 07936	201-887-0571
§ Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53209	414-228-5500
§ Magnecraft Electric Co., Northbrook, IL 60062-5376	708-564-8800
§ Midtex Relays, Inc., El Paso, TX 79906	915-772-1061;1-800-MIDTEX1
§ MKC Electronics Corp., Overland Park, KS 66215	913-894-9711
§ MSD, Inc., Magnecraft, Darlington, SC 29532	803-393-5421
§ National Controls Corp., W. Chicago, IL 60185	708-231-5900
§ Nedco Electronics, Inc., Morton Grove, IL 60053	708-967-0500
§ Nolatron, Harrisburg, PA 17111	717-564-3398
§ Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
Paragon Electric Co., Inc., Two Rivers, WI 54241	414-793-1161
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
Relay Service Co., Chicago, IL 60651	312-252-2700
† Relay Specialties, Oakland, NJ 07436	201-337-1000
§ R-K Electronics, Cincinnati, OH 45249	513-489-4060
§ Schleicher GmbH & Co., c/o Progressive Automation Controls Co., Greendale, WI 53129-2161	414-421-4380;1-800-803-0444
§ Schrack Components, Inc., Ft. Lauderdale, FL 33309	305-733-3330
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404	310-884-5200
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257
§ Square D Co., Palatine, IL 60067	708-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
† Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538	419-525-8500
Timeco, Inc., Huntington, WV 25705	304-523-5149
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
§ V R Industries, Inc., Warwick, RI 02886	401-732-6800
† Wilmar Electronics, Inc., Torrance, CA 90505	310-326-6668

Relays, Transistor & DIP Case Types — See Relays, Printed Circuit Mounting (Vol. B)

Relays, Vacuum-4500

C.P. Clare Corp., Chicago, IL 60645, 312-262-7700	**B•1436**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**B•1536-1538**

† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560 .... B•1540-1545
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1592-1594
Aleph International Corp., San Fernando, CA 91340 .... 818-365-9856;800-423-5622
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Electronic Applications Co., El Monte, CA 91734 818-442-3212
The Fredericks Company, Huntingdon Valley, PA 19006 215-947-2500
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Master Electronic Controls, Los Angeles, CA 90025 310-452-1336
§ MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500

Relays, Voltage Sensitive-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 310-944-0447 .. B•1407-1411
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 .... B•1414
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1418-1423,1427
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1436
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1438-1441,1444
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1456
Crydom Company, Long Beach, CA 90805, 310-865-3536 .... B•1464-1466
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 .... B•1476
Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 .... B•1484
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1010-1011,1500,1503
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1507
Guardian Electronics, General Cable Corporation, Highland Heights, KY 41076, 606-572-8303 .... B•1509-1511
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1513
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1514,1517
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1522-1523
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .... B•1530,1532,1534
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1551
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 .... B•1556
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 .... B•1577,1579,1589
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831, 510-471-9717;800-221-7060 .... B•1596
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1608
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200 .. B•1908
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
§ Altech Corp., Flemington, NJ 08822-6000 908-806-9400
§ American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Antex Electronics Corp., Gardena, CA 90248-2617 310-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
§ Amerace Electronic Components, Punta Gorda, FL 33950 813-575-8400
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
† Computer Components, Inc., East Granby, CT 06026 203-653-9909
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
§ Coto Wabash, A Kearney National Company, Providence, RI 02907 401-943-2686
Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Electronic Applications Co., El Monte, CA 91734 818-442-3212
§ Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§† Hamlin Inc./Elec-Trol, Lake Mills, WI 53551 414-648-3000
† INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Lark Electronics, Inc., New York, NY 10040 212-569-0430
Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Master Electronic Controls, Los Angeles, CA 90025 310-452-1336
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Midtex Relays, Inc., El Paso, TX 79906 .... 915-772-1061;1-800-MIDTEX1
MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
Relay Service Co., Chicago, IL 60651 312-252-2700
§ R-K Electronics, Cincinnati, OH 45249 513-489-4060
Schrack Components, Inc., Ft. Lauderdale, FL 33309 305-733-3330
§ Square D Co., Palatine, IL 60067 708-397-2600
SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
† Wilmar Electronics, Inc., Torrance, CA 90505 310-326-6668

Relays (MIL)-2440

§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1438-1441
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 .... B•1482
† Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 ... B•1484-1485
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 .... B•1486
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 .. B•1010-1011,1500,1503
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .... B•1536,1538
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560 .... B•1540
§† Leach Corporation, Buena Pk., CA 90622-5032, 714-739-0770 .... B•1547-1552
Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 .... B•1556
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901, 609-589-7500 .... B•1606-1613
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 .... B•1616-1621
† Allied Controls Incorporated, Waterbury, CT 06705-3827 203-757-4200
† Computer Components, Inc., East Granby, CT 06026 203-653-9909
† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
§ Coto Wabash, A Kearney National Company, Providence, RI 02907 401-943-2686
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
† Electrol, Hamlin, Inc., Lake Mills, WI 53551 414-648-3000
Master Electronic Controls, Los Angeles, CA 90025 310-452-1336
MSD, Inc., Magnecraft, Darlington, SC 29532 803-393-5421
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 510-471-9717
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Teledyne Solid State, Hawthorne, CA 90250 213-777-0077

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§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 .... A•1861
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 .... A•1877
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 .... A•1930-1931
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 .... A•1922
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 .... A•1935
§ IRC, Inc., Boone, NC 28607, 704-264-8861 .... A•1950-1951
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ... A•1960,1963-1964
§ KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 .... A•1973-1976,1978
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 .... A•1985
§ NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 .... A•2149

Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ... A•2008
§ Colber Corp., Irvington, NJ 07111 ... 201-371-9500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 ... 205-772-9620
§† International Resistive Company, Boone, NC 28607 ... 704-264-8861
§ IRC-Shallcross, Smithfield, NC 27577 ... 919-934-5181
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 ... 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 ... 818-990-1192
Meissner Industries, Dover, NJ 07801 ... 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 ... 219-356-4300
Mills Resistor Co., Los Alamitos, CA 90720 ... 310-598-2454
† Ohmite Manufacturing Co., Skokie, IL 60076 ... 708-675-2600
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 ... 201-392-4818
§† RCD Components, Inc., Manchester, NH 03109 ... 603-669-0054
§ RF Electronics, Inc., Irvine, CA 92714-5517 ... 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 ... 802-253-8567;802-253-7649
Vishay Resistors, Malvern, PA 19355 ... 215-644-1300

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§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ... A•1868
§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ... A•1869-1871
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ... A•1904
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ... A•1929
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ... A•1910-1911,1917,1921-1922
Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ... A•1932-1933
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ... A•1935
† Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ... A•1940-1941
† IRC, Inc., Boone, NC 28607, 704-264-8861 ... A•1946,1948-1949
Julie Research Labs., New York, NY 10001, 212-633-6625 ... A•1956
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ... A•1957
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ... A•1958,1962,1971
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1973-1974,1977,1979
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ... A•1984
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ... A•1985
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ... A•1988-1989
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ... A•1993
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ... A•1999
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ... A•2001-2003
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ... A•2006-2008
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ... A•2010
Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ... A•2013
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ... A•2015
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•2016-2017
Quality Thermistor, Boise, ID 83709, 208-377-3373 ... B•1893
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ... A•2020-2024,2026-2027
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ... A•2028-2030,2032-2033
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649 ... A•2036-2037
§† Vishay Resistors, Malvern, PA 19355, 215-644-1300 ... A•2041-2042,2044
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ... 818-345-7811; 800-835-3355
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 ... 301-739-8722
§† California Micro Devices, Inc., Milpitas, CA 95035 ... 408-263-3214
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ... 214-422-1844; 1-800-872-0044
§ Colber Corp., Irvington, NJ 07111 ... 201-371-9500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
† Hycomp, Inc., Marlborough, MA 01752 ... 508-485-6300
HY MEG Corp., Addison, IL 60101 ... 708-543-9250
§† International Resistive Company, Boone, NC 28607 ... 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 ... 919-934-5181
KDI/Triangle Electronics, Whippany, NJ 07981 ... 201-887-5700
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 ... 818-990-1192
Microplex, Inc., Anaheim, CA 92806 ... 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 ... 407-574-0208
§ Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 ... 605-665-9301
§† RCD Components, Inc., Manchester, NH 03109 ... 603-669-0054
Resistors, Inc., Chicago, IL 60650 ... 708-652-7555
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 ... 609-589-7500
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 ... 818-781-1642
§† Varnistor Corp., Sevierville, TN 37862 ... 615-453-0001
Wilbrecht Electronics, St. Paul, MN 55107 ... 612-222-2791

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† Marks Polarized Corp., Hauppauge, NY 11788 ... 516-273-8900

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Advanced Photonix, Inc., Camarillo, CA 93012	805-484-2884
§ Banner Engineering Corp., Minneapolis, MN 55441	612-544-3164
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075	214-422-1844; 1-800-872-0044
§ Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933

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Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313	**B•2017**
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200	**B•1908**
† DELTA M Corporation, Oak Ridge, TN 37830	615-483-1569
Dresser Instrument Div., Dresser Industries, Stratford, CT 06497	203-378-8281
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
Intek, Inc., Westerville, OH 43081	614-895-0301
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
Ocean Motions Co., Barrington, RI 02806	401-246-1394

Sensors, Angle Measuring-5500

BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161	**B•1917**
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600	**B•1917**
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782	**B•1917**
† **BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414**	**B•1917**
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000	**B•1917**
Data Technology, Inc., Woburn, MA 01811, 617-935-8820	**B•1931**
Hamlin Inc., Lake Mills, WI 53551, 414-648-3000	**B•1953**
† **Humphrey, Inc., San Diego, CA 92123, 619-565-6631**	**B•1956,1958**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529	**B•1968**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1337-1338**
U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451	**B•2019-2023, D•1327**
American Electronic Components, Elkhart, IN 46514	219-264-1116
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
§ Compumotor Division, Parker Hannifin Corp., Rohnert Park, CA 94928	707-584-7558
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Comus International, Nutley, NJ 07110	201-667-6200;1-800-35-COMUS
Disc Instruments, Honeywell, Costa Mesa, CA 92626	714-433-0343
§† Dova Controls, Redmond, WA 98052-5165	206-881-7414
§ Encoder Products, Sandpoint, ID 83864	208-263-8541
The Fredericks Company, Huntingdon Valley, PA 19006	215-947-2500
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800

§ Kistler Instruments Corp., Amherst, NY 14228-2171 716-691-5100
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
Midori America Corp., Fullerton, CA 92631 714-449-0997
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Ocean Motions Co., Barrington, RI 02806 401-246-1394
† Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
† Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
† Sundstrand Data Control, Redmond, WA 98073-9701 206-885-3711
† Teledyne Gurley, Troy, NY 12181 .... 518-272-6300;800-759-1844
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664

Sensors, CCD Image-3700

Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1324-1325
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† EEV Inc., Elmsford, NY 10523 914-592-6050
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
§ Loral Fairchild, Imaging Sensors, Milpitas, CA 95035-7407 408-433-2500
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
PULNiX America, Inc., Sunnyvale, CA 94086 408-733-1560
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611

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† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 .... B•1218-1219
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1324
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
Conax Buffalo Corporation, Buffalo, NY 14225 716-684-4500
§ Daitron, Inc., Tigard, OR 97223 503-620-2879
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 .... 215-524-2000; 800-441-8246
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
Fiberguide Industries Inc., Stirling, NJ 07980 908-647-6601
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097 .... 708-932-9380;800-468-6009
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550 508-347-9191
Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT, 06062-1198 203-747-3000
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ McGill Electrical Product Group, Valparaiso, IN 46383 219-465-2200
3M Private Network Products, 3M, Austin, TX 78726 .... 512-984-3400;800-426-8626
MetriCor, Inc., Woodinville, WA 98072 206-483-5577
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
PULNiX America, Inc., Sunnyvale, CA 94086 408-733-1560
Quantex Corporation, Rockville, MD 20850 .... 301-258-2701;800-992-5149 (Sls. only)
§† Radiant Communications Corp., South Plainfield, NJ 07080 908-757-7444
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
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§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 510-471-9717
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265 515-225-6933
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Transonic Systems Inc., Ithaca, NY 14850 607-257-5300
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 512-388-2522

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Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 .... B•1317-1318
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .... B•1326
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
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Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 .... 214-422-1844; 1-800-872-0044
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097 .... 708-932-9380;800-468-6009
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3 .... 416-825-1335; 1-800-800-4606
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458 201-825-9696
GTE Control Devices, Inc., Standish, ME 04084 207-642-4535
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 053-452-2141
Hecon Corp., Eatontown, NJ 07724 908-542-9200
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
LEL Co., Cresskill, NJ 07626 201-569-8641
§ McGill Electrical Product Group, Valparaiso, IN 46383 219-465-2200
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Precision Electro-Optics, Inc., Chatham, NJ 07928 201-635-8811
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodann Electronics Mfg. Co., Costa Mesa, CA 92626 .... 714-662-3232;800-366-7010
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Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586

Sensors, Liquid Flow-5500

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1662
American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711
Approved Purification Corp., Stamford, CT 06907, 203-357-0141 .... B•1916
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1324
Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 .... B•2017
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
§ Daitron, Inc., Tigard, OR 97223 503-620-2879
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 .... 215-524-2000; 800-441-8246
† E-T-A Circuit Breakers, Niles, IL 60714 708-647-8303
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550 508-347-9191
§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-747-3000
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† Intek, Inc., Westerville, OH 43081 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Ocean Motions Co., Barrington, RI 02806 401-246-1394
Omega Engineering, Stamford, CT 06907 800-826-6342
Polaroid Corp., Cambridge, MA 02139 800-225-1618
§† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
Transonic Systems Inc., Ithaca, NY 14850 607-257-5300
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580
U. E. Systems, Inc., Elmsford, NY 10523 .... 914-592-1220;800-223-1325

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Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1662
American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711
Approved Purification Corp., Stamford, CT 06907, 203-357-0141 .... B•1916
Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 .... B•2017
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§ Comus International, Nutley, NJ 07110 .... 201-667-6200;1-800-35-COMUS
Conax Buffalo Corporation, Buffalo, NY 14225 716-684-4500
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
§ DCT Instruments, Columbus, OH 43212 1-800-328-1028
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Endress & Hauser Instruments, Greenwood, IN 46143 .... 317-535-7138;800-428-4344
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
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§† Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198 203-747-3000
Gordon Products, Brookfield, CT 06804 203-775-4501
GTE Control Devices, Inc., Standish, ME 04084 207-642-4535
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
Intek, Inc., Westerville, OH 43081 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
§ Level Plus, Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100

Lundahl Instruments, Inc., Ezra C. Lundahl Inc., Logan, UT 84321	801-753-7300
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
# MEGA Systems & Chemicals, Phoenix, AZ 85040	602-437-9105
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Ocean Motions Co., Barrington, RI 02806	401-246-1394
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
Polaroid Corp., Cambridge, MA 02139	800-225-1618
Schlumberger Industries, Tranducers Div., Houston, TX 77082	713-558-2587
SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300
Techno-Isel USA Division, Designatronics, New Hyde Park, NY 11042-5416	516-328-3970
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580

Sensors, Moisture-5500

§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
Datachron Inc., Anaheim, CA 92805	714-385-1705
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
Forte Technology, Inc., Norwood, MA 02062	617-769-9150
Hokuriku USA Ltd., Madison, AL 35758	205-772-9620
§† Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
§ Moisture Register Products Div., Aqua Measure Instrument Co., LaVerne, CA 91750-0369	909-392-5833
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
Omega Engineering, Stamford, CT 06907	800-826-6342
Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Stephens Analytical, Inc., Montreal, Que., CA H4S 1L1	514-332-1230

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Advanced Thermal Products, Inc., St. Marys, PA 15857, 814-834-1541	**B•1858-1859**
Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000	**B•1860**
Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516	**B•1869**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591	**B•1881**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**B•1885**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1887, D•1314**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1336-1338,1888**
Raychem Corporation, Menlo Park, CA 94025, 415-361-3863;800-2-RAYCHEM/ext. 6900	**A•2179**
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500	**B•1389**
§ **Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450**	**B•1904-1905**
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200	**B•1908**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
# ACI Components, Inc., Laguna Hills, CA 92653	714-588-9611
Automation Component Technology, Fremont, CA 94538	510-226-0900; 510-490-3587 (Sales)
Control Resources Inc., Harvard, MA 01451	508-772-4043
† DELTA M Corporation, Oak Ridge, TN 37830	615-483-1569
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
Elmwood Sensors, Pawtucket, RI 02861	401-727-1300
ERNI Components, Richmond, VA 23236	804-794-6367
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
Galileo Electro-Optics Corp., Sturbridge, MA 01566-0550	508-347-9191
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GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
§† Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007	215-781-0700; 800-523-8989
Linear Laboratories, SafetyTek Corp., Fremont, CA 94538	510-226-0488
MetriCor, Inc., Woodinville, WA 98072	206-483-5577
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
Oven Industries, Mechanicsburg, PA 17055	717-766-0721
Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
† Quality Thermistor, Boise, ID 83709	208-377-3373
§ RCD Components, Inc., Manchester, NH 03109	603-669-0054
§† RdF Corporation, Hudson, NH 03051-0490	603-882-5195,800-445-8367
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796	617-527-4385
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
§ TEGAM, Inc., Madison, OH 44057	800-666-1010
§ Teledyne Components, Mountain View, CA 94039-7267	415-968-9241
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§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
U.S. Sensor Corp., Orange, CA 92667	714-639-1000

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§† Electronic Hardware Corp, Formerly Jan Hardware Mfg. Co., Farmingdale, NY 11735, 516-752-1950	**C•1525-1526**
§ B & B Motor & Control Corp., B & B Long Island City, Edison, NJ 08817	908-819-7070; 908-572-0500
§† Berg, W. M., Inc., East Rockaway, NY 11518	516-599-5010
§ Concord Electronics Corporation, New York, NY 10012	1-212-777-6571
§ Machine Components Corp., Plainview, NY 11803	516-694-7222
Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845	508-975-2711
§ PIC Design, Remington Technologies, Inc., Middlebury, CT 06762	203-758-8272
Sterling Instruments, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-3300
Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-0200;328-3300

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§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886	**C•1719**
Electro Space Fabricators, Topton, PA 19562-0067, 215-682-7181	**C•1026**
† GSI Corp., Timonium, MD 21093, 410-252-1768	**C•1751**
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136, 717-424-8510	**C•1688-1689,1694**
Power Supply Concepts Inc., Jupiter, FL 33458-8947, 407-746-1800	**D•1896**
Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970	**C•1843**
† Ad-Vance Magnetics, Inc., Rochester, IN 46975	219-223-3158
# Applied Design Company, Minneapolis, MN 55413	612-378-0094
Atlee Inc., North Andover, MA 01845	508-681-1003
§† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888	617-935-4850
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647	201-768-5400
# Electrical Insulation Suppliers, Inc., Hillside, IL 60162	708-547-5400
Electronic Packaging System, Marion, IA 52302	319-377-3423
† Equipto Electronics Corp., Aurora, IL 60506-9988	708-897-4691
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805	714-563-4300
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
W.L. Gore & Assocs., Newark, DE 19714	302-738-4880
# The Hirol Company, Ft. Lauderdale, FL 33309	305-974-4900
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139	708-307-7200
† Magnetic Radiation Labs, Itasca, IL 60143	708-285-0800
† Max Levy Autograph, Inc., Philadelphia, PA 19144-4298	215-842-3675
Minor Rubber Co., Inc., Bloomfield, NJ 07003	201-338-6800;800-433-6886
§† Parker Hannifin Corporation, Seal Grp., Irvine, CA 92715	714-833-3000
† Spira Manufacturing Corp., North Hollywood, CA 91605	818-764-8222
Tech-Etch, Inc., Plymouth, MA 02360	508-747-0300
† TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807	714-630-7127

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Silicon Foundry Services-4100 – *See Vol. D*

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Simulators, Motion-2550 – *See Vol. D*

Simulators, Optics-3700

† Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014	412-224-1800

Simulators, Power Failure-2900 – *See Vol. D*

Simulators, Powerline Disturbance-2900 – *See Vol. D*

Simulators, Radar-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Berkeley Nucleonics Corp., Richmond, CA 94804	510-234-1100
Cober Electronics, Stamford, CT 06902	203-327-0003
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060	703-552-2111
† E M S Development Corp., Farmingdale, NY 11735	516-293-7900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Interface Engineering Inc., Holbrook, MA 02343	617-986-2600
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134	408-434-3600
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788	516-273-9800
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Simulators, Resolvers-2900 – *See Vol. D*

Simulators, Thermocouple-2900 – *See Vol. D*

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† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† E M S Development Corp., Farmingdale, NY 11735	516-293-7900
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
Intronics, Inc., Canton, MA 02021	800-367-0004
† Locus, Inc., State College, PA 16804	814-466-6275
† Locus, Kaman, State College, PA 16804	814-466-6275
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
†# NAVAN Corporation, Media, PA 19063	215-352-8464
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788	516-273-9800
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173	617-861-1500
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000

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Slip Rings & Assemblies-3500

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230	**B•1234-1239**
† **Electro Miniatures Corp., Moonachie, NJ 07074, 201-460-0510**	**B•1251-1253**
† **Fabricast, S. El Monte, CA 91733, 818-443-3247**	**B•1254,1256-1259**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1260-1261**
† **Graphite Metallizing Corp., Yonkers, NY 10702, 914-968-8400**	**B•1265**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751**	**B•1278-1287,1289**
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555**	**A•2103**
† Danmar Inds., Moorpark, CA 93021	1-805-529-3788
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060	703-552-2111
§ HBM, Inc., Marlboro, MA 01752	508-624-4500
† Kirkwood Industries Inc., Cleveland, OH 44135	216-267-6200
Mercotac Inc., Carlsbad, CA 92009	619-431-7723
The J. M. Ney Company, Bloomfield, CT 06002	203-242-2281
§† Superior Carbon Products, Inc., Walnut Grove, MS 39189	601-253-2442
† Tech Laboratories Inc., Palisades Pk., NJ 07650	201-944-2221
† Unit Industries, Fullerton, CA 92631	714-871-4161

Slip Rings & Assemblies (MIL)-2440

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230	**B•1234,1236,1239**
† **Electro Miniatures Corp., Moonachie, NJ 07074, 201-460-0510**	**B•1251-1253**
† **Fabricast, S. El Monte, CA 91733, 818-443-3247**	**B•1254,1256-1259**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1261**
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1278,1285-1287,1289**
† Danmar Inds., Moorpark, CA 93021	1-805-529-3788
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060	703-552-2111
† Kirkwood Industries Inc., Cleveland, OH 44135	216-267-6200

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Sockets, Diode-2100 – *See Vol. C*

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Sockets, Lamp & Lamp Assemblies-2460

§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933**	**B•1132-1133**
§ **Aries Electronics, Frenchtown, NJ 08825, 908-996-6841**	**C•1264**
§ **Bivar, Inc., Irvine, CA 92718, 714-951-8808**	**C•1537**
§ **Bulbtronics, Inc., Farmingdale, NY 11735, 516-249-2272;1-800-654-8542**	**B•1135**
§† **Data Display Products, El Segundo, CA 90245-4630, 310-640-0442;800-421-6815**	**B•1136-1138**
§† **Dialight Corporation, Manasquan, NJ 08736, 908-223-9400**	**B•1147**
§ **Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300**	**B•1151**
† **Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442**	**B•1158-1159,1161**
Grayhill Inc., La Grange, IL 60525, 708-354-1040	**C•1341**
§ **JKL Components Corporation, Pacoima, CA 91331-2376, 818-896-0019**	**B•1168**
§† **Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 140, 03-3471-8548**	**B•1176-1177**
Osram Sylvania, Hillsboro, NH 03244, 603-464-5533;603-464-5538	**B•1190-1194**
§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62**	**C•1451**
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**B•1180**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**B•1181**
§ **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123**	**B•1182-1185,1187**
§ **Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900**	**B•1196-1199**
† Alden Products Co., Brockton, MA 02403	508-583-0160
§ Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
§ American Ultraviolet, Murray Hill, NJ 07974	908-665-2211
Andon Elctrns. Corp., Lincoln, RI 02865	401-333-0388
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
Autoswage Products, Shelton, CT 06484	203-929-1401
§ Christiana Industries Corp., Chicago, IL 60626-4094	312-465-6330
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007	708-981-6000
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
Display Devices, Inc., Encinitas, CA 92023	619-753-0113
Dupree, Inc., Chino, CA 91710	909-597-4889
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101	718-937-8000
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
§ Entrelec Inc., Irving, TX 75038	214-550-9025
Fastex, Illinois Tool Works, Des Plaines, IL 60016	708-299-2222
§† Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602	203-382-3023
GTE Products Corporation, Miniature Lighting Products, Hillsboro, NH 03244	603-464-5533;603-464-5538
† Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
§ Industrial Devices, Inc., Hackensack, NJ 07601	201-489-8989
§ Inter-Market, Glenview, IL 60025	708-729-5330
International Configurations, Inc., Enfield, CT 06082	203-749-6380

§ ITW Switches, Illinois Tool Works, Chicago, IL 60634	312-282-4040
Kyocera Industrial Ceramics Corp., San Diego, CA 92123	619-576-2688
LAMPTRONIX Co. Ltd., Crystal Lake, IL 60014-4443	815-455-0400
§† Ledco, Wilbrecht Elctrns., St. Paul, MN 55107	612-222-2791
† Ledtronics, Inc., Torrance, CA 90505	310-534-1505
§ Leecraft Mfg., Long Island City, NY 11101	718-392-8800
§† Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
§ Luminator Aircraft Products, Plano, TX 75074	214-424-6511
Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716	203-756-8847
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
§ McKenzie Technology, Fremont, CA 94538	510-651-2700
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
Optronic Laboratories, Inc., Orlando, FL 32811	407-422-3171;800-899-3171
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
Rodale Technical Sales Inc., Islip, NY 11751	516-277-5454
San-O Industrial Corp., Holbrook, NY 11741	516-472-6666
§ Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
†# Spectrum Devices, Sugar Land, TX 77487-1586	713-242-6417
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630	312-792-2700
§† Sylvania Automotive and Miniature Lighting, Osram Sylvania, Hillsboro, NH 03244	603-464-5533
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492	203-269-3337
UVP, Inc., San Gabriel, CA 91776	818-285-3123;800-452-6788
§ Voltarc Technologies, Inc., Fairfield, CT 06430	203-255-2633

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AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Andon Elctrns. Corp., Lincoln, RI 02865, 401-333-0388	**C•1256**
§† CW Industries, Southhampton, PA 18966, 215-355-7080	**C•1304**
§† Dialight Corporation, Manasquan, NJ 08736, 908-223-9400	**B•1147**
Oshino Lamps Limited, Shinagawa-Ku, Tokyo, JAPAN 140, 03-3471-8548	**B•1177**
Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123	**B•1182-1183,1185**
Texas Instruments, Connector Systems, Attleboro, MA 02703, 508-699-5269;508-699-3450	**C•1493-1498**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Aries Electronics, Frenchtown, NJ 08825	908-996-6841
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
Connector Corp., Chicago, IL 60646	312-539-3108
§† Deutsch Relays, Inc., East Northport, NY 11731	516-499-6000
† EBY Company, Philadelphia, PA 19124	215-537-4700
EDA Inc., Div. of Connector, La Habra, CA 90631	213-697-7151
§† Electronic Hardware Corp, Formerly Jan Hardware Mfg. Co., Farmingdale, NY 11735	516-752-1950
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§† Garry Electronics, WPI, Salem, NJ 08079	609-935-7603
Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716	203-756-8847
Master Electronic Controls, Los Angeles, CA 90025	310-452-1336
Oxley Inc., Branford, CT 06405	203-488-1033
§† PCD, Peabody, MA 01960	508-532-8800
§† Precicontact, Inc., Langhorne, PA 19047	215-757-1202
U.S. Terminals Inc., Cincinnati, OH 45243	513-561-8145
§† Wells Electronics, Inc., South Bend, IN 46613	219-287-5941

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Soldering Equipment, Printed Circuit-4100 — *See Vol. D*

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Soldering Equipment, Vapor Phase-4100 — *See Vol. D*

Soldering Guns, Irons & Desoldering Tools-4600 — *See Vol. C*

Soldering Machines, Laser-4100 — *See Vol. D*

Soldering (MIL)-2440

Connectronics Corp., Toledo, OH 43607, 419-537-0020	**C•1293**
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† CAD Engrg. & Assembly Inc., Mentor, OH 44060	216-255-7744
Cardinal Control Co., Kensington, CT 06037	203-828-6379
§† Chemtronics Inc., Hauppauge, NY 11788	516-582-3322;800-645-5244
dataCon, Inc., Interconnect Sub-Systems, Burlington, MA 01803	617-273-5800
§† Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081	201-467-8100
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549-1407	914-241-1008
§† Gardiner Solder Co., Div. of Gardiner Metal Co., Chicago, IL 60632	312-847-0100
† GSI Corp., Timonium, MD 21093	410-252-1768
† Hexacon Electric Co., Roselle Park, NJ 07204	908-245-6200
# HMC/Hub Material Company, Canton, MA 02021	617-821-1870
† IEM-Fusion Inc., Cleveland, OH 44139	216-349-1960
† Indium Corporation of America, Utica, NY 13502	315-853-4900;1-800-4INDIUM
§† Metcal, Inc., Menlo Park, CA 94025	800-776-1778
† Miller, L.C., Co., Monterey Pk., CA 91754	213-268-3611
Multicore Solders, Inc., Richardson, TX 75081	214-238-1224
§† Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039	401-433-7000
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984

Solenoids, Linear-4550

† Bicron Electronics, Canaan, CT 06018, 203-824-5125	**A•2299, B•1627**
Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711	**B•1628-1629**
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800	**B•1630**
§ Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521, 312-775-3600	**B•1632-1635**
† Electro-Mechanisms, Inc., San Dimas, CA 91773, 909-394-9953	**B•1636-1637**
† Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000	**B•1485**
Guardian Electronics, General Cable Corporation, Highland Heights, KY 41076, 606-572-8303	**B•1510-1511,1638-1643**
Liberty Controls, Shorewood, IL 60435, 815-725-2241	**B•1644-1645**
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621	**B•1647-1648,1650-1651**
§ Magnet Schultz of America, Westmont, IL 60559, 708-789-0600	**B•1652-1653**

§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 .... B•1654
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
Capewell Components, Cromwell, CT 06416 203-635-4045
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Copal (USA), Inc., Torrance, CA 90501 310-618-0225
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
§† Densitron Corporation, Densitron International, Torrance, CA 90505 310-530-3530
§ Detroit Coil Co., Ferndale, MI 48220 313-398-5600
§ Dynalloy, Inc., Irvine, CA 92715 714-476-1206
† Electro National Corp., Canton, MS 39046 601-859-5511
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
§ Global Components & Controls, Wanamassa, NJ 07712-4010 908-389-1470
Harting Elektronik, Inc., Hoffman Estates, IL 60195 .... 708-519-7700, ext. 200
† IMC Magnetics Corp., Tempe, AZ 85281 602-968-4441
Infranor, Naugatuck, CT 06770 .... 203-729-8258;800-BE-SERVO
§† Linear Motions Co., Valinda, CA 91744 818-918-7806
§† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
§ Namco Controls Corporation, Mentor, OH 44060 216-946-9900
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Shindengen America Inc., Westlake VI, CA 91362 800-634-3654
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
†# United States Electronics, Springfield, NJ 07081 201-912-0111
† West Coast Elec. Mfg., Fairview, NC 28730 704-628-1711

Solenoids, Proportional-4550

Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 .... B•1630
† Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 .... B•1485
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1647,1650
Magnet Schultz of America, Westmont, IL 60559, 708-789-0600 .... B•1652-1653
Detroit Coil Co., Ferndale, MI 48220 313-398-5600
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
Shindengen America Inc., Westlake VI, CA 91362 800-634-3654
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

Solenoids, Rotary-4550

Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 .... B•1628-1629
Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 .... B•1630
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1647-1651
Magnet Schultz of America, Westmont, IL 60559, 708-789-0600 .... B•1652-1653
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 .... B•1654
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§† Densitron Corporation, Densitron International, Torrance, CA 90505 310-530-3530
Detroit Coil Co., Ferndale, MI 48220 313-398-5600
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
§ Global Components & Controls, Wanamassa, NJ 07712-4010 908-389-1470
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
Shindengen America Inc., Westlake VI, CA 91362 800-634-3654
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

Solenoids, Stepping-4550

Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521, 312-775-3600 .... B•1632-1635
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1647,1650
Detroit Coil Co., Ferndale, MI 48220 313-398-5600

Solenoids (MIL)-2440

† Bicron Electronics, Canaan, CT 06018, 203-824-5125 .... A•2299, B•1627
† Electronic Specialty Corp., Vancouver, WA 98685, 206-574-5000 .... B•1485
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
Detroit Coil Co., Ferndale, MI 48220 313-398-5600
§† Electroid Co., Div.of Valcor Engrg. Corp., Springfield, NJ 07081 201-467-8100
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
† IMC Magnetics Corp., Tempe, AZ 85281 602-968-4441
† Line Electric Products, Glastonbury, CT 06033 .... 203-659-3573;1-800-331-1137
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427 513-898-3621
† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

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Sonar Systems-2440

Ocean Motions Co., Barrington, RI 02806 401-246-1394
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871 .. 401-847-8000

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Connector Corp., Chicago, IL 60646, 312-539-3108 .... C•1292
KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 .... B•1365
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 .. A•1096-1097,1980
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170 .... B•1379
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
EG&G, Inc., Electronics Components Div., Salem, MA 01970 508-745-3200
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 .... 508-745-3200;1-800-950-3441
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
§ Hobson Bros., Chicago, IL 60630-3884 312-283-3600
Ion Physics Corporation, Atkinson, NH 03811 603-893-6687
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† Joslyn Electronic Systems Corp., Goleta, CA 93116 ...... 800-752-8068; 805-968-3551
†# Lightning Protection Corp., Santa Barbara, CA 93160 .... 805-967-5089/4577
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Victoreen, Inc., Solon, OH 44139-3395 .... 216-248-9300;216-248-9043
§ World Products Inc., Sonoma, CA 95476 707-996-5201
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Speakers, Explosion & Flame Proof-1300 — *See Vol. D*

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Speakers, Weatherproof-1300 — *See Vol. D*

Speakers, Woofer-1300 — *See Vol. D*

Speakers (MIL)-2440

JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1046-1047
Accusonic Products, Global Market Development, New Hyde Park, NY 11040 516-437-6000
† MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409 612-825-1010
† MTX Oaktron, Monroe, WI 53566 608-328-5560
§ Poly-Planar Inc., Warminster, PA 18974 215-675-7805
† Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 .... 516-957-8700;800-645-5516
† Telectro Systems Corp., Corona, NY 11368 718-651-8900

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Spectrometers-2900 — *See Vol. D*

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Standards, Inductance-2900 – *See Vol. D*

Standards, Magnetic Field-2900 – *See Vol. D*

Standards, Noise-2900 – *See Vol. D*

Standards, Phase-2900 – *See Vol. D*

Standards, Phase Angle-2900 – *See Vol. D*

Standards, Resistance-2900 – *See Vol. D*

Standards, Temperature-2900 – *See Vol. D*

Standards, Time-2900 – *See Vol. D*

Standards, Voltage-2900 – *See Vol. D*

Standards, Voltage Ratio-2900 – *See Vol. D*

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Starters, Motor, Solid State-3500

§ Baldor Electric Company, Fort Smith, AR 72902	501-646-4711
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ Payne Engineering, Scott Depot, WV 25560	304-757-7353
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622	813-573-1900
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Static Eliminating Materials, Devices, & Equipment-4525 – *See Vol. C*

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Suppressors, Transient Voltage (All Types)-4300

Amber Inds., Inc., Carrollton, TX 75006, 214-490-9801	B•1343
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589	D•1630
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792	D•2254-2255
Corcom, Inc., Libertyville, IL 60048, 708-680-7400	B•1352
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040	A•1591
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427	D•2259
Fee Fil-Mag, San Diego, CA 92123, 619-569-6577	A•1637
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300	A•1641
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525	D•2267
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222	A•1085, B•1364
§† JMK, Inc., Amherst, NH 03031, 603-886-4100	A•1596
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200	B•1365
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591	B•1879
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536	A•1969
Magnetek Triad, Huntington, IN 46750, 219-356-7100	A•2384
§ Maida Development Co., Hampton, VA 23663, 804-723-0785	A•1096,1980-1982
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	D•2278-2279,2281
§† MCG Elctrns., Deer Park, NY 11729, 516-586-5125	B•1368
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	A•1660,1663
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488	A•1139-1140,1598-1599
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	A•2153, B•1889
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691	A•2172-2173
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064	A•1263
§ PolyPhaser Corporation, Minden, NV 89423-9000, 702-782-2511;800-325-7170	B•1379
PPD, Inc., Raleigh, NC 27613, 919-781-3955	B•1383
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229	D•2300
Raychem Corporation, Menlo Park, CA 94025, 415-361-3863;800-2-RAYCHEM/ext. 6900	B•1384-1385,1894-1895, D•1466
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	A•1606
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111	A•2180
Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001	D•1959
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500	B•1389
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450	B•1905
Todd Products Corp., Brentwood, NY 11717, 516-231-3366	D•1967
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222	A•1612
§ Wickmann USA, Inc., Atlanta, GA 30336, 404-699-7820	B•1397-1398
§ World Products Inc., Sonoma, CA 95476, 707-996-5201	A•1177,2050-2051,2224-2225, B•1399
§ Acme Electric Corporation, Cuba, NY 14727	716-968-2400
Aerovox Inc., North Dartmouth, MA 02747-1217	508-995-8000
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492	203-265-8910
APX Technologies Inc., Hicksville, NY 11801	516-433-1313
§ Atlantic Scientific Corporation, W. Melbourne, FL 32904	1-800-544-4737
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577	803-448-9411
§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
§ Best Power Technology, Inc., Necedah, WI 54646	608-565-7200;800-356-5794
BH Electronics, Inc., Burnsville, MN 55337	612-894-9590
BKC Semiconductors Incorporated., Lawrence, MA 01841	508-681-0392
§ Brooks Electronics, Philadelphia, PA 19140	215-228-4433
§† Brooks Power Systems, Bensalem, PA 19020	215-244-0264;1-800-523-1551
§† Bud Industries, Inc., Willoughby, OH 44094-0431	216-946-3200
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
§ Comdata Corp., Morton Grove, IL 60053	708-470-9600
§ Computer Power Inc., High Bridge, NJ 08829	908-638-8000;800-526-5088
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380	607-724-2484
Cosel U.S.A. Inc., (Formerly U.S. Elco Inc.), Santa Clara, CA 95054	408-980-5144
C-S Electronic Sales, Inc., Frankfort, IN 46041	317-659-1874
§† Cuesta Systems Corporation, San Luis Obispo, CA 93401	805-541-4160; 800-332-3440
§† Current Technology, Inc., Richardson, TX 75081-4802	214-238-5300
§ The Cylix Corporation, Westlake VL, CA 91361	805-379-3155
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180	605-665-9301
§ Datatran Corp., Denver, CO 80223	303-778-0870
Diodes Inc., Chatsworth, CA 91311	818-882-4920;800-821-1178
# Douglas International, Inc., Geneva, IL 60134-0761	708-232-7419
Edal Industries, East Haven, CT 06512	203-467-2591
† EEV Inc., Elmsford, NY 10523	914-592-6050
§† EFI Electronics Corp., Salt Lake City, UT 84119	801-977-9009;800-877-1174
§ Electrocube, Monrovia, CA 91016	818-301-0122
§ Electronic Specialists, Natick, MA 01760	508-655-1532;800-225-4876
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Entrelec Inc., Irving, TX 75038	214-550-9025
EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627	714-557-1636
§ FIC Corp., Rockville, MD 20852	301-881-8124;800-638-6594
GBC, Inc., Lamp Division, Ocean, NJ 07712	908-774-8502
§† General Instrument, Power Semiconductor Div., Hicksville, NY 11802	516-933-3333
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659	312-761-0403
§ GlobTek, Inc., Northvale, NJ 07647	201-784-1000

GTE Control Devices, Inc., Standish, ME 04084	207-642-4535
§ Hammond Manufacturing Co., Buffalo, NY 14225	716-894-5710
Hipotronics Inc., Brewster, NY 10509	914-279-8091
Instrument Specialties Co. Headquarters, Delaware Water Gap, PA 18327-0136	717-424-8510
§ Intermatic, Spring Grove, IL 60081	815-675-2321
† International Power Machines, Garland, TX 75042	800-527-1208
Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523	914-347-2474
§ ITW Paktron, Div. of Illinois Tool Works, Lynchburg, VA 24502	804-239-6941
† Joslyn Electronic Systems Corp., Goleta, CA 93116	800-752-8068; 805-968-3551
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359	215-837-0700
L-Com Inc., N. Andover, MA 01845	508-682-6936
†# Lightning Protection Corp., Santa Barbara, CA 93160	805-967-5089/4577
Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955	708-359-2790
§† Microsemi Corp., Santa Ana, CA 92799-6890	714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390	602-941-6300
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
§ MTE Corp., Menomonee Falls, WI 53051	414-253-8200
North American Capacitor Co., Indianapolis, IN 46224	317-273-0090
§ NTE Electronics, Inc., Bloomfield, NJ 07003	201-748-5089
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
§ Perma Power Elctrns., Niles, IL 60714	312-763-0763
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Power Dynamics Inc., West Orange, NJ 07052	201-736-5722
§† Power Integrity Corp., Greensboro, NC 27408	910-379-9773;800-237-6260
§† ProTek Devices, Tempe, AZ 85281	602-968-6060
§ R-K Electronics, Cincinnati, OH 45249	513-489-4060
Sanford-Miller Corp., Oceanside, NY 11572	516-763-0926;800-645-5900
Seacor, Inc., Westwood, NJ 07675	201-666-5600
§ Semikron, Inc., Hudson, NH 03051-0066	603-883-8102;1-800-258-1308
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148	708-620-8394; 1-800-367-5811
§ Shindengen America Inc., Westlake Vl., CA 91362	800-634-3654
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
§ SL Waber, Inc., Mt. Laurel, NJ 08054	609-866-8888;800-257-8384
§ Sola, Elk Grove Village, IL 60007-5666	708-439-2800
§ Square D Co., Palatine, IL 60067	708-397-2600
Staffall Inc., Cranston, RI 02910	401-461-5554
§† Standard Condenser Corp., Skokie, IL 60076	708-675-3133
Stetron International, Inc., Buffalo, NY 14203	716-854-3443
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609	812-332-1435
§ Sunshine Instruments, Philadelphia, PA 19115	215-673-5600;800-343-1199
§† Superior Electric, Warner Electric, Bristol, CT 06010	203-582-9561
§† Surgeonics Limited, Fort Edward, NY 12828	518-747-2156
Sutton Designs, Inc., Ithaca, NY 14850	800-326-8119
§ Teccor Electronics, Inc., Irving, TX 75038	214-580-1515
§ Techni-Tool, Plymouth Meeting, PA 19462	215-825-4990
§ Telebyte Technology, Inc., Greenlawn, NY 11740	516-423-3232;800-835-3298
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
§ TII Industries Inc., Copiague, NY 11726	516-789-5000
§ Total Concept Sales, Glendale, CA 91202-2896	818-547-9476
§† Transtector Systems, Inc., Hayden Lake, ID 83835	800-829-2901
§ Tripp Lite, Chicago, IL 60610-4188	312-329-1777
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9	403-259-3200
§# U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503	310-316-9984
Victoreen, Inc., Solon, OH 44139-3395	216-248-9300;216-248-9043
† Victor Elec. Wire & Cable, W. Warwick, RI 02893	401-821-1700;SALES 401-821-7800
Vitec Electronics Corp., Visalia, CA 93291	209-651-1535
Voltage Multipliers, Inc., Visalia, CA 93291	209-651-1402
§† The Wiremold Company, W. Hartford, CT 06110	203-233-6251
World Products Inc., Systems Devices Grp., Sonoma 95476	707-996-5201
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069	619-471-4001

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Surface Acoustic Wave, Filter-2700 – *See Vol. A*

Surface Mounted Assemblies, Devices & Technology – See Product type: Amplifiers, Circuits, Diodes, etc.

Surveillance (MIL), EW Drone-2440

§† Aydin Corporation (West), San Jose, CA 95119-1371	408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000

Surveillance Systems (MIL)-2440

AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123	619-277-6700
† Condor Systems, Inc., San Jose, CA 95124	408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
† E-Systems, Melpar Div., Falls Church, VA 22046	703-560-5000
# Heitz, Karl, Inc., Woodside, NY 11377	718-565-0004
MACOM, Inc., Lowell, MA 01851	617-272-3000

† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† NAVAN Corporation, Media, PA 19063	215-352-8464
† ST Olektron Systems, Signal Technology Corp., Webster, MA 01570	508-943-7440
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400

Switched Filter Banks-3450 – *See Vol. A*

Switches, Backup-5100

† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Machine Components Corp., Plainview, NY 11803	516-694-7222

Switches, Cam-5100

§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600**	**B•1681-1682**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1694**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100**	**B•1699**
§ **Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200**	**B•1716**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	**B•1722**
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800	**B•1743**
§† **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040**	**B•1754**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1772**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221**	**B•1815**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Chicago Lock Co., Chicago, IL 60641	312-282-7177
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Enprotech Corp., Kalamazoo, MI 49007	616-381-0665
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
§ Entrelec Inc., Irving, TX 75038	214-550-9025
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
† Precision Mechanisms, Westbury, NY 11590	516-ED3-5955
† Pres-Air-Trol Corp., Mamaroneck, NY 10543	914-698-2026;800-431-2625
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549	914-241-1334
§ Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
Techniques, Inc., Englewood, NJ 07631	201-569-5900
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400

Switches, Capacitive – See Switches, Touch Actuated (Vol. B)

Switches, Coaxial – See Switches, RF (Vol. B)

Switches, Coded-5100

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
§ **AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752**	**C•1163**
§ **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200**	**B•1678**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1694,1697-1698**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100**	**B•1699**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1702**
§† **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321**	**B•1708**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1719**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1730-1731,1733**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489**	**B•1756**
† **Janco Corp., Burbank, CA 91508, 818-846-1800**	**B•1759**
§ **Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210**	**B•1770-1771**
§ **MORS Components, Wakefield, MA 01880-4444, 617-246-1007**	**B•1780**
§ **NKK Switches, Scottsdale, AZ 85260, 602-991-0942**	**B•1782,1785,1788**
§† **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200**	**B•1790**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221**	**B•1815**
Airflyte Elctrns. Co., Bayonne, NJ 07002	201-436-2230
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
CTS Corporation, Elkhart, IN 46514	219-293-7511
CTS Corp, Microelectronics, W. Lafayette, IN 47906	317-463-2565
§† EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
Enerco, Inc., Seattle, WA 98108	206-762-1422

Switches, Coded-5100 (Cont'd)

§ ERNI Components, Richmond, VA 23236	804-794-6367
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
§ Inter-Market, Glenview, IL 60025	708-729-5330
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
§ ITT Schadow, Eden Prairie, MN 55344	612-934-4400
† Maurey Instrument Corp., Chicago, IL 60629	312-581-4555
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008	708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056	708-390-6680; 800-323-6693
Seacor, Inc., Westwood, NJ 07675	201-666-5600
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY	0911-65521
TELTEC, Inc., Minneapolis, MN 55425	612-854-9177
§ Via West Interface, Inc., Tucson, AZ 85705	602-623-5716;1-800-266-5716

Switches, Crossbar – See Switches, Matrix (Vol. B)

Switches, Data, Manual-2325 – *See Vol. D*

Switches, Data, Programmable-2325 – *See Vol. D*

Switches, Decade-5100

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1694**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100**	**B•1699**
§† **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1702**
§ **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321**	**B•1708**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221**	**B•1815**
§ C & K Components, Inc., Newton, MA 02158-1082	617-964-6400
§ Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
Meissner Industries, Dover, NJ 07801	201-366-1700
§† OakGrigsby Inc., Sugar Grove, IL 60554	708-556-4200
§ Power Dynamics Inc., West Orange, NJ 07052	201-736-5722
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960

Switches, Diode-3450 – *See Vol. A*

Switches, DIP-5100

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
§ **AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752**	**B•1666-1667, C•1163**
§ **Aries Electronics, Frenchtown, NJ 08825, 908-996-6841**	**B•1673**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
§ **CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575**	**B•1704-1705**
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**B•1706**
§† **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1730-1731**
§ **ITT Schadow, Eden Prairie, MN 55344, 612-934-4400**	**B•1744**
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374**	**B•1765**
§ **Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210**	**B•1770-1771**
§ **MORS Components, Wakefield, MA 01880-4444, 617-246-1007**	**B•1780**
§ **NKK Switches, Scottsdale, AZ 85260, 602-991-0942**	**B•1782-1785,1788-1789**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
§† American Research & Engineering, Elgin, IL 60123	708-888-7245
§ Annulus Technical Industries, Inc., Port Dover, Ont., CAN NOA 1NO	519-583-3440
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Assmann Electronics, Inc., Assmann Electronics GMBH, Tempe, AZ 85283	602-897-7001
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
§† CTS Corporation, Elkhart, IN 46514	219-293-7511
Direct Sound Corporation, Boston, MA 02116	1-800-372-1616
§ EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
E-Mark, Inc., Trumbull, CT 06611	203-452-1003
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
General Electronic Materials Technology, Los Alamitos, CA 90720	714-761-5684
§ ICO-RALLY Corporation, Palo Alto, CA 94303	415-856-9900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
International Microelectronics, Arlington, TX 76003	817-473-1730
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459	203-283-8261
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008	708-364-6038
§ North American Capacitor Co., Indianapolis, IN 46224	317-273-0090
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
RC Electronics, Fremont, CA 94538-3164	510-656-8490
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
§ SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
§ TELTEC, INC., Minneapolis, MN 55425	612-854-9632
§ TELTEC, Inc., Minneapolis, MN 55425	612-854-9177
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
USAPEX Corp., Santa Clara, CA 95051	408-982-9063
§ Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710	813-347-2181
§ Weitz Electronics/Marvwa USA, New York, NY 10022	718-523-3688

Switches, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1208, C•1163**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171**	**B•1799**
T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227	**B•1814**
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
§ EAO Switch Corp., Milford, CT 06460	203-877-4577
Fiberguide Industries Inc., Stirling, NJ 07980	908-647-6601
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
Gems Sensors Division, Div. of IMO Industries Inc., Plainville, CT 06062-1198	203-747-3000
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
MarLee Switch Co., Upland, CA 91786	714-982-8988
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
Optivision, Inc., Davis, CA 95616	916-757-4850;800-562-8934
† Penn Keystone Corp., Wallingford, CT 06492	203-294-0537
§ SC Technology, Inc., Livermore, CA 94550	510-373-9230
Signal Switch Company, Corona, CA 91720	909-736-5404
† UCE, Inc., Norwalk, CT 06854	203-838-7509
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Switches, Foot Pedal, Mat, Ribbon, etc.-5100

§ **Altech Corp., Flemington, NJ 08822-6000, 908-806-9400**	**C•1156**
§† **Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625**	**B•1800**
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
Herga Inc. Herga Electric Limited, West Chester, PA 19380	215-430-1970
§ Lektra Laboratories Inc., Bronx, NY 10451	718-292-8243
§† Linemaster Switch, Woodstock, CT 06281-0238	203-974-1000
§ Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
§ Marsh Products, Inc., Spectrum Companies, Intl., Batavia, IL 60510	708-879-8008
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Square D Co., Palatine, IL 60067	708-397-2600
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312
WECO Electrical Connectors, Inc., Mooers, NY 12958	518-298-4810

Switches, Hall Effect-5100

American Electronic Components, Elkhart, IN 46514, 219-264-1116	**B•1711**
BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600	**B•1681**
§ **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1973**
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670	800-262-4638; 800-525-3536
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514	216-758-8299
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075	214-422-1844; 1-800-872-0044
§ EAO Switch Corp., Milford, CT 06460	203-877-4577
Keithley Instrs., Cleveland, OH 44139	800-552-1115
§ Linemaster Switch, Woodstock, CT 06281-0238	203-974-1000
§ Machine Components Corp., Plainview, NY 11803	516-694-7222
MagneLink, Inc., Hillsboro, OR 97123	800-638-0801
† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015	800-222-7846
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006	214-466-6000
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992	219-563-2191

Switches, High Voltage (Over 250 Volts)-5100

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1405**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100**	**B•1699**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075	**B•1474**
Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260	**B•1710**
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577**	**B•1713**
§† **Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200**	**B•1716**
Hermetic Switch, Chickasha, OK 73018, 405-224-4046	**B•1737**
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800	**B•1743**
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	**D•1192**
† **Janco Corp., Burbank, CA 91508, 818-846-1800**	**B•1759**
† **Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560**	**B•1540**

McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200 .... B•1768-1769
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629 .... C•1137
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1593,1802
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 .... B•1810
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Carlingswitch, Inc., Plainville, CT 06062-1177 .... 203-793-9281;1-800-243-8556
C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Dreefs Switch, Inc., Waukegan, IL 60087 .... 708-662-7667;800-323-9605
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
† EG&G, Inc., Electronics Components Div., Salem, MA 01970 508-745-3200
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761 904-672-7335
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Ferraz Corporation, Parsippany, NJ 07054 .... 201-428-8400;800-526-9067
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
Instrument Research Co., Columbia, MD 21045 410-740-3411
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
J. R. Merritt Controls, Inc., Norwalk, CT 06854 .... 203-855-9100;800-333-5762
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
† Multi-Tech Industries, Inc., Marlboro, NJ 07746 908-462-6100
§ OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
† Precision Mechanisms, Westbury, NY 11590 .... 516-ED3-5955
§ Square D Co., Palatine, IL 60067 708-397-2600
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
Teledyne Kinetics, Div. of Teledyne, Inc., San Diego, CA 92123-1502 619-576-1005

Switches, Illuminated-5100

A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700 .... B•1669
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1670-1671
Aztec Industries, Inc., Mesa, AZ 85210, 602-833-3131;800-729-3132 .... B•1821
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 .... B•1685
Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 .... B•1687
§ **Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556 .... B•1350,1688-1689**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1693,1697
Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1702
CW Industries, Southhampton, PA 18966, 215-355-7080 .... B•1707
Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616 .... B•1709
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577 .... B•1713**
† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 .... B•1714-1715**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639 .... B•1722
George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1832
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1738-1740
† **IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 .... B•1078**
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... B•1742
§ **ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 .... B•1745,1839**
§ **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 .... B•1746-1749,1752**
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .. B•1756
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374 .... B•1760-1761
§ **McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200 .... B•1767,1769**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1775**
§ **NKK Switches, Scottsdale, AZ 85260, 602-991-0942 .... B•1782,1784-1785,1787**
§† **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 .... B•1793**
Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 .... B•1797
§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 .... B•1803**
† **Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610 .... B•1804-1806,1850-1851**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... C•1460
Solico/Mec, Hartford, CT 06114, 203-527-3092 .... B•1812
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 .... B•1813
†# **Veetronix, Inc., Lexington, NE 68850, 308-324-4600 .... B•1816-1817**
ACI Components, Inc., Laguna Hills, CA 92653 714-588-9611
Advanced Connector Technology, Ventura, CA 93003 805-644-9990
Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Dialight Corporation, Manasquan, NJ 08736 908-223-9400
§ Dreefs Switch, Inc., Waukegan, IL 60087 .... 708-662-7667;800-323-9605
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
Elna America, Inc., Cypress, CA 90630 714-761-8600
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
# GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Janco Corp., Burbank, CA 91508 818-846-1800
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805 .... 708-398-5311;800-323-5207
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 804-766-1500
§ MEC A/S, Ballerup, DENMARK DK-2750 011-45-44973366
§ MORS Components, Wakefield, MA 01880-4444 617-246-1007
New England Keyboard Inc., Fitchburg, MA 01420 508-345-8332
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
RDI Elctrns., Inc., Mamaroneck, NY 10543 914-777-7000
Seacor, Inc., Westwood, NJ 07675 201-666-5600
Sorenson Lighted Controls, Hartford, CT 06114 .... 203-527-3092;1-800-275-7089
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492 203-269-3337
§ Unimax, A Divison of C & K, Wallingford, CT 06492 203-269-8701
United Switch Company, Seattle, WA 98199 206-282-8823

Switches, Intelligent-5100

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 .... B•1665
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 .... B•1684**
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469 .... B•1852
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 .. 800-523-2702;601-467-8231
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
Ocean Motions Co., Barrington, RI 02806 401-246-1394

Switches, Interlock-5100

American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711
§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 .... B•1683**
† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 .... B•1687**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1693**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 .... B•1699**
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577 .... B•1713**
§† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 .... B•1714**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639 .... B•1722
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 .... B•1727
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1772-1773,1775,1777**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 .... B•1798-1799**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 .... B•1810
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 .... B•1813**
§ Carlingswitch, Inc., Plainville, CT 06062-1177 .... 203-793-9281;1-800-243-8556
§† C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§† C.P. Clare Corp., Chicago, IL 60645 312-262-7700
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761 904-672-7335
† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
† Kilovac Corp., Santa Barbara, CA 93140-4422 .... 805-684-4560;App. Hot Line 800-253-4560
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427 513-898-3621
MagneLink, Inc., Hillsboro, OR 97123 800-638-0801
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ MORS Components, Wakefield, MA 01880-4444 617-246-1007
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
Seacor, Inc., Westwood, NJ 07675 201-666-5600
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
† Signal Systems International, Lavalette, NJ 08735 908-793-4668
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 708-964-2330
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492 203-269-3337
§ Unimax, A Divison of C & K, Wallingford, CT 06492 203-269-8701
United Switch Company, Seattle, WA 98199 206-282-8823

Switches, Keyboard-5150

† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300 .... B•1687**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1693,1824**
Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 .. B•1708
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577 .... B•1713**
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804, 408-922-9000 .... B•1831
† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1832**
The Hall Company, Urbana, OH 43078, 513-652-1376 .... B•1834

Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836-1837**
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400	**B•1744-1745,1839**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040	**B•1746,1748**
Jayco Interface Technology, Orange, CA 92665, 714-974-1701	**B•1840**
Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210	**B•1771**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1777**
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942	**B•1784**
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629	**C•1137**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1803**
† Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610	**B•1804,1851**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600	**B•1816-1817**
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469	**B•1852**
Advanced Connector Technology, Ventura, CA 93003	805-644-9990
Advanced Input Devices, Coeur d'Alene, ID 83814	208-765-8000;800-444-5923
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201	414-355-8300
§ Corby Industries, Inc., Allentown, PA 18103	215-433-1412
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501	515-573-1300
§ DataLux Corp., Winchester, VA 22602	703-662-1500
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135	408-922-9000
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
# GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
† Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
International Microelectronics, Arlington, TX 76003	817-473-1730
§ ITT Components, ITT Corporation, Irvine, CA 92718	714-727-3001
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666	804-766-1500
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
§ Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
§ Marsh Products, Inc., Spectrum Companies, Intl., Batavia, IL 60510	708-879-8008
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
MOLEX, Inc., Lisle, IL 60532	708-969-4550
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
§# Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
Seacor, Inc., Westwood, NJ 07675	201-666-5600
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
§# Solico/Mec, Hartford, CT 06114	203-527-3092
Spectra Lux Corp., Kirkland, WA 98034	206-823-6857
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY	0911-65521
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
United Switch Company, Seattle, WA 98199	206-282-8823
Westlake Components International, Westlake Village, CA 91361	800-228-1097

Switches, Key Lock-5100

Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200	**B•1677**
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600	**B•1682**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131	**B•1685**
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300	**B•1687**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1693**
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100	**B•1699**
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**B•1703**
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577	**B•1713**
§ Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200	**B•1716**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1719-1720**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	**B•1722**
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550	**B•1739-1740**
§ Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800	**B•1742-1743**
† Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1759**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1775**
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942	**B•1783**
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200	**B•1795**
§† Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794	**B•1797**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1803**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
§ Alarm Controls Corporation, Deer Park, NY 11729	516-586-4220
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
§ C & K Components, Inc., Newton, MA 02158-1082	617-964-6400
§ Chicago Lock Co., Chicago, IL 60641	312-282-7177
§ Corby Industries, Inc., Allentown, PA 18103	215-433-1412
§ Direct Sound Corporation, Boston, MA 02116	1-800-372-1616
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
Entech Systems, Inc., Simsbury, CT 06070	203-651-9557
§ Entrelec Inc., Irving, TX 75038	214-550-9025
§ Furnas Elec., Batavia, IL 60510	708-879-6000
George Risk Industries, Inc., Kimball, NE 69145	308-235-4645
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
§ Grayhill Inc., La Grange, IL 60525	708-354-1040
International Microelectronics, Arlington, TX 76003	817-473-1730
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634	312-282-4040
Judco Mfg. Inc., Harbor City, CA 90710	310-534-0959
Lamb Industries, Inc., Portland, OR 97225	503-297-8878,800-824-9374
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
§ MORS Components, Wakefield, MA 01880-4444	617-246-1007
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
§ Power Dynamics Inc., West Orange, NJ 07052	201-736-5722
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Square D Co., Palatine, IL 60067	708-397-2600
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701
United Switch Company, Seattle, WA 98199	206-282-8823

Switches, Leaf, Single/Multiple-5100

Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	B•1809
Capitol Switch Inc., Bethel, CT 06801	203-744-3300
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634	312-282-4040
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701

Switches, Lever/Paddle-5100

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**C•1163**
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933	**B•1132,1671-1672**
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200	**B•1679**
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600	**B•1681-1683**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131	**B•1685**
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400	**B•1684**
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300	**B•1687**
§ Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556	**B•1691**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1693-1697**
§ Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**B•1702**
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**B•1706**
§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	B•1708
§ Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616	**B•1709**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	B•1722-1723
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550	**B•1739**
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040	**B•1754**
McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200	**B•1767-1768**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1772-1777**
§ MORS Components, Wakefield, MA 01880-4444, 617-246-1007	**B•1779,1781**
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942	**B•1782-1783,1785-1786,1789**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796**
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171	**B•1798-1799**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**B•1809**

§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700	**B•1813**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
† Cole Instrument Corp., Santa Ana, CA 92704	714-556-3100
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936	201-887-9400
Dreefs Switch, Inc., Waukegan, IL 60087	708-662-7667;800-323-9605
§ EAO Switch Corp., Milford, CT 06460	203-877-4577
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§† Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
Entech Systems, Inc., Simsbury, CT 06070	203-651-9557
§ Furnas Elec., Batavia, IL 60510	708-879-6000
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Hamlin Inc., Lake Mills, WI 53551	414-648-3000
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6	416-292-4463
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
§ Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
§† Namco Controls Corporation, Mentor, OH 44060	216-946-9900
§† OakGrigsby Inc., Sugar Grove, IL 60554	708-556-4200
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701

Switches, Limit-5100

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1662**
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600	**B•1681-1683**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1695**
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1173**
§† Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311	**B•1702, C•1577**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1727**
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040	**B•1729,1733**
† Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1759**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1772-1773**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796**
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171	**B•1798-1799**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1803**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ Altech Corp., Flemington, NJ 08822-6000	908-806-9400
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
† Control Products, Inc., E. Hanover, NJ 07936	201-887-9400
Daido Precision Engineered Products/, Sumtak Electronics, Somerset, NJ 08875	908-805-1900
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
§ Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Furnas Elec., Batavia, IL 60510	708-879-6000
† Giannini Institute, Indio, CA 92201	619-347-2833
§ Gordon Products, Brookfield, CT 06804	203-775-4501
§ Go Switch, Louisville, KY 40233	502-969-2386
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
Hermetic Switch, Chickasha, OK 73018	405-224-4046
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634	312-282-4040
† Machine Components Corp., Plainview, NY 11803	516-694-7222
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
Magnetoelastic Devices, Pittsfield, MA 01201	413-445-5608
Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
§ MORS Components, Wakefield, MA 01880-4444	617-246-1007
§† Namco Controls Corporation, Mentor, OH 44060	216-946-9900
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
Parker Hannifin Corp., Cleveland, OH 44112-1290	800-272-7537;800-C-PARKER
§ Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
† Precision Mechanisms, Westbury, NY 11590	516-ED3-5955
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543	914-698-2026;800-431-2625
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
† Saint Switch, Inc., St. Charles, IL 60174	708-377-3779
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
† Signal Systems International, Lavalette, NJ 08735	908-793-4668
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788	516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Square D Co., Palatine, IL 60067	708-397-2600
† Sterling Instruments, a DSG Company, New Hyde Pk., NY 11042-5416	516-328-3300
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000

Switches, Liquid Level-5100

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1662**
Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374	**B•1761**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777	**B•1811**
Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
§ Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
Gordon Products, Brookfield, CT 06804	203-775-4501
Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
Intek, Inc., Westerville, OH 43081	614-895-0301
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
Ocean Motions Co., Barrington, RI 02806	401-246-1394
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Switches, Lock — See Switches, Key Lock (Vol. B)

Switches, Low Voltage-5100

§ Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556	**B•1350,1690**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1695**
§† CW Industries, Southhampton, PA 18966, 215-355-7080	**B•1707**
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525	**B•1845**
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942	**B•1782-1783,1785-1786,1789**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1888-1889**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600	**B•1817**
§ Annulus Technical Industries, Inc., Port Dover, Ont., CAN NOA 1NO	519-583-3440
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
§ C & K Components, Inc., Newton, MA 02158-1082	617-964-6400
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501	515-573-1300
CUI Stack Inc., Beaverton, OR 97005	503-643-4899
§ Dreefs Switch, Inc., Waukegan, IL 60087	708-662-7667;800-323-9605
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
ELMA Electronic Inc., Fremont, CA 94538	510-656-3400
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602	203-382-3023
Henricks Technologies, Inc., Forsyth, GA 31029	912-993-1060;800-241-0806
ITT Schadow, Eden Prairie, MN 55344	612-934-4400
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634	312-282-4040
Keithley Instrs., Cleveland, OH 44139	800-552-1115
Lamb Industries, Inc., Portland, OR 97225	503-297-8878,800-824-9374
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ MORS Components, Wakefield, MA 01880-4444	617-246-1007
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Schurter, Inc., Petaluma, CA 94954	800-848-2600 ext.62
Seacor, Inc., Westwood, NJ 07675	201-666-5600
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610

Switches, Low Voltage-5100 (Cont'd)

Shallco, Inc., Smithfield, NC 27577	919-934-3135; 1-800-876-3135
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701
United Switch Company, Seattle, WA 98199	206-282-8823

Switches, Matrix-5100

CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117	**D•1250**
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1403**
Information Transfer Inc., Bloomfield, NY 14469, 716-657-7074	**D•1192-1193**
† **JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340**	**D•1275**
Keithley Instrs., Cleveland, OH 44139, 800-552-1115	**D•1287**
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448	**B•1843**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301	**B•1562-1563,1565**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**A•1673, D•1200**
† **Signal Switch Company, Corona, CA 91720, 909-736-5404**	**B•1479**
§ **T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227**	**B•1814**
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
Advanced Input Devices, Coeur d'Alene, ID 83814	208-765-8000;800-444-5923
Amber Inds., Inc., Carrollton, TX 75006	214-490-9801
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
Bytex Corp., Westborough, MA 01581	508-366-8000
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
§ Covid, Inc., Tempe, AZ 85281	602-966-2221
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
Dow-Key Microwave Corporation, Ventura, CA 93003	805-650-0260
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086	408-732-0880
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
# Glasgal Communications, Inc., Northvale, NJ 07647	201-768-8082
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
† Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634	312-282-4040
† Joslyn Jennings Corporation, San Jose, CA 95122-2696	408-292-4025
K&L Microwave, Inc., Salisbury, MD 21801	410-749-2424
L-Com Inc., N. Andover, MA 01845	508-682-6936
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6	416-292-4463
† Loral Microwave-Wavecom, Northridge, CA 91324	818-882-3010
§ Mantex Corp., Oxford, MI 48371	313-628-8210
† MarLee Switch Co., Upland, CA 91786	714-982-8988
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3	613-592-2122
§ Network Technologies Inc., Aurora, OH 44202	216-562-7070/800-742-8324
OMNI Switch USA, Inc., Phoenix, AZ 85027	602-582-0629
Optivision, Inc., Davis, CA 95616	916-757-4850;800-562-8934
§† Oxley Inc., Branford, CT 06405	203-488-1033
P.G. Electronics Ltd., Weston, Ont., CANADA M9M2Z8	416-741-7682
§ Racal-Datacom, Sunrise, FL 33323-2899	305-846-1601;1-800-RACAL-55
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
§ Sierra Automated Systems & Engineering Corp., Burbank, CA 91504	818-840-6749
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
† Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220
Telenex Corporation, A Unit of General Signal Corp., Mt. Laurel, NJ 08054	609-234-7900
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
§† Touch Technology, Austin, TX 78746	512-328-9284
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412

Switches, Membrane-5150

Aztec Industries, Inc., Mesa, AZ 85210, 602-833-3131;800-729-3132	**B•1821**
The Bergquist Co., Minneapolis, MN 55439, 800-347-4572	**B•1822-1823**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1824**
Douglas Corp., Eden Prairie, MN 55344-3512, 612-941-3847;1-800-728-3189	**B•1826**
EAO Switch Corp., Milford, CT 06460, 203-877-4577	**B•1713**
The Hall Company, Urbana, OH 43078, 513-652-1376	**B•1834**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836-1837**
Jayco Interface Technology, Orange, CA 92665, 714-974-1701	**B•1840-1841**
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448	**B•1842-1843**
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525	**B•1845**
New England Keyboard Inc., Fitchburg, MA 01420, 508-345-8332	**B•1847**
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629	**C•1137**
Pactec Corp., LaFrance Corp., Philadelphia, PA 19153, 215-365-8400	**C•1064,1068**
† **S & S Associates, Inc., San Luis Obispo, CA 93401, 805-544-2500**	**C•1082-1083**
§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62**	**B•1803**
† **Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610**	**B•1806,1850**
# **Thrust Industries, Inc., Haubstadt, IN 47639, 800-467-6730;812-768-6730**	**C•1668**
Advanced Connector Technology, Ventura, CA 93003	805-644-9990
Advanced Input Devices, Coeur d'Alene, ID 83814	208-765-8000;800-444-5923
A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
† Barrington Plastics, Mt. Laurel, NJ 08054	609-235-5151
† Basic Electronics, Inc., Stanton, CA 90680	714-530-2400
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201	414-355-8300
† C.A.M. Graphics Co., Inc., Amityville, NY 11701	516-842-3400
C.P. Clare Corp., Chicago, IL 60645	312-262-7700
EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
Endicott Research Group, Endicott, NY 13760	607-754-9187
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804	408-922-9000
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
† GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
† Hallmark Technologies, Mt. Dora, FL 32757	800-874-9063
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
LaFrance Corp., Philadelphia, PA 19153-3893	215-365-8000
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666	804-766-1500
§ Mantex Corp., Oxford, MI 48371	313-628-8210
§ Marsh Products, Inc., Spectrum Companies, Intl., Batavia, IL 60510	708-879-8008
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§† Miller Dial Corp., El Monte, CA 91731	818-444-4555
§ MOLEX, Inc., Lisle, IL 60532	708-969-4550
Moxness Products, Inc., Versa Technologies, Racine, WI 53405	414-554-5050; 800-558-5706
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383	219-477-4488
Paneltec, Santa Clara, CA 95054	408-496-1175
† Sheldahl, Inc., Northfield, MN 55057	507-663-8000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
† Southwestern Nameplate & Mfg. Co., Inc., Anna, TX 75003	214-231-6663; 214-924-3289;1-800-331-6600
§† Square D Co., Palatine, IL 60067	708-397-2600
Tarsan Eng. Inc., Burlingame, CA 94010	415-348-8666;800-284-8666
Technical Panels, Inc., Lake Havasu City, AZ 86403	602-680-9191
§ Topflight, York, PA 17404	717-843-9901;800-233-9386
2M Sales Company, Burnsville, MN 55337	612-890-7774
United Switch Company, Seattle, WA 98199	206-282-8823
USAPEX Corp., Santa Clara, CA 95051	408-982-9063
Westlake Components International, Westlake Village, CA 91361	800-228-1097

Switches, Mercury Displacement-5100

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1405**
§ **American Electronic Components, Elkhart, IN 46514, 219-264-1116**	**B•1711**
§ **Comus International, Nutley, NJ 07110, 201-667-6200;1-800-35-COMUS**	**B•1700**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1726-1727**
† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1777**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777	**B•1810**
§ CCW Industries Inc., Bethel, CT 06801	203-744-6715
C.P. Clare Corp., Chicago, IL 60645	312-262-7700
C.P Clare Corp., Chicago, IL 60645	312-262-7700
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
International Microelectronics, Arlington, TX 76003	817-473-1730
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
† Select Controls Inc., Bohemia, NY 11716	516-467-8577
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788	516-582-5600

Switches, Microwave — See Switches, Diode (Vol. A)

Switches, Momentary Action-5100

§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933**	**B•1670-1671**
§ **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200**	**B•1677**
§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600**	**B•1682-1683**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1695**
§ **CUI Stack Inc., Beaverton, OR 97005, 503-643-4899**	**B•1706**
§† **CW Industries, Southhampton, PA 18966, 215-355-7080**	**B•1707**
§ **Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616**	**B•1709**
§† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180**	**B•1714-1715**
§† **Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200**	**B•1716**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1718,1720**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	**B•1722-1723**
† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1729**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1740**

§ Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800	**B•1742-1743**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836-1837**
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400	**B•1744**
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040	**B•1746,1748-1749,1753-1754**
† Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1758-1759**
Jayco Interface Technology, Orange, CA 92665, 714-974-1701	**B•1840**
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374	**B•1760-1761,1763,1765**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1772-1773,1775-1776**
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942	**B•1782-1789**
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200	**B•1793**
§† Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794	**B•1797**
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171	**B•1798-1799**
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625	**B•1800**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1803**
† Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610	**B•1850**
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**B•1809**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
§# Solico/Mec, Hartford, CT 06114, 203-527-3092	**B•1812**
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700	**B•1813**
§ T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227	**B•1814**
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600	**B•1816-1817**
Advanced Connector Technology, Ventura, CA 93003	805-644-9990
Aerodyne Controls Corporation, Ronkonkoma, NY 11779	516-737-1900
Aerospace Optics, Inc., Fort Worth, TX 76112	817-451-1141
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
† Basic Electronics, Inc., Stanton, CA 90680	714-530-2400
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201	414-355-8300
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§ Carlingswitch, Inc., Plainville, CT 06062-1177	203-793-9281;1-800-243-8556
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
Conductive Rubber Technology, Inc., Bothell, WA 98021	206-486-8559
† Control Products, Inc., E. Hanover, NJ 07936	201-887-9400
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501	515-573-1300
CTS Corp., Electrocomponents, Elkhart, IN 46514	219-295-3575
§ DataLux Corp., Winchester, VA 22602	703-662-1500
§ Dreefs Switch, Inc., Waukegan, IL 60087	708-662-7667;800-323-9605
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101	718-937-8000
§ EAO Switch Corp., Milford, CT 06460	203-877-4577
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
§† Entech Systems, Inc., Simsbury, CT 06070	203-651-9557
§ Gaynor Electric Co., Thomaston, CT 06787-0316	203-283-4388
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602	203-382-3023
# GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
† Hallmark Technologies, Mt. Dora, FL 32757	800-874-9063
§ Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065	805-522-7958
† Hoffman Engineering Corp., Stamford, CT 06902	203-325-8933
Hokuriku USA Ltd., Madison, AL 35758	205-772-9620
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
International Microelectronics, Arlington, TX 76003	817-473-1730
§ ITT Components, ITT Corporation, Irvine, CA 92718	714-727-3001
Judco Mfg. Inc., Harbor City, CA 90710	310-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060	708-949-8505
Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
§† Machine Components Corp., Plainview, NY 11803	516-694-7222
§ Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
Microavionics Corp., Costa Mesa, CA 92626	714-957-6904
§ MORS Components, Wakefield, MA 01880-4444	617-246-1007
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008	708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056	708-390-6680; 800-323-6693
§ Power Dynamics Inc., West Orange, NJ 07052	201-736-5722
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Seacor, Inc., Westwood, NJ 07675	201-666-5600
Shallco, Inc., Smithfield, NC 27577	919-934-3135; 1-800-876-3135
Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
§ Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
§† Square D Co., Palatine, IL 60067	708-397-2600
† Stacoswitch, Costa Mesa, CA 92626	714-549-3041
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492	203-269-3337
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701
United Switch Company, Seattle, WA 98199	206-282-8823
Wilbrecht Electronics, St. Paul, MN 55107	612-222-2791

Switches, Multiposition-5100

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230	**B•1239**
American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1666-1667, C•1163**
§ Aries Electronics, Frenchtown, NJ 08825, 908-996-6841	**B•1673, C•1268**
§ Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556	**B•1350**
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1695,1697-1698**
§ CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**B•1706**
§† CW Industries, Southhampton, PA 18966, 215-355-7080	**B•1707**
§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	**B•1708**
† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260	**B•1710**
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200	**B•1716**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1718**
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040	**B•1729,1731-1733**
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550	**B•1740**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040	**B•1751**
§ IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489	**B•1756**
† Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1758-1759**
Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210	**B•1771**
§ MORS Components, Wakefield, MA 01880-4444, 617-246-1007	**B•1778**
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200	**B•1791-1792,1795**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796**
Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794	**B•1797**
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171	**B•1798-1799**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**A•1606-1607, B•1803, C•1453**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
Solico/Mec, Hartford, CT 06114, 203-527-3092	**B•1812**
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221	**B•1815**
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600	**B•1816**
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811	**B•2025**
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
Arcolectric Corp., Canoga Park, CA 91304	818-700-1933
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
C & K Components, Inc., Clayton, NC 27520	919-553-3131
§ C & K Components, Inc., Newton, MA 02158-1082	617-964-6400
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
Chicago Lock Co., Chicago, IL 60641	312-282-7177
† Cole Instrument Corp., Santa Ana, CA 92704	714-556-3100
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501	515-573-1300
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
§ Dreefs Switch, Inc., Waukegan, IL 60087	708-662-7667;800-323-9605
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§† EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680	714-669-9473
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
§† Entech Systems, Inc., Simsbury, CT 06070	203-651-9557
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
§ ITT Schadow, Eden Prairie, MN 55344	612-934-4400
Judco Mfg. Inc., Harbor City, CA 90710	310-534-0959
K&L Microwave, Inc., Salisbury, MD 21801	410-749-2424
Lamb Industries, Inc., Portland, OR 97225	503-297-8878,800-824-9374
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
§† Machine Components Corp., Plainview, NY 11803	516-694-7222
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
† Microavionics Corp., Costa Mesa, CA 92626	714-957-6904
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
† Multi-Tech Industries, Inc., Marlboro, NJ 07746	908-462-6100

Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
Sorenson Lighted Controls, Hartford, CT 06114 .... 203-527-3092;1-800-275-7089
§† Spectrol Electronics Corp., Ontario, CA 91761 909-923-3313
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
United Switch Company, Seattle, WA 98199 206-282-8823
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Switches, Optical-3700

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1662
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1696
Approved Purification Corp., Stamford, CT 06907 203-357-0141
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
BT & D Technologies, Kennett Square, PA 19348 .... 215-444-6888;800-545-4306
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 .... 214-422-1844; 1-800-872-0044
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 .... 418-683-0211; 1-800-663-EXFO
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
† HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Isocom Inc., Campbell, CA 95008 408-370-2212
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Optivision, Inc., Davis, CA 95616 .... 916-757-4850;800-562-8934
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Quality Technologies, Sunnyvale, CA 94086 408-720-1440
§ SC Technology, Inc., Livermore, CA 94550 510-373-9230
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
† UCE, Inc., Norwalk, CT 06854 203-838-7509
United Switch Company, Seattle, WA 98199 206-282-8823

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§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1740
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1324-1325
Aleph International Corp., San Fernando, CA 91340 .... 818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974 908-464-3550
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171 .... 617-328-3300;1-800-225-5280
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 .... 215-524-2000; 800-441-8246
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 708-882-5757
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458 201-825-9696
† HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
§ Isocom Inc., Campbell, CA 95008 408-370-2212
§ IVO Industries, Inc., Eatontown, NJ 07724 .... 908-542-5151;800-932-0489
§ McGill Electrical Product Group, Valparaiso, IN 46383 219-465-2200
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173 708-843-7900
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
§ Redington Counters, Windsor, CT 06095 203-688-6205
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
Silonex Inc., Plattsburgh, NY 12901 518-561-3160
§† Square D Co., Palatine, IL 60067 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 919-266-3671
I I Stanley Co., Inc., Irvine, CA 92714 .... 1-800-LED-LCD1
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664 512-388-2522

Switches, Power-5100

§ American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1674
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 .... B•1682
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 .... B•1685
§ Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556 .... B•1350,1688-1691
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1695-1696
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1437
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 .... B•1699
CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 .... B•1704
§ CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 .... B•1706
§† CW Industries, Southhampton, PA 18966, 215-355-7080 .... B•1707
§ Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616 .... B•1709
† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1710
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 .... B•1713
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 .... B•1715
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 .... B•1716
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639 .... B•1722
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 .... C•1340
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1729
§† Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800, 609-896-0009 .... B•1360
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 .... B•1737
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... B•1742-1743
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 .... B•1754-1755
† Janco Corp., Burbank, CA 91508, 818-846-1800 .... B•1759
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560 .... B•1540
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374 .... B•1760,1763-1765
§ McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200 .... B•1767-1769
Mechanical Products Inc., Jackson, MI 49204, 517-782-0391 .... B•1369-1373
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1772-1773,1775
§ MORS Components, Wakefield, MA 01880-4444, 617-246-1007 .... B•1778-1779
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942 .... B•1782,1789
† Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 .... B•1797
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 .... B•1801
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1593,1802
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 .... B•1803
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 .... B•1808
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .... B•1809
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 .... B•1810
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 .... B•1813
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 .... B•1815
Weber Protection, inc., Malvern, PA 19355, 610-651-0770;800-WEBERPA .... B•1391-1393
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
§ Arrow Hart Controls, Products Unlimited Corp., Sterling, IL 61081 815-626-0300
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
Delta Products Corporation, Fremont, CA 94538 510-770-0660
§ Dreefs Switch, Inc., Waukegan, IL 60087 .... 708-662-7667;800-323-9605
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
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† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761 904-672-7335
§ Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Ferraz Corporation, Parsippany, NJ 07054 .... 201-428-8400;800-526-9067
§ Furnas Elec., Batavia, IL 60510 708-879-6000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
Hamlin Inc., Lake Mills, WI 53551 414-648-3000
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427 513-898-3621
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
J. R. Merritt Controls, Inc., Norwalk, CT 06854 .... 203-855-9100;800-333-5762
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Multi-Tech Industries, Inc., Marlboro, NJ 07746 908-462-6100
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† OakGrigsby Inc., Sugar Grove, IL 60554 708-556-4200
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110 708-428-7171
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818

§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
§ Payne Engineering, Scott Depot, WV 25560	304-757-7353
Power Dynamics Inc., West Orange, NJ 07052	**201-736-5722**
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549	**914-241-1334**
Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081	201-379-7778
Shokai Far East Ltd., Peekskill, NY 10566	**914-736-3500**
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	**714-996-0960**
Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§† Square D Co., Palatine, IL 60067	**708-397-2600**
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
Teledyne Kinetics, Div. of Teledyne, Inc., San Diego, CA 92123-1502	619-576-1005
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
§ USD Products , Div. of Bussmann, Chicago, IL 60656	708-867-4600
§ Walther Electric Corporation, WALTHER WERKE, Ferdinand Walther, E. Brunswick, NJ 08816	908-238-1166

Switches, Pressure-5100

Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•1796**
† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625	**B•1800**
Aerodyne Controls Corporation, Ronkonkoma, NY 11779	516-737-1900
§ Automatic Switch Co., Florham Park, NJ 07932	1-201-966-2000
§† Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058	213-589-6181
Cambridge Aeroflo, Inc., Shirley, MA 01464	508-425-2346
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
Custom Control Sensors, Inc., Chatsworth, CA 91313-2516	818-341-4610
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342	818-362-7151
† Electro National Corp., Canton, MS 39046	601-859-5511
§ Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
Herga Inc. Herga Electric Limited, West Chester, PA 19380	215-430-1970
§ IC Sensors, Inc., Milpitas, CA 95035	800-767-1888
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Lamb Industries, Inc., Portland, OR 97225	503-297-8878,800-824-9374
§ Leybold Inficon Inc., E. Syracuse, NY 13057-9714	315-434-1100
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786	305-973-6166
Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§ Norgren, Littleton, CO 80120-1663	303-794-2611
§ Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
† Pressure Controls, Inc., Belleville, NJ 07109	201-751-5002
§ SOR, Inc., Lenexa, KS 66215	913-888-2630
§† Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000

Switches, Program-5100

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1696**
CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575	**B•1704**
§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	**B•1708**
§ Jolo Industries, Inc., Garden Grove, CA 92643, 714-554-6840	**C•1360**
NKK Switches, Scottsdale, AZ 85260, 602-991-0942	**B•1782,1789**
OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200	**B•1790**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221	**B•1815**
Airflyte Elctrns. Co., Bayonne, NJ 07002	201-436-2230
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498	203-399-6253
§† American Research & Engineering, Elgin, IL 60123	708-888-7245
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
† Cole Instrument Corp., Santa Ana, CA 92704	714-556-3100
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
§ Cramer Co., Old Saybrook, CT 06475-1261	800-247-6784
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022	**201-941-4455**
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ Dreefs Switch, Inc., Waukegan, IL 60087	**708-662-7667;800-323-9605**
§† EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	**800-452-4844**
Inter-Market, Glenview, IL 60025	708-729-5330
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
§ IVO Industries, Inc., Eatontown, NJ 07724	**908-542-5151;800-932-0489**
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	**813-347-2181**
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	**513-898-3621**
§ MEC A/S, Ballerup, DENMARK DK-2750	**011-45-44973366**
Micro Switch, A Honeywell Div., Freeport, IL 61032	**1-800-537-6945**
§ MORS Components, Wakefield, MA 01880-4444	617-246-1007
† Precision Mechanisms, Westbury, NY 11590	**516-ED3-5955**
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	**201-321-3400**
SMK Electronics Corporation, U.S.A. Placentia, CA 92670	714-996-0960
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY	0911-65521
Techniques, Inc., Englewood, NJ 07631	201-569-5900
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800

Switches, Programmable-5100

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
§ AMP, Harrisburg, PA 17105. 717-564-0100;800-522-6752	**B•1666-1667, C•1163**
§ Aries Electronics, Frenchtown, NJ 08825, 908-996-6841	**B•1673**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550	**D•1200**
Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610	**B•1807**
Signal Switch Company, Corona, CA 91720, 909-736-5404	**B•1479**
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700	**B•1813**
Aerospace Optics, Inc., Fort Worth, TX 76112	817-451-1141
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520	800-523-2702;601-467-8231
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
CYTEC Corp., Penfield, NY 14526	716-381-4740;800-346-3117
§ Electro Standards Lab., Inc., Data Communications Products Div., Cranston, RI 02921	401-943-1164
Flann Microwave Inc., Cambridge, MA 02139	1-800-937-3772
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458	201-825-9696
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
§ MORS Components, Wakefield, MA 01880-4444	617-246-1007
Pass & Seymour Canada, Inc., Legrand, Concord, ONT L4K 3M9	416-738-9195
picosecond ATE Inc., Beaverton, OR 97075	503-641-3295
† Precision Mechanisms, Westbury, NY 11590	516-ED3-5955
† Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
WECO Electrical Connectors, Inc., Mooers, NY 12958	518-298-4810

Switches, Proximity-5100

§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600	**B•1682-1683**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1727**
† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645	**B•1832**
† Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800	**D•1015**
Reed Switch Developments, Inc., Racine, WI 53403, 414-637-8848	**B•2006**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777	**B•1810**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
§ American Electronic Components, Elkhart, IN 46514	219-264-1116
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
§ C & K Components, Inc., Newton, MA 02158-1082	617-964-6400
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514	216-758-8299
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
§ C.P. Clare Corp., Chicago, IL 60645	312-262-7700
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
† Computer Components, Inc., East Granby, CT 06026	203-653-9909
Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341	215-524-2000; 800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
† Electro National Corp., Canton, MS 39046	601-859-5511
§ FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
§ Furnas Elec., Batavia, IL 60510	708-879-6000
† Giannini Institute, Indio, CA 92201	619-347-2833
# Globetron Electronics Corp., Oakville, Ont., CAN L6J 4Z3	416-825-1335; 1-800-800-4606
§ Gordon Products, Brookfield, CT 06804	203-775-4501
§ Go Switch, Louisville, KY 40233	502-969-2386
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
Hermetic Switch, Chickasha, OK 73018	405-224-4046
† INRESCO, Inc., Manasquan, NJ 08736	908-223-6330
§ IVO Industries, Inc., Eatontown, NJ 07724	908-542-5151;800-932-0489
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	**908-291-0500;800-631-2165**
MagneLink, Inc., Hillsboro, OR 97123	**800-638-0801**
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	**1-800-537-6945**
§ Namco Controls Corporation, Mentor, OH 44060	**216-946-9900**
§ Norgren, Littleton, CO 80120-1663	**303-794-2611**

Switches, Proximity-5100 (Cont'd)

Ocean Motions Co., Barrington, RI 02806	401-246-1394
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§ Philips ECG, North American Philips Co., Williamsport, PA 17701	717-323-4691
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
Sensor Corp., Scottdale, PA 15683	412-887-4080
Sentech, Inc., Cheltenham, PA 19012	215-663-0422
† Signal Systems International, Lavalette, NJ 08735	908-793-4668
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788	516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§† Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Tane Alarm Products, Floral Park, NY 11001	516-328-3351
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580

Switches, Pushbutton-5100

A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700	**B•1669**
§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933**	**B•1670-1672**
§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600**	**B•1681-1683**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131	**B•1685**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300**	**B•1687**
§ **Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556**	**B•1690**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1693,1696**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1702-1703**
§ **CUI Stack Inc., Beaverton, OR 97005, 503-643-4899**	**B•1706**
§† **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321**	**B•1708**
§ **Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616**	**B•1709**
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577**	**B•1713**
§† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180**	**B•1714-1715**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1719-1720**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	**B•1722-1723**
E-T-A Circuit Breakers, Niles, IL 60714, 708-647-8303	**B•1721**
† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040**	**B•1729**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550**	**B•1738-1740**
§ **ITT Schadow, Eden Prairie, MN 55344, 612-934-4400**	**B•1744-1745**
§† **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040**	**B•1746-1749,1754**
§† **Janco Corp., Burbank, CA 91508, 818-846-1800**	**B•1759**
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374**	**B•1761,1765**
§† **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1773,1775,1777**
§ **MORS Components, Wakefield, MA 01880-4444, 617-246-1007**	**B•1778-1780**
§ **NKK Switches, Scottsdale, AZ 85260, 602-991-0942**	**B•1782-1785,1787,1789**
§ **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200**	**B•1793,1979**
§† **Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794**	**B•1797**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171**	**B•1798-1799**
§ **Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625**	**B•1800**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62**	**B•1803**
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**B•1809**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
Solico/Mec, Hartford, CT 06114, 203-527-3092	**B•1812**
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700**	**B•1813**
§ **T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227**	**B•1814**
†# **Veetronix, Inc., Lexington, NE 68850, 308-324-4600**	**B•1816-1817**
Advanced Connector Technology, Ventura, CA 93003	805-644-9990
Advanced Input Devices, Coeur d'Alene, ID 83814	208-765-8000;800-444-5923
Aerospace Optics, Inc., Fort Worth, TX 76112	817-451-1141
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
Allied Controls Incorporated, Waterbury, CT 06705-3827	203-757-4200
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
§ Amptronix, Inc., Rowland Heights, CA 91748	213-666-1564
Ark-Les Corp, Raleigh, NC 27620	919-231-2000
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C.	886-2-9174302
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
§ Cole Hersee Co., Boston, MA 02127-2467	617-268-2100
† Cole Instrument Corp., Santa Ana, CA 92704	714-556-3100
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936	201-887-9400
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501	515-573-1300
§ CTS Corp., Electrocomponents, Elkhart, IN 46514	219-295-3575
§ DataLux Corp., Winchester, VA 22602	703-662-1500
§ Dialight Corporation, Manasquan, NJ 08736	908-223-9400
§ Drivecon Corporation, Libertyville, IL 60048	708-918-1406
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
† Entech Systems, Inc., Simsbury, CT 06070	203-651-9557
§ Entrelec Inc., Irving, TX 75038	214-550-9025
§ Gaynor Electric Co., Thomaston, CT 06787-0316	203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
† Giannini Institute, Indio, CA 92201	619-347-2833
GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
§ ICO-RALLY Corporation, Palo Alto, CA 94303	415-856-9900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
§ Inter-Market, Glenview, IL 60025	708-729-5330
International Microelectronics, Arlington, TX 76003	817-473-1730
International Resource Svcs., Miami, FL 33166	305-884-2924
§ ITT Components, ITT Corporation, Irvine, CA 92718	714-727-3001
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
Judco Mfg. Inc., Harbor City, CA 90710	310-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060	708-949-8505
§ Klockner Moeller, Franklin, MA 02038	508-520-7080
Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
§ Luminator Aircraft Products, Plano, TX 75074	214-424-6511
§† Machine Components Corp., Plainview, NY 11803	516-694-7222
§ Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
§ Midstates Marketing, Inc., Indianapolis, IN 46202	317-639-9999
† Milton Ross Co., Warrington, PA 18976	215-491-0600
MOLEX, Inc., Lisle, IL 60532	708-969-4550
Mouser Electronics, Santee, CA 92071-	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008	708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094	201-392-4818
Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§ Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578	708-438-4000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9	514-745-0310
Saint Switch, Inc., St. Charles, IL 60174	708-377-3779
§ Seacor, Inc., Westwood, NJ 07675	201-666-5600
§ Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
Shelly Associates, Inc., Tustin, CA 92680	714-669-9850
Shin-Etsu Polymer America, Inc., Union City, CA 94587	510-475-9000
§ SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
§ Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
§† Square D Co., Palatine, IL 60067	708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545	919-266-3671
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY	0911-65521
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312
† Thermo Electric, Saddle Brook, NJ 07662	201-843-5800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
§ Toko America, Inc., Mt. Prospect,, IL 60056	708-297-0070
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076	708-964-2330
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492	203-269-3337
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701
United Switch Company, Seattle, WA 98199	206-282-8823
Wilbrecht Electronics, St. Paul, MN 55107	612-222-2791

Switches, Reed-5100

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1405**
Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
† **Capitol Switch Inc., Bethel, CT 06801, 203-744-3300**	**B•1687**
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700**	**B•1437**
§ **Coto Wabash, A Kearney National Company, Providence, RI 02907, 401-943-2686**	**B•1451**
§† **George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645**	**B•1832**
§† **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000**	**B•1734**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1735**
Hermetic Switch, Chickasha, OK 73018, 405-224-4046	**B•1737,1954**
Reed Switch Developments, Inc., Racine, WI 53403, 414-637-8848	**B•2006**
† **Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777**	**B•1810-1811**
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450	**B•1906**
†# **Veetronix, Inc., Lexington, NE 68850, 308-324-4600**	**B•1816-1817**
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670	800-262-4638; 800-525-3536
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800

§C & K Components, Inc., Newton, MA 02158-1082	617-964-6400
§Canfield Connector, Canfield Industries, Youngstown, OH 44514	216-758-8299
§C.P. Clare Corp., Chicago, IL 60645	312-262-7700
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
Dow-Key Microwave Corporation, Ventura, CA 93003	805-650-0260
Electric Device, Canfield, OH 44406	216-533-1111
†Electro National Corp., Canton, MS 39046	601-859-5511
Fifth Dimension, Inc., Trenton, NJ 08638	609-393-8350
GTE Supply, GTE, Irving, TX 75038	800-433-4837
§†Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
†INRESCO, Inc., Manasquan, NJ 08736	908-223-6330
International Microelectronics, Arlington, TX 76003	817-473-1730
MagneLink, Inc., Hillsboro, OR 97123	800-638-0801
MarLee Switch Co., Upland, CA 91786	714-982-8988
§Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015	800-222-7846
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
§NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
§Norgren, Littleton, CO 80120-1663	303-794-2611
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404	407-881-3200
Philips Components Discrete Products Div., Professional Components Grp., Slatersville, RI 02876	401-762-3800
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
Signal Switch Company, Corona, CA 91720	909-736-5404
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
§Spectron Glass & Electronics, Inc., Hauppauge, NY 11788	516-582-5600
†Teledyne Microwave, Mountain View, CA 94043	415-968-2211

Switches, RF-5100

§†**CW Industries, Southhampton, PA 18966, 215-355-7080**	**B•1707**
§†**Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260**	**B•1710**
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500	**A•1403**
†**Janco Corp., Burbank, CA 91508, 818-846-1800**	**B•1759**
†**Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025**	**B•1536,1538**
†**Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560**	**B•1540**
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301	**B•1565**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500	**A•1725**
†**Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1593,1802**
†**Signal Switch Company, Corona, CA 91720, 909-736-5404**	**B•1479**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
§ASI Instruments, Inc., Houston, TX 77024	800-245-7056
§†Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054	408-727-0700
#BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059	310-515-1720
†Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
†Communications Sys. Technology, Inc., Hermosa Beach, CA 90254	213-374-3849
†Compac, Holbrook, NY 11741	516-585-3400
§Control Cable, Inc., Baltimore, MD 21244	410-298-4411
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
†Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
†Dielectric Communications, General Signal, Raymond, ME 04071	207-655-4555; 800-341-9678
Fifth Dimension, Inc., Trenton, NJ 08638	609-393-8350
†General Microwave Corporation, Amityville, NY 11701	516-226-8900
Henricks Technologies, Inc., Forsyth, GA 31029	912-993-1060;800-241-0806
Hermetic Switch, Chickasha, OK 73018	405-224-4046
Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065	805-522-7958
Information Transfer Inc., Bloomfield, NY 14469	716-657-7074
†Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
†JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
§K&L Microwave, Inc., Salisbury, MD 21801	410-749-2424
†KDI/Triangle Electronics, Whippany, NJ 07981	201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
§Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6	416-292-4463
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
†Loral Microwave Narda, Hauppauge, NY 11788	516-231-1700
†Loral Microwave-Wavecom, Northridge, CA 91324	818-882-3010
†Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710	813-347-2181
MACOM, Inc., Lowell, MA 01851	617-272-3000
§†M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
†MarLee Switch Co., Upland, CA 91786	714-982-8988
Micronetics, Hudson, NH 03051	603-883-2900
†Microwave Device Tech., Westford, MA 01886	508-692-7800
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
†Multi-Tech Industries, Inc., Marlboro, NJ 07746	908-462-6100
§Namco Controls Corporation, Mentor, OH 44060	216-946-9900
OakGrigsby Inc., Sugar Grove, IL 60554	708-556-4200
Peca, Inc., Bensalem, PA 19020	215-245-1550
Phoenix Microwave, Telford, PA 18969	215-723-6011
Pro Com Technology Inc., Plainview, NY 11803	516-293-4443;800-762-3785
†Racal-Dana Instrs. Inc., Irvine, CA 92718	714-859-8999
†RLC Electronics, Inc., Mt. Kisco, NY 10549	914-241-1334
†Sector Microwave Ind. Inc., Deer Park, NY 11729	516-242-2300
†Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
†Sivers IMA AB, Culver City, CA 90230	213-306-4248
§SOR, Inc., Lenexa, KS 66215	913-888-2630
†ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300
§†ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915	508-922-0019
§#Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
†Teledyne Microwave, Mountain View, CA 94043	415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652	714-494-9401
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0	613-258-5928
†Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007
Trilithic, Inc., Indianapolis, IN 46236	800-344-2412
§Trimm Inc., Libertyville, IL 60048	708-362-3700
†TRM, Inc., Manchester, NH 03110	603-627-6000
Unadilla Antenna Mfg. Co., Andover, MA 01810	508-475-7831
†Vectronics Microwave Corp., Middlesex, NJ 08846	908-356-2377
†Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

Switches, Rocker-5100

§**AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752**	**C•1163**
A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700	**B•1669**
§**Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933**	**B•1670-1672**
§**Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550**	**B•1674**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131	**B•1685**
§**C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
§**Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556**	**B•1350,1688-1690**
§**Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1702**
§**CUI Stack Inc., Beaverton, OR 97005, 503-643-4899**	**B•1706**
§†**CW Industries, Southhampton, PA 18966, 215-355-7080**	**B•1707**
§**Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616**	**B•1709**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	**B•1722**
E-T-A Circuit Breakers, Niles, IL 60714, 708-647-8303	**B•1721**
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	**C•1340**
Grayhill Inc., La Grange, IL 60525, 708-354-1040	**B•1730-1731**
§†**Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800,** 609-896-0009	B•1360-1362
§**ITT Schadow, Eden Prairie, MN 55344, 612-934-4400**	**B•1744**
§**ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040**	B•1751-1752
§**Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374**	B•1760-1761,1763
§**McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200**	**B•1767-1769**
†**Measurement Systems, Inc., Fairfield, CT 06430, 203-336-4590**	**D•1163**
§**Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1773.1775-1777**
§**MORS Components, Wakefield, MA 01880-4444, 617-246-1007**	**B•1779-1781**
§**NKK Switches, Scottsdale, AZ 85260, 602-991-0942**	**B•1782-1783,1785-1786,1789**
†**Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794**	**B•1797**
§**Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171**	**B•1798**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097	**C•1428,1430**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
§**Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62**	**B•1803**
†**Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911**	**B•1809**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**
§**Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700**	**B•1813**
Weber Protection, inc., Malvern, PA 19355, 610-651-0770;800-WEBERPA	**B•1391-1393**
†Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
§Ark-Les Corp, Raleigh, NC 27620	919-231-2000
§Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
†Capitol Switch Inc., Bethel, CT 06801	203-744-3300
§Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
CTS Corporation, Elkhart, IN 46514	219-293-7511
§Dreefs Switch, Inc., Waukegan, IL 60087	708-662-7667;800-323-9605
§Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101	718-937-8000
§Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
§Entech Systems, Inc., Simsbury, CT 06070	203-651-9557
§GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
§General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602	203-382-3023
§ICO-RALLY Corporation, Palo Alto, CA 94303	415-856-9900
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090	708-537-1800
†Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
International Microelectronics, Arlington, TX 76003	817-473-1730
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
Joemex Electrics, Irvine, CA 92718	714-855-4472
Judco Mfg. Inc., Harbor City, CA 90710	310-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060	708-949-8505
Leecraft Mfg., Long Island City, NY 11101	718-392-8800
Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
§Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
§MG Electronics, Hauppauge, NY 11788	516-582-3400
Mouser Electronics, Santee, CA 92071	800-346-6873

Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 315-468-6211
Philips Technologies, Airpax Protector Group, Cambridge, MD 21613 410-228-4600
§# Powell Electronics Inc., Philadelphia, PA 19101 215-365-1900
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Shin-Etsu Polymer America, Inc., Union City, CA 94587 510-475-9000
§ SL Waber, Inc., Mt. Laurel, NJ 08054 .... 609-866-8888;800-257-8384
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377 .... 718-478-5000;800-221-0487
Texas Instruments, Connector Systems, Attleboro, MA 02703 .... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
United Switch Company, Seattle, WA 98199 206-282-8823

Switches, Rotary-5100

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 .... B•1239
Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 .... B•1662
§ **AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... C•1163**
A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700 .... B•1669
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 .... B•1675-1676,1680
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 .... B•1685
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 .... B•1684**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1697
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 .... B•1699**
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 .... B•1706
§† **Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 .... B•1716**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 .... B•1718-1720
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639 .... B•1722-1723
§† **Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1730-1733**
§ **Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... B•1742-1743**
§† **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 .... B•1750-1751**
§† **Janco Corp., Burbank, CA 91508, 818-846-1800 .... B•1758-1759**
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374 .... B•1763,1765**
† **Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 .... B•1766**
Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 .... A•2093
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .... A•2099,2102**
McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200 .... B•1768
§ **Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 .... A•2106, B•1770-1771**
§ **MORS Components, Wakefield, MA 01880-4444, 617-246-1007 .... B•1780**
§ **NKK Switches, Scottsdale, AZ 85260, 602-991-0942 .... B•1782,1785,1788-1789**
§† **OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 .... B•1790-1792,1795**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 .... B•1798**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 .... B•1593**
§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 .... B•1803**
† **Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610 .... B•1807**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 .... B•1808
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .... B•1809
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 .... C•1460
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 .... B•1815**
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
AME Corporation, Towaco, NJ 07082-0195 201-263-1700
§ Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
Ark-Les Corp, Raleigh, NC 27620 919-231-2000
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
§ Carlingswitch, Inc., Plainville, CT 06062-1177 .... 203-793-9281;1-800-243-8556
Carlon, A Div. of Lamson & Sessions, Cleveland, OH 44122 216-831-4000
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 317-257-3191
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. 886-2-9174302
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 708-455-8830
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
§ CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
CTS Corp, Microelectronics, W. Lafayette, IN 47906 317-463-2565
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 414-449-7326
§ EECO Div.,Transico Inc., Santa Ana, CA 92702-0659 714-835-6000
§† Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
† Electro National Corp., Canton, MS 39046 601-859-5511
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761 904-672-7335
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Entrelec Inc., Irving, TX 75038 214-550-9025
§ ERNI Components, Richmond, VA 23236 804-794-6367
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-3023
Ghielmetti, Inc., Westlake Village, CA 91361 800-228-1097
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY .... (0)911/65521 or 65520
IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
International Microelectronics, Arlington, TX 76003 817-473-1730
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 .... 516-937-3475;800-626-6116
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 .... 908-291-0500;800-631-2165
Littelfuse, Inc., Des Plaines, IL 60016 .... 708-824-1188;708-824-0400
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 .... 800-336-2112;703-953-4751
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805 .... 708-398-5311;800-323-5207
J. R. Merritt Controls, Inc., Norwalk, CT 06854 .... 203-855-9100;800-333-5762
† Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† Multi-Tech Industries, Inc., Marlboro, NJ 07746 908-462-6100
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 .... 708-843-7900;1-800-626-6766
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 .... 708-390-6680; 800-323-6693
§ Powell Electronics Inc., Philadelphia, PA 19101 215-365-1900
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
SACO Controls Inc., Montreal,Qc., CANADA H4S 1V9 514-745-0310
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
§† Spectrol Electronics Corp., Ontario, CA 91761 909-923-3313
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Numberg 82, WEST GERMANY 0911-65521
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ TELTEC, Inc., Minneapolis, MN 55425 612-854-9177
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492 203-269-3337
United Switch Company, Seattle, WA 98199 206-282-8823
§ Walther Electric Corporation, WALTHER WERKE, Ferdinand Walther, E. Brunswick, NJ 08816 908-238-1166

Switches, Sealed-5100

§ **American Electronic Components, Elkhart, IN 46514, 219-264-1116 .... B•1711**
§ **AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 .... B•1666**
A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700 .... B•1669
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 .... B•1670-1672
§ **Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 .... B•1674**
Aztec Industries, Inc., Mesa, AZ 85210, 602-833-3131;800-729-3132 .... B•1821
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 .... B•1675-1678,1680
§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 .... B•1681-1683**
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 .... B•1685
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 .... B•1684**
§ **Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556 .... B•1350,1688**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 .... B•1693,1695,1697**
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 .... B•1437**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 .... B•1699**
§ **Comus International, Nutley, NJ 07110, 201-667-6200;1-800-35-COMUS .... B•1700**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 .... B•1702-1703**
CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 .... B•1704-1705
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 .... B•1706
§ CW Industries, Southhampton, PA 18966, 215-355-7080 .... B•1707
§† **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321 .... B•1708**
Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616 .... B•1709
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577 .... B•1713**
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 .... B•1716
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 .... B•1718-1720
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639 .... B•1722
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 .... B•1726-1727
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645 .... B•1832
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 .... B•1729-1733
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 .... B•1734**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292 .... B•1735
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 .... B•1737,1954

IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ...... B•1738-1739
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311 ...... B•1835
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200 ...... B•1836-1837
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ...... B•1744
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ...... B•1750,1754-1755
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489 .. B•1756
† Janco Corp., Burbank, CA 91508, 818-846-1800 ...... B•1758-1759
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560;App. Hot Line 800-253-4560 ...... B•1540-1541
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374 ...... B•1760,1765
† Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621 ...... B•1766
§ McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200 .... B•1768
§ Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ...... A•2106, B•1770-1771
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ...... B•1772-1777
§ MORS Components, Wakefield, MA 01880-4444, 617-246-1007 ...... B•1778,1780-1781
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942 ...... B•1782-1789
§† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200 ... B•1790-1791,1793,1795
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629 ...... C•1137
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ...... B•1798-1799
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 ...... B•1800
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ...... B•1801
Reed Switch Developments, Inc., Racine, WI 53403, 414-637-8848 ...... B•2006
† Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610 ...... B•1804,1807,1850
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ...... B•1808
§# Solico/Mec, Hartford, CT 06114, 203-527-3092 ...... B•1812
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ...... B•1810-1811
§ T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227 ...... B•1814
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ...... B•1815
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ...... B•1906
†# Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ...... B•1816-1817
Advanced Connector Technology, Ventura, CA 93003 805-644-9990
Advanced Input Devices, Coeur d'Alene, ID 83814 ...... 208-765-8000;800-444-5923
Aerodyne Controls Corporation, Ronkonkoma, NY 11779 516-737-1900
† Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
AME Corporation, Towaco, NJ 07082-0195 201-263-1700
§† American Research & Engineering, Elgin, IL 60123 708-888-7245
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657 ...... 800-347-2484 ext. 4529
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
§ EECO Div.,Transico Inc., Santa Ana, CA 92702-0659 714-835-6000
† Electro National Corp., Canton, MS 39046 601-859-5511
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
† Giannini Institute, Indio, CA 92201 619-347-2833
#GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ...... (0)911/65521 or 65520
† Hallmark Technologies, Mt. Dora, FL 32757 800-874-9063
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Inter-Market, Glenview, IL 60025 708-729-5330
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 ...... 800-336-2112;703-953-4751
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 804-766-1500
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ MEC A/S, Ballerup, DENMARK DK-2750 011-45-44973366
MOLEX, Inc., Lisle, IL 60532 708-969-4550
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 ...... 708-843-7900;1-800-626-6766
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Saint Switch, Inc., St. Charles, IL 60174 708-377-3779
Schroff, Inc., Warwick, RI 02886 401-732-3770
§ Schurter, Inc., Petaluma, CA 94954 ...... 800-848-2600 ext.62
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Signal Systems International, Lavalette, NJ 08735 908-793-4668
§ Sorenson Lighted Controls, Hartford, CT 06114 ...... 203-527-3092;1-800-275-7089
§ Switches Unlimited, Inc., Woodside, NY 11377 ...... 718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
§ Unimax, A Divison of C & K, Wallingford, CT 06492 203-269-8701
United Switch Company, Seattle, WA 98199 206-282-8823

Switches, Shock/Water Proof-5100

EAO Switch Corp., Milford, CT 06460, 203-877-4577 ...... B•1713
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 ...... B•1720
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374 .. B•1760
§ Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 ...... B•1800
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ...... B•1801
§ Carlingswitch, Inc., Plainville, CT 06062-1177 ...... 203-793-9281;1-800-243-8556
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 312-282-4040
§ Schurter, Inc., Petaluma, CA 94954 ...... 800-848-2600 ext.62
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
§ Tschudin & Heid, Inc, Tschudin & Heid AG, Wallingford, CT 06492 203-269-3337

Switches, Slide-5100

§ AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ...... B•1666
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ...... B•1670-1671
§ Aries Electronics, Frenchtown, NJ 08825, 908-996-6841 ...... B•1673
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ...... B•1685
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ...... B•1684
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ...... B•1696
§ CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575 ...... B•1705
§ CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ...... B•1706
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ...... B•1707
§ Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616 ...... B•1709
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639 ...... B•1722
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ...... B•1730-1731
§ Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 708-537-1800 .... B•1743
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ...... B•1750-1751,1754
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374 .. B•1764
Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ...... B•1770
§ MORS Components, Wakefield, MA 01880-4444, 617-246-1007 ...... B•1781
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942 .... B•1782-1783,1785,1789
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ...... B•1801
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .. B•1809
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ...... C•1460
SMK Electronics Corporation, U.S.A., Placentia, CA 92670, 714-996-0960 ...... C•1461
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ...... B•1813
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§† American Research & Engineering, Elgin, IL 60123 708-888-7245
§ Annulus Technical Industries, Inc., Port Dover, Ont., CAN NOA 1NO 519-583-3440
§ Ark-Les Corp, Raleigh, NC 27620 919-231-2000
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
§ Carlingswitch, Inc., Plainville, CT 06062-1177 ...... 203-793-9281;1-800-243-8556
Carlon, A Div. of Lamson & Sessions, Cleveland, OH 44122 216-831-4000
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Daburn Electronics & Cable Corp., Northvale, NJ 07647 201-768-5400
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 .. 414-449-7326
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ...... 201-288-4477; 800-447-5639
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ...... (0)911/65521 or 65520
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries Inc., St. Petersburg, FL 33716 813-572-9010
International Resource Svcs., Miami, FL 33166 305-884-2924
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ...... 516-937-3475;800-626-6116
ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Judco Mfg. Inc., Harbor City, CA 90710 310-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 708-949-8505
§ Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805 ... 708-398-5311;800-323-5207
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Powell Electronics Inc., Philadelphia, PA 19101 215-365-1900
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
RC Electronics, Fremont, CA 94538-3164 510-656-8490
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† Roanwell, New York, NY 10014 212-989-1090
† Secma, Inc., Secme, Irvine, CA 92714 714-261-0610
Sorenson Lighted Controls, Hartford, CT 06114 ...... 203-527-3092;1-800-275-7089
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377 ...... 718-478-5000;800-221-0487
Texas Instruments, Connector Systems, Attleboro, MA 02703 ...... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 508-699-3800
United Switch Company, Seattle, WA 98199 206-282-8823

Wilbrecht Electronics, St. Paul, MN 55107 ... 612-222-2791

Switches, Snap Action (All Types)-5100

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 ... B•1662
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ... B•1672
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ... B•1674
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ... B•1679
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ... B•1681-1683
C & K Components, Inc., Clayton, NC 27520, 919-553-3131 ... B•1685
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ... B•1684
Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556 ... B•1350
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ... B•1696-1697
§† Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... B•1703
§ CUI Stack Inc., Beaverton, OR 97005, 503-643-4899 ... B•1706
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ... B•1707
§ Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616 ... B•1709
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ... B•1713
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ... B•1716
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400 ... B•1718
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ... B•1726
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1729
The Hall Company, Urbana, OH 43078, 513-652-1376 ... B•1834
† Heinemann Products, Eaton Corporation, Lawrenceville, NJ 08648-0800, 609-896-0009 ... B•1360,1362
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ... B•1752-1755
Jayco Interface Technology, Orange, CA 92665, 714-974-1701 ... B•1840
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374 ... B•1765
§ McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200 ... B•1768-1769
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ... B•1772-1773,1775
§ MORS Components, Wakefield, MA 01880-4444, 617-246-1007 ... B•1778
§ NKK Switches, Scottsdale, AZ 85260, 602-991-0942 ... B•1782-1783,1785,1789
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561 ... B•1849
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171 ... B•1798-1799
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 ... B•1803
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ... B•1906
Advanced Connector Technology, Ventura, CA 93003 ... 805-644-9990
Advanced Input Devices, Coeur d'Alene, ID 83814 ... 208-765-8000;800-444-5923
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 ... 414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362 ... 818-889-9304
§ Annulus Technical Industries, Inc., Port Dover, Ont., CAN NOA 1NO ... 519-583-3440
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 ... 508-699-9800
Aztec Industries, Inc., Mesa, AZ 85210 ... 602-833-3131;800-729-3132
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 ... 213-589-6181
Chicago Lock Co., Chicago, IL 60641 ... 312-282-7177
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C. ... 886-2-9174302
§ Cole Hersee Co., Boston, MA 02127-2467 ... 617-268-2100
† Control Products, Inc., E. Hanover, NJ 07936 ... 201-887-9400
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 ... 515-573-1300
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 ... 219-295-3575
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216 ... 414-449-7326
§ Electric Switches, Inc., Los Angeles, CA 90039 ... 213-660-1310
† Elmwood Sensors, Pawtucket, RI 02861 ... 401-727-1300
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761 ... 904-672-7335
§ Entech Systems, Inc., Simsbury, CT 06070 ... 203-651-9557
§ FENWAL Inc., Ashland, MA 01721 ... 508-881-2000
§ GC-Thorsen, Rockford, IL 61105-1209 ... 815-968-9661
# GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
§ Go Switch, Louisville, KY 40233 ... 502-969-2386
§ Gunther, W., GmbH, D 8500 Numberg 82, GERMANY ... (0)911/65521 or 65520
† Hallmark Technologies, Mt. Dora, FL 32757 ... 800-874-9063
† Haydon Switch & Instrument, Waterbury, CT 06705 ... 203-756-7441
§ ICO-RALLY Corporation, Palo Alto, CA 94303 ... 415-856-9900
International Microelectronics, Arlington, TX 76003 ... 817-473-1730
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 ... 312-421-1090
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 ... 708-949-8505
Leecraft Mfg., Long Island City, NY 11101 ... 718-392-8800
§ Linemaster Switch, Woodstock, CT 06281-0238 ... 203-974-1000
Littelfuse, Inc., Des Plaines, IL 60016 ... 708-824-1188;708-824-0400
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666 ... 804-766-1500
§† Machine Components Corp., Plainview, NY 11803 ... 516-694-7222
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 ... 313-435-0700
§ Mantex Corp., Oxford, MI 48371 ... 313-628-8210
§ Marquardt Switches Inc., Cazenovia, NY 13035 ... 315-655-8050
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ... 203-855-9100;800-333-5762
Milton Ross Co., Warrington, PA 18976 ... 215-491-0600
Mouser Electronics, Santee, CA 92071 ... 800-346-6873
Mouser Electronics, Mansfield, TX 76063 ... 800-346-6873
Mouser Electronics, Gilroy, CA 95020 ... 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 ... 708-364-6038
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173 ... 708-843-7900;1-800-626-6766
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 ... 315-468-6211
Philips Technologies, Airpax Protector Group, Cambridge, MD 21613 ... 410-228-4600
§ Powell Electronics Inc., Philadelphia, PA 19101 ... 215-365-1900
§ Power Dynamics Inc., West Orange, NJ 07052 ... 201-736-5722
† Precision Mechanisms, Westbury, NY 11590 ... 516-ED3-5955
RDI Elctrns., Inc., Mamaroneck, NY 10543 ... 914-777-7000
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
† Roanwell, New York, NY 10014 ... 212-989-1090
† Saint Switch, Inc., St. Charles, IL 60174 ... 708-377-3779
Schroff, Inc., Warwick, RI 02886 ... 401-732-3770
§ Seacor, Inc., Westwood, NJ 07675 ... 201-666-5600
† Secma, Inc., Secme, Irvine, CA 92714 ... 714-261-0610
Shallco, Inc., Smithfield, NC 27577 ... 919-934-3135; 1-800-876-3135
Shin-Etsu Polymer America, Inc., Union City, CA 94587 ... 510-475-9000
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ... 609-866-8888;800-257-8384
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 ... 800-482-2828
§† Square D Co., Palatine, IL 60067 ... 708-397-2600
Square D. Company, Control Products, Knightdale, NC 27545 ... 919-266-3671
§ Stancor, White-Rodgers, Logansport, IN 46947 ... 219-722-2244
† Sundstrand Data Control, Redmond, WA 98073-9701 ... 206-885-3711
§ Switches Unlimited, Inc., Woodside, NY 11377 ... 718-478-5000;800-221-0487
† Tech Laboratories Inc., Palisades Pk., NJ 07650 ... 201-944-2221
Texas Instruments, Connector Systems, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 ... 508-699-3800
§ Toko America, Inc., Mt. Prospect,, IL 60056 ... 708-297-0070
§ Torq Corp., Bedford, OH 44146 ... 216-232-4100
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 ... 708-964-2330
§† Unimax, A Divison of C & K, Wallingford, CT 06492 ... 203-269-8701
§ (UEC) United Electric Controls, Watertown, MA 02272-9143 ... 617-926-1000
United Switch Company, Seattle, WA 98199 ... 206-282-8823
Westlake Components International, Westlake Village, CA 91361 ... 800-228-1097

Switches, Solid State-5100

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622 ... B•1662
American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000 ... B•1665
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ... B•1679-1680
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600 ... B•1681-1683
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200 ... B•1694
§ Crydom Company, Long Beach, CA 90805, 310-865-3536 ... B•1464-1466,1468-1470
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ... B•1474-1475, D•1155
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ... B•1713
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ... A•1403
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1733
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ... B•1563
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ... B•1775
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ... A•2172-2173
† Signal Switch Company, Corona, CA 91720, 909-736-5404 ... B•1479
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811 ... B•2025
AEL Defense Corp., Lansdale, PA 19446 ... 215-822-2929
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 ... 516-694-6700
§† Amplifonix, Inc., Philadelphia, PA 19154 ... 215-464-4000
§† Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
Astro-Geo-Marine, Inc., Ventura, CA 93003 ... 805-654-8300
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058 ... 213-589-6181
§ Bay Technical Associates, Inc., Bay St. Louis, MS 39520 ... 800-523-2702;601-467-8231
Cambridge Aeroflo, Inc., Shirley, MA 01464 ... 508-425-2346
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 ... 514-739-3274
§ C & K Components, Inc., Newton, MA 02158-1082 ... 617-964-6400
§ Cole Hersee Co., Boston, MA 02127-2467 ... 617-268-2100
Cross Electronics, Warrendale, PA 15086 ... 412-776-1591
† Daico Industries, Inc., Rancho Dominguez, CA 90220 ... 310-631-1143
Darrah Electric Company, Cleveland, OH 44102 ... 216-631-0912
† Dionics, Westbury, NY 11590 ... 516-997-7474
Dynage/Controls, Inc., Canistota, SD 57012 ... 605-296-3487
§ Efector, Inc., a subsidiary of ifm electronic, Exton, PA 19341 ... 215-524-2000; 800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ... 214-470-2106
Enerco, Inc., Seattle, WA 98108 ... 206-762-1422
† General Microwave Corporation, Amityville, NY 11701 ... 516-226-8900
§ Gunther, W., GmbH, D 8500 Numberg 82, GERMANY ... (0)911/65521 or 65520
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 ... 612-443-2500
§† Honeywell Microswitch Div., Richardson, TX 75081 ... 214-470-4271
† Integrated Microwave, San Diego, CA 92121-1009 ... 619-259-2600
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634 ... 312-282-4040
† JFW Industries, Inc., Indianapolis, IN 46237 ... 317-887-1340
§ Linemaster Switch, Woodstock, CT 06281-0238 ... 203-974-1000
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 ... 813-347-2181
§ Lutron Electronics Co., Coopersburg, PA 18036 ... 215-282-3800
§† Machine Components Corp., Plainview, NY 11803 ... 516-694-7222
MACOM, Inc., Lowell, MA 01851 ... 617-272-3000

§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295	508-442-5000
MagneLink, Inc., Hillsboro, OR 97123	800-638-0801
† MarLee Switch Co., Upland, CA 91786	714-982-8988
† Merrimac Industries, West Caldwell, NJ 07006	201-575-1300
Micronetics, Hudson, NH 03051	603-883-2900
Microphase, Norwalk, CT 06856	203-866-8000
MITEQ Inc., Hauppauge, NY 11788	516-436-7400
OakGrigsby Inc., Sugar Grove, IL 60554	708-556-4200
Omega Engineering, Stamford, CT 06907	800-826-6342
§ Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
§ Payne Engineering, Scott Depot, WV 25560	304-757-7353
§ Phasetronics Inc./Motortronics Inc., Clearwater, FL 34622	813-573-1900
Phoenix Microwave, Telford, PA 18969	215-723-6011
Power Functions Engineering, Garland, TX 75042	214-278-0996
§ Regent Controls, Inc., Shelton, CT 06484-0767	203-924-2924
† RLC Electronics, Inc., Mt. Kisco, NY 10549	914-241-1334
§ Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
Smart Relay Technology, Inc., Commack, NY 11725	516-543-7161
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901	609-589-7500
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
Tempo Instrument, Inc., Commack, NY 11725	516-864-3700
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141
Wide Band Engineering Co., Inc., Phoenix, AZ 85036	602-254-1570

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§ **BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600**	**B•1244, 1681-1683**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100**	**B•1699**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711**	**B•1440-1441**
§ **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1702**
† **Janco Corp., Burbank, CA 91508, 818-846-1800**	**B•1759**
† **Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427, 513-898-3621**	**B•1766**
† **Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625**	**B•1800**
§ **Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62**	**B•1803**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
Solico/Mec, Hartford, CT 06114, 203-527-3092	**B•1812**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221**	**B•1815**
†# **Veetronix, Inc., Lexington, NE 68850, 308-324-4600**	**B•1816**
Airflyte Elctrns. Co., Bayonne, NJ 07002	201-436-2230
§ Amerace Electronic Components, Punta Gorda, FL 33950	813-575-8400
† DARE Electronics, Inc., Troy, OH 45373	513-335-0031
Douglas Randall, Pawcatuck, CT 06379	203-599-2075
† Electro National Corp., Canton, MS 39046	601-859-5511
GTE Supply, GTE, Irving, TX 75038	800-433-4837
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634	312-282-4040
§† Machine Components Corp., Plainview, NY 11803	516-694-7222
J. R. Merritt Controls, Inc., Norwalk, CT 06854	203-855-9100;800-333-5762
§ Ohmite Manufacturing Co., Skokie, IL 60076	708-675-2600
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800

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Switches, Thermally Actuated-5300

Advanced Thermal Products, Inc., St. Marys, PA 15857, 814-834-1541	**B•1858**
Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300	**B•1872-1873**
Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000	**B•1875**
Philips Technologies, Airpax Protector Group, Frederick, MD 21701, 301-663-5141	**B•1891**
§ **Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673**	**B•1896-1897**
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500	**B•1389,1903**
§ **Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450**	**B•1905-1907**
Warren G-V, General Signal Corp., Whippany, NJ 07981, 201-386-1200	**B•1908**
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 91911	619-575-4011
§ Automatic Switch Co., Florham Park, NJ 07932	1-201-966-2000
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058	213-589-6181
Burling Instruments, Inc., Chatham, NJ 07928-0298	201-635-9481
Cambridge Aeroflo, Inc., Shirley, MA 01464	508-425-2346
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8	514-739-3274
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
† Control Products, Inc., E. Hanover, NJ 07936	201-887-9400
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
§ E-Squared Technology Corp., Ventura, CA 93003	805-644-9544
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
Hold-Heet Products Corp., Chicago, IL 60640	312-728-4454;312-728-4455
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622	312-421-1090
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
§ Relay Specialties, Oakland, NJ 07436	201-337-1000

Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Stancor, White-Rodgers, Logansport, IN 46947	219-722-2244
† Sundstrand Data Control, Redmond, WA 98073-9701	206-885-3711
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562	919-636-5720
§ Tokin America, Inc., San Jose, CA 95134	408-432-8020
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
§ West Electronic Sales Team, Huntington Beach, CA 92647	714-375-6500; 310-495-5569
Western Elctrn. Comps. Corp., Camarillo, CA 93012	805-482-8002

Switches, Thumbwheel-5100

American Control Technology, Inc., Elgin, IL 60123-1203, 708-468-6000	**B•1665**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200**	**B•1696-1698**
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1701**
§† **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1702**
§† **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321**	**B•1708**
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550	**B•1740**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489**	**B•1756**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221**	**B•1815**
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C.	886-2-9174302
§ Cincinnati Electrosystems, Milford, OH 45150	513-831-6800
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
§† EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
§ Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ ERNI Components, Richmond, VA 23236	804-794-6367
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
Ghielmetti, Inc., Westlake Village, CA 91361	800-228-1097
§ Inter-Market, Glenview, IL 60025	708-729-5330
International Microelectronics, Arlington, TX 76003	817-473-1730
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500,800-631-2165
§ MORS Components, Wakefield, MA 01880-4444	617-246-1007
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
§ Omron Electronics, Inc., Control Components Division, Schaumburg, IL 60173	708-843-7900;1-800-626-6766
§ Powell Electronics Inc., Philadelphia, PA 19101	215-365-1900
§ Seacor, Inc., Westwood, NJ 07675	201-666-5600
† Secma, Inc., Secme, Irvine, CA 92714	714-261-0610
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
SMK Electronics Corporation, U.S.A., Placentia, CA 92670	714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§ Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664

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American Electronic Components, Elkhart, IN 46514, 219-264-1116	**B•1711**
A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700	**B•1669**
§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933**	**B•1670-1671**
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200	**B•1679**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400**	**B•1684**
§ **Carlingswitch, Inc., Plainville, CT 06062-1177, 203-793-9281;1-800-243-8556**	**B•1350,1689-1691**
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022, 201-941-4455	**B•1701**
§† **Crouzet Corporation, Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311**	**B•1703**
§ **CUI Stack Inc., Beaverton, OR 97005, 503-643-4899**	**B•1706**
§ **Direct Sound Corporation, Boston, MA 02116, 1-800-372-1616**	**B•1709**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1718-1719**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	**B•1722**
E-T-A Circuit Breakers, Niles, IL 60714, 708-647-8303	**B•1721**
Grayhill Inc., La Grange, IL 60525, 708-354-1040	**B•1730-1731**
Hasco Components International Co., Bellrose Village, NY 11001, 516-328-9292	**B•1735**
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374**	**B•1763,1765**
§ **McGill Electrical Product Group, Valparaiso, IN 46383, 219-465-2200**	**B•1767**
§† **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1776**
§ **MORS Components, Wakefield, MA 01880-4444, 617-246-1007**	**B•1778,1780-1781**
§ **NKK Switches, Scottsdale, AZ 85260, 602-991-0942**	**B•1782-1783,1785-1786,1789**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171**	**B•1798-1799**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
† **Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610**	**B•1807**
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**B•1809**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**C•1460**

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Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700	**B•1813**
§ T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227	**B•1814**
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221	**B•1815**
ACI Components, Inc., Laguna Hills, CA 92653	714-588-9611
Adams Rite Products, Inc., Glendale, CA 91204	818-241-5121
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201	414-382-2000
† Alpha Products, Inc., Westlake Village, CA 91362	818-889-9304
§ Amptronix, Inc., Rowland Heights, CA 91748	213-666-1564
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703	508-222-2202
§† Brim Electronics, Fair Lawn, NJ 07410	201-796-2886
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
Carlon, A Div. of Lamson & Sessions, Cleveland, OH 44122	216-831-4000
CIC Components Inds. Co., Ltd., Hsin Tien City, TAIWAN R.O.C.	886-2-9174302
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6	416-292-4463
† Control Products, Inc., E. Hanover, NJ 07936	201-887-9400
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501	515-573-1300
§ Eagle Electric Mfg. Co. Inc., Long Island City, NY 11101	718-937-8000
§† Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
§ Electric Switches, Inc., Los Angeles, CA 90039	213-660-1310
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
§ Gaynor Electric Co., Thomaston, CT 06787-0316	203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209	815-968-9661
§ General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602	203-382-3023
† Haydon Switch & Instrument, Waterbury, CT 06705	203-756-7441
§ ICO-RALLY Corporation, Palo Alto, CA 94303	415-856-9900
† Imtronics Industries Inc., St. Petersburg, FL 33716	813-572-9010
International Microelectronics, Arlington, TX 76003	817-473-1730
ISL Products Int'l, Ltd., Syosset, NY 11791-6093	516-937-3475;800-626-6116
§ Leecraft Industries Ltd., Scarborough, Ont., CANADA M1B 3R6	416-292-4463
† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
Littelfuse, Inc., Des Plaines, IL 60016	708-824-1188;708-824-0400
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805	708-398-5311;800-323-5207
§† Machine Components Corp., Plainview, NY 11803	516-694-7222
§ Marquardt Switches Inc., Cazenovia, NY 13035	315-655-8050
§ MEC A/S, Ballerup, DENMARK DK-2750	011-45-44973366
§ MG Electronics, Hauppauge, NY 11788	516-582-3400
Mouser Electronics, Santee, CA 92071	800-346-6873
Mouser Electronics, Mansfield, TX 76063	800-346-6873
Mouser Electronics, Gilroy, CA 95020	800-346-6873
Optrex/Satori, Torrance, CA 90503	310-214-1791
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221	315-468-6211
† Philips Technologies, Airpax Protector Group, Cambridge, MD 21613	410-228-4600
§ Philmore Manufacturing, Rockford, IL 61125-1386	815-229-7773
§ Power Dynamics Inc., West Orange, NJ 07052	201-736-5722
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
† Resistance Technology Inc., St. Paul, MN 55112	612-636-9770
† Sage Laboratories, Inc., Natick, MA 01760	508-653-0844
§ Spemco Switches, St. Clair Shores, MI 48080	800-482-2828
§† Switches Unlimited, Inc., Woodside, NY 11377	718-478-5000;800-221-0487
Texas Instruments, Connector Systems, Attleboro, MA 02703	508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703	508-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
§ Unimax, A Divison of C & K, Wallingford, CT 06492	203-269-8701
United Switch Company, Seattle, WA 98199	206-282-8823

Switches, Touch Actuated-5100

The Hall Company, Urbana, OH 43078, 513-652-1376	**B•1834**
† IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311	**B•1078,1835**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836-1837**
Jayco Interface Technology, Orange, CA 92665, 714-974-1701	**B•1840**
† Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610	**B•1806,1850-1851**
Adams Rite Products, Inc., Glendale, CA 91204	818-241-5121
Advanced Input Devices, Coeur d'Alene, ID 83814	208-765-8000;800-444-5923
Aleph International Corp., San Fernando, CA 91340	818-365-9856;800-423-5622
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201	414-355-8300
C.A.M. Graphics Co., Inc., Amityville, NY 11701	516-842-3400
† Capitol Switch Inc., Bethel, CT 06801	203-744-3300
Enerco, Inc., Seattle, WA 98108	206-762-1422
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
§ Gunther, W., GmbH, D 8500 Numberg 82, GERMANY	(0)911/65521 or 65520
† Hallmark Technologies, Mt. Dora, FL 32757	800-874-9063
Hokuriku USA Ltd., Madison, AL 35758	205-772-9620
† Holt Inc., Irvine, CA 92718	714-859-8800
Lucas Control Systems Products, Lucas Industries PLC, Hampton, VA 23666	804-766-1500
§ Lutron Electronics Co., Coopersburg, PA 18036	215-282-3800
§ Micro Switch, A Honeywell Div., Freeport, IL 61032	1-800-537-6945
§† Miller Dial Corp., El Monte, CA 91731	818-444-4555
MOLEX, Inc., Lisle, IL 60532	708-969-4550
New England Keyboard Inc., Fitchburg, MA 01420	508-345-8332
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094	201-392-4818
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543	914-698-2026;800-431-2625
Relay Service Co., Chicago, IL 60651	312-252-2700
§ Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312
§ Topflight, York, PA 17404	717-843-9901;800-233-9386
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
United Switch Company, Seattle, WA 98199	206-282-8823

Switches, Vacuum-5100

Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374	**B•1761-1762**
§ Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625	**B•1800**
† Pressure Controls, Inc., Belleville, NJ 07109	201-751-5002
Ross Engineering Corp., Campbell, CA 95008	408-377-4621

Switches (MIL), Non-RF-2440

A.P.M. Hexseal Corporation, Englewood, NJ 07631, 201-569-5700	**B•1669**
† Capitol Switch Inc., Bethel, CT 06801, 203-744-3300	**B•1687**
Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100	**B•1699**
§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	**B•1708**
† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200	**B•1716**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1718**
† Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300	**B•1872**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1726**
George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645	**B•1832**
§† Grayhill Inc., La Grange, IL 60525, 708-354-1040	**B•1730-1733**
IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409, 818-787-0311	**B•1078,1835**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836**
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040	**B•1752-1755**
† Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1758-1759**
Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891	**A•2093**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1772-1776**
† OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200	**B•1790-1791,1793**
† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561	**D•1167**
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 708-428-7171	**B•1798-1799**
† Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135	**B•1808**
§ T-Bar Data Switch Corp., Orange, CT 06477, 203-795-0739;800-726-8227	**B•1814**
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221	**B•1815**
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811	**B•2025**
Adams Rite Products, Inc., Glendale, CA 91204	818-241-5121
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
AME Corporation, Towaco, NJ 07082-0195	201-263-1700
§† Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763	508-699-9800
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
† Control Products, Inc., E. Hanover, NJ 07936	201-887-9400
§† EECO Div.,Transico Inc., Santa Ana, CA 92702-0659	714-835-6000
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
Entech Corp. of Volusia County, Ormond Beach, FL 32174-8761	904-672-7335
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
† Joslyn Jennings Corporation, San Jose, CA 95122-2696	408-292-4025
† Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
† Machine Components Corp., Plainview, NY 11803	516-694-7222
MACOM, Inc., Lowell, MA 01851	617-272-3000
§ McGill Electrical Product Group, Valparaiso, IN 46383	219-465-2200
Microavionics Corp., Costa Mesa, CA 92626	714-957-6904
Micronetics, Hudson, NH 03051	603-883-2900
† Orbit Instrument Corp., Hauppauge, NY 11788	516-435-8300
† Saint Switch, Inc., St. Charles, IL 60174	708-377-3779
† Tapeswitch Corp. of America, Farmingdale, NY 11735	516-694-6312

Switches (MIL), RF-2440

§† Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321	**B•1708**
† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260	**B•1710**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350	**B•1726**
§† George Risk Industries, Inc., Kimball, NE 69145, 308-235-4645	**B•1832**
Grayhill Inc., La Grange, IL 60525, 708-354-1040	**B•1730**
† Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1758-1759**
Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891	**A•2093**
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811	**B•2025**
Adams Rite Products, Inc., Glendale, CA 91204	818-241-5121
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007	708-952-8800
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022	201-941-4455
† Daico Industries, Inc., Rancho Dominguez, CA 90220	310-631-1143
§ Eaton Corp., Aerospace & Commercial Controls, Milwaukee, WI 53216	414-449-7326
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106

† General Microwave Corporation, Amityville, NY 11701	516-226-8900
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
† JFW Industries, Inc., Indianapolis, IN 46237	317-887-1340
† Joslyn Jennings Corporation, San Jose, CA 95122-2696	408-292-4025
§ K&L Microwave, Inc., Salisbury, MD 21801	410-749-2424
Line Electric Products, Glastonbury, CT 06033	203-659-3573;1-800-331-1137
† Loral Microwave-Wavecom, Northridge, CA 91324	818-882-3010
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
† Machine Components Corp., Plainview, NY 11803	516-694-7222
MACOM, Inc., Lowell, MA 01851	617-272-3000
† MarLee Switch Co., Upland, CA 91786	714-982-8988
Micronetics, Hudson, NH 03051	603-883-2900
OakGrigsby Inc., Sugar Grove, IL 60554	708-556-4200
Phoenix Microwave, Telford, PA 18969	215-723-6011
† RLC Electronics, Inc., Mt. Kisco, NY 10549	914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760	508-653-0844
† Signal Switch Company, Corona, CA 91720	909-736-5404
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
† Teledyne Microwave, Mountain View, CA 94043	415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715	406-586-0291
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012	805-987-8007

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Switching Assemblies, PCB Mounted-5150

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1662**
AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1667**
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200	**B•1679**
§ BURGESS-SAIA, Inc., Buffalo Grove, IL 60089, 708-215-9600	**B•1681,1683**
C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400	**B•1684**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 708-662-9200	**B•1697**
§ Comus International, Nutley, NJ 07110, 201-667-6200;1-800-35-COMUS	**B•1700**
CTS Corp., Electrocomponents, Elkhart, IN 46514, 219-295-3575	**B•1704-1705**
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**B•1706**
ELMA Electronic Inc., Fremont, CA 94538, 510-656-3400	**B•1718-1719**
E-Switch, Electronic Components Groupe, Minneapolis, MN 55403, 612-375-9639	**B•1722**
Intaq Key Panels, GM Nameplate, Inc., Seattle, WA 98119, 206-284-2200	**B•1836**
ITT Schadow, Eden Prairie, MN 55344, 612-934-4400	**B•1839**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040	**B•1746-1748,1751,1753**
Janco Corp., Burbank, CA 91508, 818-846-1800	**B•1759**
Jayco Interface Technology, Orange, CA 92665, 714-974-1701	**B•1840**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878,800-824-9374	**B•1765**
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525	**B•1845**
MORS Components, Wakefield, MA 01880-4444, 617-246-1007	**B•1781**
OakGrigsby Inc., Sugar Grove, IL 60554, 708-556-4200	**B•1790,1792,1979**
OMNI Switch USA, Inc., Phoenix, AZ 85027, 602-582-0629	**C•1137**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**B•1801**
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62	**B•1803**
† Secma, Inc., Secme, Irvine, CA 92714, 714-261-0610	**B•1804-1807,1850-1851**
Signal Switch Company, Corona, CA 91720, 909-736-5404	**B•1479**
Solico/Mec, Hartford, CT 06114, 203-527-3092	**B•1812**
§# A.D. Data Systems Corp., Photographic Sciences Corp., Webster, NY 14580-0478	716-265-1600
Aztec Industries, Inc., Mesa, AZ 85210	602-833-3131;800-729-3132
§ C.ITOH Technology, Inc., Electronic Comp. Div., Irvine, CA 92713-9657	800-347-2484 ext. 4529
DataLux Corp., Winchester, VA 22602	703-662-1500
E-Mark, Inc., Trumbull, CT 06611	203-452-1003
# GM Nameplate, Inc., Seattle, WA 98119	206-284-2200
Hamlin Inc., Lake Mills, WI 53551	414-648-3000
† Integrated Microwave, San Diego, CA 92121-1009	619-259-2600
Interconnect Devices, Inc., Kansas City, KS 66106	913-342-5544
† Interface Products, Inc., Oceanside, CA 92056	619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010	415-347-8217
Phoenix Microwave, Telford, PA 18969	215-723-6011
Sorenson Lighted Controls, Hartford, CT 06114	203-527-3092;1-800-275-7089
§# Support Systems Intl. Corp., Richmond, CA 94804	510-234-9090
United Switch Company, Seattle, WA 98199	206-282-8823

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† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

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† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300	**D•1173**
† American Electronics, Inc., Fullerton, CA 92631	714-871-3020
† Astro Instrument Corp., Deerfield, FL 33442-3019	305-698-6000
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Fasco Motors Group, Chesterfield, MO 63017	314-532-3505
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380	215-692-2700
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720	914-373-9003
† Magtech Controls, Vemitron Corporation, San Diego, CA 92173	619-662-2235
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
VME Microsystems Intl. Corp., Huntsville, AL 35803-3308	205-880-0444

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Tables, X-Y Axis-4900 — *See Vol. D*

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Tachometers, Generator-4900 — *See Vol. D*

Tachometers, Optical-4900 — *See Vol. D*

Tachometers, Pulse-4900 — *See Vol. D*

Tachometers, Stroboscopic-4900 — *See Vol. D*

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Temperature Compensators-5300

Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ... B•1860-1861
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ... B•1864-1865, 1867-1869
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ... B•1876
§ KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1975
Omega Engineering, Stamford, CT 06907, 800-826-6342 ... B•1886,2005, D•1016,1314
† Quality Thermistor, Boise, ID 83709, 208-377-3373 ... B•1892-1893
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 ... B•1389,1903
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 ... B•1904-1905,1907
Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974 ... B•1909-1910
ASC Systems, St. Clair Shores, MI 48080 ... 313-882-1133
§ EDL, Inc., Danville, VA 24540 ... 804-799-0807;1-800-DIAL EDL
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
§ Jumo Process Control, Inc., Coatsville, PA 19320 ... 215-380-8002
† Micro-Ohm Corp., Duarte, CA 91010 ... 818-3575377
Precision Resistor Co., Inc., Largo, FL 34647-1421 ... 813-541-5771
U.S. Sensor Corp., Orange, CA 92667 ... 714-639-1000
U.S. Sensor Corp., Orange, CA 92667 ... 714-639-1000
Western Elctrn. Comps. Corp., Camarillo, CA 93012 ... 805-482-8002

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Beau Interconnect Systems, Vernitron Corp., Laconia, NH 03247, 603-524-5102 ... C•1270,1272-1273
Andon Elctrns. Corp., Lincoln, RI 02865 ... 401-333-0388
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 ... 508-222-2202
# Clifford of Vermont, Inc., Bethel, VT 05032 ... 802-234-9921;800-451-4381
Concord Electronics Corporation, New York, NY 10012 ... 1-212-777-6571
Doran Manufacturing Co., Cincinnati, OH 45225 ... 513-681-5424
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
§ Entrelec Inc., Irving, TX 75038 ... 214-550-9025
† FIC Corp., Rockville, MD 20852 ... 301-881-8124;800-638-6594
Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805 ... 708-398-5311;800-323-5207
Marco Manufacturing Co., Inc., Philadelphia, PA 19145 ... 215-463-2332
§† Pass & Seymour/Legrand, Pass & Seymour/Inc., Syracuse, NY 13221 ... 315-468-6211
§† PCD, Peabody, MA 01960 ... 508-532-8800
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117 ... 800-245-4501

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Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 ... 508-222-2202
† Aydin Corp., Horsham, PA 19044 ... 215-657-7510
† Miltope Corp., Melville, NY 11747 ... 516-420-0200
† Northern Precision Labs., Fairfield, NJ 07006 ... 201-227-4800
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 ... 408-748-1010
U.S. Terminals Inc., Cincinnati, OH 45243 ... 513-561-8145

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Terminations, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ... B•1202-1204,1206, C•1163
† Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121 ... B•1223
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962 ... 1-800-344-0223, Ext. 1027
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 ... 508-222-2202
Berg Electronics, Camp Hill, PA 17011 ... 800-237-2374
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 ... 708-981-6000
§ Concord Electronics Corporation, New York, NY 10012 ... 1-212-777-6571
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 ... 418-683-0211; 1-800-663-EXFO
Fiberguide Industries Inc., Stirling, NJ 07980 ... 908-647-6601
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6 ... 613-226-4000
† Interoptics, Purdy Group, Burlingame, CA 94010 ... 415-347-7727
† Light Control Systems Inc., M/A COM Inc., Hudson, NH 03051 ... 603-883-8300
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701 ... 516-226-8950
3M Private Network Products, 3M, Austin, TX 78726 ... 512-984-3400;800-426-8626
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401 ... 803-676-2900

Terminations, Microwave-3450 — *See Vol. A*

Terminations, VHF, Video, Pulse-1900 — *See Vol. D*

Termination Systems, Wire & Cable-2100 — *See Vol. C*

Test Assemblies (MIL)-2440

AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 ... D•1229

§ **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
Assembly Specialists, Chelmsford, MA 01824	508-250-5900
† Cardinal Control Co., Kensington, CT 06037	203-828-6379
Computer Doctors, College Park, MD 20740	1-800-RAM-STAR;301-474-3095
§ Interconnect Devices, Inc., Kansas City. KS 66106	913-342-5544
Pacific Power Source Corp., Huntington Bch., CA 92649	714-898-2691;800-854-2433
Telegenix/Grim Corp., Cherry Hill, NJ 08034	609-424-5220

Test Equipment – See Meters, Acceleration, Admittance, etc. (Vol. D)

Test Equipment, Closed Circuit TV-Also See Television Systems & Equipment, Closed-Circuit-2900 – *See Vol. D*

Test Equipment, Color TV-2900 – *See Vol. D*

Test Equipment, Data Communications, Monitors & Recorders-2900 – *See Vol. D*

Test Equipment, Fiber Optic-2475

Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001	**B•1214**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
Advantest America, Inc., Buffalo Grove, IL 60089-4503	800-441-0852
Advantest Corporation, Tokyo 163, JAPAN	03-3342-7500
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809	408-776-8300
§ Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974	908-464-3550
§ AT&T Network Systems,Network Cable Sys. Div., Morristown, NJ 07962	1-800-344-0223, Ext. 1027
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Berkeley Nucleonics Corp., Richmond, CA 94804	510-234-1100
Cabletron Systems, Inc., Rochester, NH 03867	603-332-9400
§ Contact East, N. Andover, MA 01845	508-682-2000
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
§ Dupont Electro-Optic Products, Dupont Electronics, Research Triangle Park, NC 27709	1-800-888-LAN1;919-481-5100
Dymec Inc., Winchester, MA 01890	617-729-7870
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
† Force, Inc., Christiansburg, VA 24073	703-382-0462
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
Φ Genstar Rentals, Inc., Calabasas, CA 91302	800-422-3300
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
§ Harris Corp., Dracon Div., Camarillo, CA 93012	805-987-9511
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
Instrumentation Northwest, Redmond, WA 98052	206-885-3729
§ Laser Precision Corp., Utica, NY 13502	315-797-4449
† Lightwave Communications, Inc., Milford, CT 06460	203-878-9838
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701	516-226-8950
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
Olympus Corporation, Industrial Fiberoptics Division, Lake Success, NY 11042-1179	516-488-3880
Oriel Corp., Stratford, CT 06497-0872	203-377-8282
Photon, Inc., Santa Clara, CA 95054-3432	408-492-9449
† Power Technology, Inc., Little Rock, AR 72219-1117	501-568-1995
Precision Electro-Optics, Inc., Chatham, NJ 07928	201-635-8811
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444
Rifocs Corp., Camarillo, CA 93012	805-389-9800
Ross Engineering Corp., Campbell, CA 95008	408-377-4621
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
§ Wandel & Goltermann Inc., Morrisville, NC 27560-9228	919-460-3300
# Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109	317-788-9351

Test Equipment, Mechanical Impedance-2900 – *See Vol. D*

Test Equipment, Memory Systems, Disk-2900 – *See Vol. D*

Test Equipment, Motor-2900 – *See Vol. D*

Test Equipment, Rental & Lease - Also See Services, Electrical Measurement & Test-2900 – *See Vol. D*

Test Equipment, RFI Susceptibility-2900 – *See Vol. D*

Test Equipment (MIL)-2440

Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000	**A•1339**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438	**D•1266-1273**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800	**D•2281**
†Φ **Noise Com Inc., Paramus, NJ 07652, 201-261-8797**	**D•1311**
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309, 305-739-7004	**D•1212**
AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
† Atec, Inc., Houston, TX 77055	713-468-7971
†Φ Ballantine Laboratories, Cedar Knolls, NJ 07927	201-984-1900
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044	800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794	216-248-1200
Blue M, A General Signal Company, Blue Island, IL 60406	708-385-9000
Cincinnati Sub-Zero Prods., Cincinnati, OH 45241	513-772-8810
Cirris Systems Corp., Salt Lake City, UT 84119	801-973-4600;800-441-9910
Custom Sci. Instrs., Atlas Electric Devices Co., Cedar Knolls, NJ 07927	201-538-8500
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
† Electro Optical Industries Inc., Santa Barbara, CA 93111	805-964-6701 (ext. 280)
Φ# Equipment Remarketing Company, Boston Financial & Equity Corporation, Boston, MA 02215	617-267-8600
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975	201-633-6000
† Hayes Instrument Service Inc., Billercia, MA 01821	508-663-4800
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
† Industrial Control Co., Rockledge, FL 32955	407-259-7105
Interface Technology, Dynatech Corp., Pomona, CA 91768-4300	714-595-6030
ITF Corp., Buford, GA 30518	404-945-3844
§† Jonard Industries Corp., Tuckahoe, NY 10707	914-793-0700
Julie Research Labs., New York, NY 10001	212-633-6625
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025	201-227-2000
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
† Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
LTX Corporation, Westwood, MA 02090	617-461-1000
Midamerica Design Service, Spirit of America Corp., Fort Wayne, IN 46818	219-489-2511
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714	714-474-3900
North Atlantic Instruments, Inc., Bohemia, NY 11716-2416	516-567-1100
§ PACE, Inc., Laurel, MD 20723-1990	301-490-9860
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192	818-341-5151
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
SCHENCK PEGASUS Corporation, Troy, MI 48083	313-689-9000
† Sencore, Sioux Falls, SD 57107	1-800-736-2673; 605-339-0100
Sensidyne, Inc., Clearwater, FL 34620	813-530-3602;1-800-451-9444
†Φ Sheldon Instruments, Provo, UT 84604	801-376-7861
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
§ TEGAM, Inc., Madison, OH 44057	800-666-1010
† Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900
Φ Test Systems, Inc., Phoenix, AZ 85021	602-861-1010
Thermotron Inds., Holland, MI 49423	616-392-1491
Transmagnetics, Farmingdale, NY 11735	516-293-3100
† Trio-Tech International, San Fernando, CA 91340	818-365-9200
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
† VA-Tran Systems Inc., Chula Vista, CA 91911	619-423-4555
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300
† Watkins-Johnson Co., Palo Alto, CA 94304	415-493-4141

Test Fixtures, ATE-2900 – *See Vol. D*

Test Methods (MIL)-2440

Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433	**D•2289-2290**
Product Technology, Inc., Irvine, CA 92714, 714-474-8998	**C•1673**
§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
LTX Corporation, Westwood, MA 02090	617-461-1000
RTS Systems, Telex Communications, Inc., Burbank, CA 91506	818-566-6700
† Teradyne Inc., Assembly Test Group, Walnut Creek, CA 94598	510-932-6900

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Test Sets (MIL)-2440

§† **Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046**	**D•1317**
† Atec, Inc. Houston. TX 77055	713-468-7971
† Cabletest Products Co., Malden, MA 02148	617-665-2932
Colorado Data Systems, Tektronix, Englewood, CO 80110	303-762-1640; 800-237-2831
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
† Comtech Microwave Corp, Comtech Telecommunications Corp., Melville, NY 11747	516-777-8900
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499	206-657-7474
† Electro Optical Industries Inc., Santa Barbara, CA 93111	805-964-6701 (ext. 280)
† ETM Electromatic Inc, Newark, CA 94560	510-797-1100
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
Kenmar/TSI, Raleigh, NC 27604	919-876-6049
† Kestrel Systems Co., Leucadia, CA 92024	619-944-2957
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449	805-581-3950
† Northern Precision Labs., Fairfield, NJ 07006	201-227-4800
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745	206-881-1700
† Production Automation, Inc., San Jose, CA 95131-1026	408-894-9064
† Sunrise Electronics, Inc., Glendora, CA 91740	818-914-1926
† Telecommunications Techniques Corp., Germantown, MD 20876	301-353-1550
† Teledyne Ryan Electronics, San Diego, CA 92123	619-560-6400
Φ Test Systems, Inc., Phoenix, AZ 85021	602-861-1010
§ Triplett Corporation, Bluffton, OH 45817-9987	419-358-5015
Wavetek Corp., San Diego, CA 92123	619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123	619-279-2200

Test Systems, Automatic DC-2900 — ***See Vol. D***

Test Systems, Board-2900 — ***See Vol. D***

Test Systems, Component-2900 — ***See Vol. D***

Test Systems, Computer Controlled (Automatic)-2900 — ***See Vol. D***

Test Systems, Development Engineering — See Services, Assembly & Fabrication (Vol. D)

Test Systems, Functional-2900 — ***See Vol. D***

Test Systems, Hall Effect-2900 — ***See Vol. D***

Test Systems, IC-2900 — ***See Vol. D***

Test Systems, Thermal Stress-2550 — ***See Vol. D***

Test Systems, Ultrasonic, Computer Controlled-2900 — ***See Vol. D***

Test Systems, VLSI & Memory-2900 — ***See Vol. D***

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Testers, Bit Rate-2900 — ***See Vol. D***

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Testers, Capacitor-2900 — ***See Vol. D***

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Testers, Coil & Transformer-2900 — ***See Vol. D***

Testers, Communication Equipment (Automatic)-2900 — ***See Vol. D***

Testers, Component Linearity-2900 — ***See Vol. D***

Testers, Corona-2900 — ***See Vol. D***

Testers, CRT-2900 — ***See Vol. D***

Testers, Diode-2900 — ***See Vol. D***

Testers, Electron Beam-2900 — ***See Vol. D***

Testers, Electrical Parameter-2900 — ***See Vol. D***

Testers, Electric Power — See Monitors, Power, AC & DC (Vol. D)

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Testers, Fiber Optic-2900 — ***See Vol. D***

Testers, Ground Resistance — See Meters, Ohm (Vol. D)

Testers, Heat, Manual-2550 — ***See Vol. D***

Testers, Hipot — See Testers, Insulation Breakdown (Vol. D)

Testers, Insulation Breakdown-2900 — ***See Vol. D***

Testers, Insulation Resistance-2900 — ***See Vol. D***

Testers, Integrated Circuit (Automatic)-2900 — ***See Vol. D***

Testers, Integrated Circuit (Manual)-2900 — ***See Vol. D***

Testers, Interface-2900 — ***See Vol. D***

Testers, LED & LED Arrays-2900 — ***See Vol. D***

Testers, Life, Component-2550 — ***See Vol. D***

Testers, Logic Card-2900 — ***See Vol. D***

Testers, Loopback-2900 — ***See Vol. D***

Testers, Magnetic Core-2900 — ***See Vol. D***

Testers, Magnetic Head Media-2900 — ***See Vol. D***

Testers, Magnetic Medium-2900 — ***See Vol. D***

Testers, Magnetron-2900 — ***See Vol. D***

Testers, Material-2550 — ***See Vol. D***

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Testers, Meter-2900 — ***See Vol. D***

Testers, Microwave-2900 — ***See Vol. D***

Testers, Modem-2900 — ***See Vol. D***

Testers, Motor-2900 — ***See Vol. D***

Testers, Phase Noise-2900 — ***See Vol. D***

Testers, PIND-2900 — ***See Vol. D***

Testers, Potentiometer-2900 — ***See Vol. D***

Testers, Power Supply-2900 — ***See Vol. D***

Testers, Pulse Jitter-2900 — ***See Vol. D***

Testers, RAM-2900 — ***See Vol. D***

Testers, Relay-2900 — ***See Vol. D***

Testers, Resistivity-2900 — ***See Vol. D***

Testers, Resistor-2900 — ***See Vol. D***

Testers, ROM Devices-2900 — ***See Vol. D***

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Testers, Shock-2550 — ***See Vol. D***

Testers, Short Turn — See Testers, Coil (Vol. D)

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Testers, Solderability-4100 — ***See Vol. D***

Testers, Synchro/Resolver-2900 — ***See Vol. D***

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Testers, Thyristor-2900 — ***See Vol. D***

Testers, Tracking & Erosion Resistance (Insulation)-2900 — ***See Vol. D***

Testers, Transistor-2900 — ***See Vol. D***

Testers, Transmission & Delay-2900 — ***See Vol. D***

Testers, Tube-2900 — ***See Vol. D***

Testers, Vibration-Also See Services, Environmental Test-2900 — ***See Vol. D***

Testers, Voltage-2900 — ***See Vol. D***

Testers, Voltage Breakdown-2900 — ***See Vol. D***

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Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 .... D•2288
§† Qualitec Technologies, Inc., Fremont, CA 94538, 510-498-1046 .... D•1317
Valhalla Scientific, San Diego, CA 92121, 619-457-5576 .... D•1330
† Kestrel Systems Co., Leucadia, CA 92024 619-944-2957
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Production Automation, Inc., San Jose, CA 95131-1026 408-894-9064
† Telecommunications Techniques Corp., Germantown, MD 20876 301-353-1550
Φ Test Systems, Inc., Phoenix, AZ 85021 602-861-1010
† Trio-Tech International, San Fernando, CA 91340 818-365-9200

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Thermal Converters — See Converters, Thermal (Vol. B)

Thermal Imagers — See Imagers, Thermal (Vol. D)

Thermal Platforms-2900 — ***See Vol. D***

Thermistors-5300

Advanced Thermal Products, Inc., St. Marys, PA 15857, 814-834-1541 .... B•1858
† Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 .... B•1860-1861
† Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 .... B•1864-1865, 1867-1869
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 .... B•1873
§† Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000 .... B•1875
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 .... A•1091, B•1365
§† Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 .... B•1876-1878
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .... B•1879-1882
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 .... A•1969
† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .... B•1885
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... D•1359,1361
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•1796,1887, C•1792
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... B•1336
† Quality Thermistor, Boise, ID 83709, 208-377-3373 .... B•1892-1893
† Sensor Scientific, Inc., Fairfield, NJ 07004, 201-227-7790;800-524-1610 .... B•1898-1901
§ Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500 .... B•1903

§ **Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 .... B•1904-1905,1907**
§ **Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974 .... B•1909-1910**
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 .... 818-765-8300;800-827-7422
Alpha Thermistor, Inc., San Diego, CA 92121 .... 619-549-4660;800-235-5445
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
† Digitec, Marion, OH 43302 614-387-3444
§ EDL, Inc., Danville, VA 24540 .... 804-799-0807;1-800-DIAL EDL
Electro-Dyn Electronics, Niagara Falls, NY 14301 716-284-8747
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
† GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Interelectronics Corp., Congers, NY 10920 .... 914-EL8-8000
International Microelectronics, Arlington, TX 76003 817-473-1730
International Resistive Company, Boone, NC 28607 704-264-8861
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733 802-247-6811
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus. NJ 07094 201-392-4818
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Philips Technologies, North American Philips Corporation, Cheshire, CT 06410 203-271-6525
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
§† RdF Corporation, Hudson, NH 03051-0490 603-882-5195,800-445-8367
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§ TEGAM, Inc., Madison, OH 44057 800-666-1010
· Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562 919-636-5720
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
§ (UEC) United Electric Controls, Watertown, MA 02272-9143 617-926-1000
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
† U.S. Sensor Corp., Orange, CA 92667 714-639-1000
† U.S. Sensor Corp., Orange, CA 92667 714-639-1000
§† Victory Engineering Corp., Springfield, NJ 07081 201-379-5900
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300 512-244-1956
§ West Electronic Sales Team, Huntington Beach, CA 92647 .... 714-375-6500; 310-495-5569
Western Elctrn. Comps. Corp., Camarillo, CA 93012 805-482-8002

Thermistors (MIL)-2440

§† **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 .... A•1010-1011**
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 .... B•1864-1865, 1867-1868
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 .... B•1873
§ **Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 .... B•1876-1878**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .... B•1885
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... B•1888-1889
† **Sensor Scientific, Inc., Fairfield, NJ 07004, 201-227-7790;800-524-1610 .... B•1898-1901**
Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450 .... B•1904-1905,1907
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Electro-Dyn Electronics, Niagara Falls, NY 14301 716-284-8747
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 .... 201-288-4477; 800-447-5639
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
Fenwal Electronics, Inc., Milford, MA 01757 508-478-6000
Instrulab, Dayton, OH 45404 513-223-2241
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
Quality Thermistor, Boise, ID 83709 208-377-3373
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
Victory Engineering Corp., Springfield, NJ 07081 201-379-5900
Western Elctrn. Comps. Corp., Camarillo, CA 93012 805-482-8002
† Yellow Springs Instruments Co., Yellow Springs, OH 45387 800-765-4974

Thermocouple Devices & Materials – See Cooling/Heating Modules, Thermoelectric (Vol. B)

Thermocouple Interfaces for Personal Computers-2000 – *See Vol. D*

Thermocouples, Elements & Accessories-5300

Best Technology Inc., Seattle, WA 98109, 206-382-1300 .... B•1863
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 .... D•1373,1380,1382
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT .... D•1360-1361**
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•2005, C•1792, D•1016
OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900 .... D•1367
Quality Thermistor, Boise, ID 83709, 208-377-3373 .... B•1892
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 .... D•1373,1380
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 .... D•1392,1396
Acculex Corporation, Taunton, MA 02780 508-880-3660
† Alberox Corporation, New Bedford, MA 02745 508-995-1725
Alpha-M Corp., Dallas, TX 75229 214-406-0424
§ Alpha Wire Corp., Elizabeth, NJ 07207-0711 908-925-8000
Altech Corp., Flemington, NJ 08822-6000 908-806-9400
ARi Industries, Inc., Addison, IL 60101 .... 708-953-9100;800-237-6725
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Ballantine Laboratories, Cedar Knolls, NJ 07927 201-984-1900
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
Bartlett Instrument Co., Ft. Madison, IA 52627 319-372-8366
Burling Instruments, Inc., Chatham, NJ 07928-0298 201-635-9481
Calex Mfg. Co., Inc., Concord, CA 94520 510-687-4411
Ceramaseal, New Lebanon, NY 12125 518-794-7800
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Conax Buffalo Corporation, Buffalo, NY 14225 716-684-4500
§ Crompton Modutec, Manchester, NH 03109 .... 603-669-5121;800-METERS-1
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
† Digitec, Marion, OH 43302 614-387-3444
§ EDL, Inc., Danville, VA 24540 .... 804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
† Electro Physics Co., Inc., Waukegan, IL 60085 708-249-5801
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ FENWAL Inc., Ashland, MA 01721 508-881-2000
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
Hades Manufacturing Corp., Farmingdale, NY 11735 516-249-4244
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731 818-444-4000
Incotherm Limited, Inco Alloys Ltd., Hereford, UNITED KINGDOM HR4 9SL .... (44) 432 355880
Julie Research Labs., New York, NY 10001 212-633-6625
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
† Minco Products, Minneapolis, MN 55432 612-571-3121
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733 802-247-6811
PYCO, Inc., Penndel, PA 19047 215-757-3704
§ Pyrocom Co., Seattle, WA 98133 206-365-3535
§† RdF Corporation, Hudson, NH 03051-0490 603-882-5195,800-445-8367
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796 617-527-4385
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
† Simmonds Precision Engine Systems, BF Goodrich Aerospace, Norwich, NY 13815 607-335-5000
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309 305-739-7004
§ Sunshine Instruments, Philadelphia, PA 19115 .... 215-673-5600;800-343-1199
† Syscon Intl., Inc., So. Bend, IN 46601-3796 219-232-3900
§ TEGAM, Inc., Madison, OH 44057 800-666-1010
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 .... 516-549-6415/6428
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
† Thermometrics, Inc., Edison, NJ 08817-4695 908-287-2870
§ (UEC) United Electric Controls, Watertown, MA 02272-9143 617-926-1000
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
§ Wavetek Corp., San Diego, CA 92123 619-279-2200
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300 512-244-1956
§ WestCon, Marion, OH 43302 614-382-5771
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818 401-884-4188

Thermoelectric, Modules – See Cooling/Heating Modules, Thermolectric (Vol. B)

Thermographs-2900 — *See Vol. D*

Thermometers, Electronic (All Types) — See Meters, Temperature (Vol. D)

Thermometers, Microscopic, Infrared-2900 — *See Vol. D*

Thermometers, Resistance-2900 — *See Vol. D*

Thermostats-Also See Switches, Thermally Actuated; Controls, Temperature-5300

Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
† Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300	**B•1872**
Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000	**B•1875**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1314,1363**
† Philips Technologies, Airpax Protector Group, Frederick, MD 21701, 301-663-5141	**B•1891**
§ Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673	**B•1896-1897**
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500	**B•1389,1903**
Advanced Thermal Products, Inc., St. Marys, PA 15857	814-834-1541
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058	213-589-6181
§† Bud Industries, Inc., Willoughby, OH 44094-0431	216-946-3200
Burling Instruments, Inc., Chatham, NJ 07928-0298	201-635-9481
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8	514-739-3274
† Chatham Controls, Chatham, NJ 07928	201-635-8892
§ Eliwell Inc., Baldwinsville, NY 13027	315-638-9598
§ E-Squared Technology Corp., Ventura, CA 93003	805-644-9544
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Upper Saddle River, NJ 07458	201-825-9696
† Home and Building Control, Honeywell Inc. MN 27-3176, Minneapolis, MN 55408	1-800-328-5111
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
§ Letco International, New Braunfels, TX 78131-1200	1-800-222-9676
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
§ Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
Thermik Corp., Thermik Sensor Technics, GmbH, New Bern, NC 28562	919-636-5720
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538	419-525-8450
§ (UEC) United Electric Controls, Watertown, MA 02272-9143	617-926-1000
Warren G-V, General Signal Corp., Whippany, NJ 07981	201-386-1200

Thermowells-5300

Yellow Springs Instruments Co., Yellow Springs, OH 45387, 800-765-4974	**B•1910**
Conax Buffalo Corporation, Buffalo, NY 14225	716-684-4500
§ DELTA M Corporation, Oak Ridge, TN 37830	615-483-1569
§ GIC Thermodynamics, Royal Oak, MI 48073	313-280-1648
Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
Minco Products, Minneapolis, MN 55432	612-571-3121
Omega Engineering, Stamford, CT 06907	800-826-6342
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
PYCO, Inc., Penndel, PA 19047	215-757-3704
§ Pyrocom Co., Seattle, WA 98133	206-365-3535
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796	617-527-4385
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538	419-525-8500
† Thermo Electric, Saddle Brook, NJ 07662	201-843-5800

Thin-Film Memory Systems, Planar — See Memory Systems (Vol. D)

Thyristors and SCRs, Surface Mount-4800 — *See Vol. A*

Thyristors (Incl. Silicon Controlled Rectifiers) - Also see DIACs; TRIACs, SIDACs-4800 — *See Vol. A*

Thyristors (MIL)-2440

† NWL Transformers, Bordentown, NJ 08505, 609-298-7300	**D•1851**
† PowerTech. Inc., Fair Lawn, NJ 07410	201-791-5050
§ Sanyo Semiconductor Corp., Allendale, NJ 07401	201-825-8080

Ties, Wire & Cable — See Wire & Cable Ties (Vol. C)

Time Delays, Precision-2900 — *See Vol. D*

Time Dispenser, Microprocessor based-2200 — *See Vol. D*

Time Management Systems-2200 — *See Vol. D*

Timers, Counting-2200 — *See Vol. D*

Timers, Cycle & Reset-2200 — *See Vol. D*

Timers, Delay-2200 — *See Vol. D*

Timers, Electrolytic Cell-2200 — *See Vol. D*

Timers, Interval-2200 — *See Vol. D*

Timers, Programmed-2200 — *See Vol. D*

Timers, Sequence-2200 — *See Vol. D*

Timers, Solid State-2200 — *See Vol. D*

Tool Kits & Sets-5400 — *See Vol. C*

Tools & Kits, Contact Insertion/Removal-5400 — *See Vol. C*

Tools, Alignment & Tuning-5400 — *See Vol. C*

Tools, Specialty-5400 — *See Vol. C*

Tools, Cable Tie-5400 — *See Vol. C*

Tools, Connector-5400 — *See Vol. C*

Tools, Crimping & Swaging-5400 — *See Vol. C*

Tools, Heat Sealing-5400 — *See Vol. C*

Tools, Lead Bending & Insertion-5400 — *See Vol. C*

Tools, Magnetic Pickup-5400 — *See Vol. C*

Tools, Marking, Numbering, Engraving-5400 — *See Vol. C*

Tools, Parts Handling, Vacuum Operated-5400 — *See Vol. C*

Tools, Relay Servicing-5400 — *See Vol. C*

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Tools, Wire Wrapping-5400 — *See Vol. C*

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Totalizers, Digital-2200 — *See Vol. D*

Touch Monitors-2000 — *See Vol. D*

Touch Panels-2000 — *See Vol. D*

Touch Screens-2450

Transparent Devices, Inc., Newbury Park, CA 91320, 805-499-5000	**B•1126**

Touch Terminals-2000 — *See Vol. D*

Tracers, Curve-2900 — *See Vol. D*

Tracers, Signal — See Testers, Signal Tracing (Vol. D)

Trackballs, XY Positioning-2200 — *See Vol. D*

Tracking Systems (MIL)-2440

† Orbit Instrument of Cal., Orbit Instrument Corp., Cypress, CA 90630, 714-527-0561	**D•1167**
† Accusonic Division, O.R.E. International Inc., Falmouth, MA 02541	508-548-5800
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† Anaren Microwave, Inc., E. Syracuse, NY 13057	315-432-8930
† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† Datron Systems Division, Simi Valley, CA 93065-1650	805-584-1717
† DBA Systems, Inc., Melbourne, FL 32902-0550	407-727-0660
Dowty Avionics, Arcadia, CA 91006	818-445-5955
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371	818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359	214-470-2106
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
† MFG, Parabam Div., Carson, CA 90745	213-549-5044
Orbit Advanced Technologies, Horsham, PA 19044	215-674-4220
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311	818-885-8223
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
† Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
§† Vega Precision Labs., Vienna, VA 22180	703-938-6300

Training Systems (MIL)-2440

† Control Technology Co., Inc., Long Island City, NY 11101	718-361-2133
† E M S Development Corp., Farmingdale, NY 11735	516-293-7900
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
GP Training Systems, GPS Technologies, Inc., Pottstown, PA 19464	215-327-8800
† Matrox Electronic Systems, Ltd., Dorval, Que., CANADA H9P 2T4	514-685-2630
† Metric Systems, Ft. Walton Beach, FL 32548-9990	904-244-9600
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000

Transceivers-1900 — *See Vol. D*

Transceivers, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1207-1208, C•1163**
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001	**B•1213**

† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1218-1219**
§ S.I. Tech, Batavia, IL 60510, 708-232-8640	**B•1229**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§ AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
Dolan-Jenner Inds., Woburn, MA 01801	617-935-7444
† Dymec Inc., Winchester, MA 01890	617-729-7870
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
H & L Instruments, Burlingame, CA 94010	415-342-7850
Lentronics, Prism Systems Inc., Burnaby, B.C., CANADA V5A 1X7	604-421-8733
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086	408-730-5900
Nu Data, Inc., Little Silver, NJ 07739	908-842-5757

Transceivers (MIL)-2440

Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1219**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† Aydin Corp., Horsham, PA 19044	215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
§† Holt Inc., Irvine, CA 92718	714-859-8800
† ILC Data Device Corp., Bohemia, NY 11716-2482	516-567-5600
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086	408-730-6300

Transducer Elements-5500

G.L. Collins Corporation, Long Beach, CA 90805, 310-531-6500	**B•1952**
§ Data Instruments, Inc., Acton, MA 01720, 800-332-3282	**B•1929**
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1936**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591	**B•1882**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1970-1971**
† Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244	**A•2114**
Ocean Motions Co., Barrington, RI 02806, 401-246-1394	**B•1980**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004**
Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313	**B•2016**
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777	**A•2128**
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718	516-694-9000
† Channel Industries, Santa Barbara, CA 93111	805-967-0171
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ HBM, Inc., Marlboro, MA 01752	508-624-4500
JEMA, Wilmette, IL 60091	708-251-3600
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823	814-355-1593
§ Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748	508-435-6831

Transducers, Acceleration — See Accelerometers (Vol. B)

Transducers, Audio-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000	**D•1026-1027**
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**D•1029**
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970	**D•1032**
§ International Components Corp., Melville, NY 11747, 516-293-1500	**D•1033-1034**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1024-1025,1042-1043,1046-1047**
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400	**D•1051**
Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050	**A•2406**
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600	**B•1974**
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**B•1976-1977, D•1055**
§ North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090	**A•1130**
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133	**A•1665**
§† Projects Unlimited, Dayton, OH 45414, 513-890-1918	**D•1057**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1061-1062**
Rodale Technical Sales Inc., Islip, NY 11751, 516-277-5454	**D•1063**
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911	**D•1064**
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512	**D•1068-1071**
§ AKG Acoustics, Inc., San Leandro, CA 94577	510-351-3500
† Blatek, Inc., State College, PA 16801	814-231-2085;814-231-2086
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Jaro Components, Inc., Boca Raton, FL 33487-8295	407-241-8600
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
§ Midstates Marketing, Inc., Indianapolis, IN 46202	317-639-9999
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
§ Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
SAE Power, Inc., Santa Clara, CA 95050	408-988-0700
§ Shure Brothers Inc., Evanston, IL 60202-3696	708-866-2200
Sonicall, Inc., Signal Hill, CA 90806	213-490-2143
† Stanton Magnetics, Inc., Plainview, NY 11803-1511	516-349-0235
§# Tauber Elctrns. Inc., San Diego, CA 92117	619-274-7242;1-800-927-0004
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056	708-803-6100
§ Wheelock, Inc., Long Branch, NJ 07740	908-222-6880

Transducers, Ceramic-5500

§ MG Electronics, Hauppauge, NY 11788, 516-582-3400	**D•1051**
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133	**A•1665**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1061-1062**
Blatek, Inc., State College, PA 16801	814-231-2085;814-231-2086
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† Channel Industries, Santa Barbara, CA 93111	805-967-0171
DJ Instruments, Inc., N. Billerca, MA 01862	508-667-5301
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111	805-683-2575
§ Jaro Components, Inc., Boca Raton, FL 33487-8295	407-241-8600
JEMA, Wilmette, IL 60091	708-251-3600
LZR Electronics, Inc., Gaithersburg, MD 20879	301-921-4600
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113	505-822-8801
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062	708-205-2867
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
Projects Unlimited, Dayton, OH 45414	513-890-1918
§ Stetco, Inc., Franklin Pk., IL 60131	708-671-4208
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748	508-435-6831

Transducers, Current-2200

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100	**B•1914**
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309, B•1455,1927**
GMW Associates, Redwood City, CA 94064, 415-368-4884	**B•1950-1951**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1385,1387**
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900	**B•1963**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**B•1987,1995-1996**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828	**A•1283**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1385,1387**
U.R.D. America, Laguna Nigel, CA 92607, 714-831-0111	**D•1169**
Moore Products Co., Spring House, PA 19477	215-646-7400

Transducers, Displacement-5500

§ Data Instruments, Inc., Acton, MA 01720, 800-332-3282	**B•1930**
Dynamation Transducers Corporation, Holliston, MA 01746, 508-429-8440	**A•2081-2083**
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193, 508-658-6100	**B•1935**
Hermetic Switch, Chickasha, OK 73018, 405-224-4046	**B•1954-1955**
† Humphrey, Inc., San Diego, CA 92123, 619-565-6631	**B•1956**
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555	**A•2097-2098**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1970-1971**
† Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244	**A•2114**
Ocean Motions Co., Barrington, RI 02806, 401-246-1394	**B•1980**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004-2005, D•1415**
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777	**A•2128**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
§ Automatic Timing and Controls, Sycon Corp., Marion, OH 43302	614-387-8827
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Blatek, Inc., State College, PA 16801	814-231-2085;814-231-2086
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
† Bourns Instruments Inc., Riverside, CA 92507	714-781-5148
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Capacitec, Inc., Ayer, MA 01432	508-772-6033
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91309-7964	818-884-6860
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004	201-227-4222
G.L. Collins Corporation, Long Beach, CA 90805	310-531-6500
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
Computer Instruments Div., Westbury, NY 11590	516-876-8400
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Disc Instruments, Honeywell, Costa Mesa, CA 92626	714-433-0343
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY	(0)911/65521 or 65520
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
HBM, Inc., Marlboro, MA 01752	508-624-4500
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
§† Kavlico Corp., Moorpark, CA 93021	805-523-2000
LEL Co., Cresskill, NJ 07626	201-569-8641
Lisk, G. W., Co., Clifton Springs, NY 14432	315-462-2611

† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Magnetoelastic Devices, Pittsfield, MA 01201 413-445-5608
Midori America Corp., Fullerton, CA 92631 714-449-0997
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
MTS Systems, Eden Prairie, MN 55344 612-937-4000
NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
Pres-Air-Trol Corp., Mamaroneck, NY 10543 .... 914-698-2026;800-431-2625
Sensotec, Inc., Columbus, OH 43212 614-486-7723
† Sentech, Inc., Cheltenham, PA 19012 215-663-0422
§ SKF Condition Monitoring, San Diego, CA 92123-1841 619-496-3400
† Teledyne Gurley, Troy, NY 12181 .... 518-272-6300;800-759-1844
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403 215-539-4400
TRW Technar, Inc., TRW, Inc., Irwindale, CA 91706 818-334-0250
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Flow-5500

Dresser Instrument Div., Dresser Industries, Stratford, CT 06497, 203-378-8281 .... B•1933
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 .... B•1324,1970-1971,1973
Ocean Motions Co., Barrington, RI 02806, 401-246-1394 .... B•1980
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•2005
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
Accusonic Division, O.R.E. International Inc., Falmouth, MA 02541 508-548-5800
Airmar Technology, Milford, NH 03055 603-673-9570
Blatek, Inc., State College, PA 16801 .... 814-231-2085;814-231-2086
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-425-2346
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
† Computer Instruments Div., Westbury, NY 11590 516-876-8400
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887 .... 508-658-5410;800-848-9800
† EG & G Flow Technology, Inc., Phoenix, AZ 85072 602-437-1315
§† Fenwal Electronics, Inc., Milford, MA 01757 508-478-6000
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
GP:50 New York, Grand Island, NY 14072 716-773-9300
Gutwerk Instruments Inc., McKeesport, PA 15132 412-672-3668
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
§ IC Sensors, Inc., Milpitas, CA 95035 800-767-1888
† Intek, Inc., Westerville, OH 43081 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
# Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
Micronel U.S., Vista, CA 92083 619-727-7400
§† MKS Instruments, Inc., Andover, MA 01810 .... 508-975-2350;800-227-8766
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062 708-205-2867
Panametrics, Waltham, MA 02154-3497 617-899-2719
PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053 215-355-6900
Pres-Air-Trol Corp., Mamaroneck, NY 10543 .... 914-698-2026;800-431-2625
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
Sensym, Inc., Sunnyvale, CA 94089 408-744-1500
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
Transonic Systems Inc., Ithaca, NY 14850 607-257-5300
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057

Transducers, Force-5500

§ Data Instruments, Inc., Acton, MA 01720, 800-332-3282 .... B•1930
† Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650 .... B•1936
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•2004
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811 .... B•2025
† A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
Cambridge Technology, Inc., Watertown, MA 02172 617-923-1181
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
§ DCT Instruments, Columbus, OH 43212 1-800-328-1028
§ Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
DJ Instruments, Inc., N. Billerca, MA 01862 508-667-5301
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§† Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§ Kavlico Corp., Moorpark, CA 93021 805-523-2000
§† Kistler Instruments Corp., Amherst, NY 14228-2171 716-691-5100
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
Magnetoelastic Devices, Pittsfield, MA 01201 413-445-5608
NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
Sensor Developments Inc., Lake Orion, MI 48361 313-391-3000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
§ Vitec, Inc., Cleveland, OH 44122 1-800-321-6384

Transducers, Frequency — See Transducers, Volt, Watt, Current, etc. (Vol. B)

Transducers, Humidity-5500

Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•2004-2005, D•1362,1415
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... B•1888
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
§ Eliwell Inc., Baldwinsville, NY 13027 315-638-9598
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§† Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731 818-444-4000
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 .... 603-883-3390; 800-999-3390
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-973-8228
† Thunder Scientific Corp., Albuquerque, NM 87123 .... 505-265-8701;800-872-7728

Transducers, Incremental Digital Position, Rotary — See Encoders, Shaft Angle (Vol. B)

Transducers, Liquid Level-5500

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 .... B•1916
Ocean Motions Co., Barrington, RI 02806, 401-246-1394 .... B•1980
Omega Engineering, Stamford, CT 06907, 800-826-6342 .... B•2004, D•1362-1363,1415
Reed Switch Developments, Inc., Racine, WI 53403, 414-637-8848 .... B•2006
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
Airmar Technology, Milford, NH 03055 603-673-9570
American Magnetics, Oak Ridge, TN 37831-2509 615-482-1056
Blatek, Inc., State College, PA 16801 .... 814-231-2085;814-231-2086
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
§ DCT Instruments, Columbus, OH 43212 1-800-328-1028
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
Fluid Components, Inc., San Marcos, CA 92069 619-744-6950
Gordon Products, Brookfield, CT 06804 203-775-4501
GP:50 New York, Grand Island, NY 14072 716-773-9300
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305 .... 803-574-8960;1-800-845-2102
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
Instrumentation Northwest, Redmond, WA 98052 206-885-3729
Intek, Inc., Westerville, OH 43081 614-895-0301
Johnson Yokogawa Corp., Newnan, GA 30265 404-254-0400
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 .... 412-788-2830;800-998-1020
§ Level Plus, Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
Lundahl Instruments, Inc., Ezra C. Lundahl Inc., Logan, UT 84321 801-753-7300
MagneTek Controls, MagneTek Inc., Clawson, MI 48017 313-435-0700
# Meriam Instrument, Scott Fetzer, Cleveland, OH 44102 216-281-1100
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709 919-677-0100
MTS Systems, Eden Prairie, MN 55344 612-937-4000
Polaroid Corp., Cambridge, MA 02139 800-225-1618
Precise Sensors, Inc., Monrovia, CA 91016 818-358-4578
Schlumberger Industries, Tranducers Div., Houston, TX 77082 713-558-2587
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 510-471-9717
SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
§ Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403 215-539-4400
§ TURCK Inc., Minneapolis, MN 55441-2656 .... 612-553-9224;1-800-328-0580

Transducers, Magnetic Pickup-5500

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 .... D•1152,1236
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 .... B•1954-1955
† International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622 .... D•1039
JEMA, Wilmette, IL 60091, 708-251-3600 .... D•1042
Magnetic Shield Corporation, Perfection Mica Co., Bensenville, IL 60106, 708-766-7800 .... C•1696-1697

Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1970-1971**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**B•1996**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1336-1338**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1061-1062**
Reed Switch Developments, Inc., Racine, WI 53403, 414-637-8848	**B•2006**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500	**A•2118**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670	800-262-4638; 800-525-3536
§ ALTEK Corporation, Silver Springs, MD 20904-7802	301-572-2555
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ Danaher Controls, Gurnee, IL 60031-1282	708-662-2666
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Dixson, Inc., Grand Junction, CO 81503	303-244-1241
§ Dynalco Controls, Ft. Lauderdale, FL 33309	305-739-4300
§ Dynapar, Gurnee, IL 60031	312-662-2666
Elna America, Inc., Cypress, CA 90630	714-761-8600
General Vibrations Mfg. Co., Manchester, CT 06040	203-646-0090
§ Grado Laboratories, Brooklyn, NY 11220	718-435-5340
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015	800-222-7846
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Motion Sensors, Inc., Cranford, NJ 07701	908-709-0025
Murata Erie North America, Inc., Smyrna, GA 30080	404-436-1300
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
Philips Technologies, Automotive Electronics Group, Cheshire, CT 06410	203-271-6000
§ Rye Industries, Inc., Fuquay-Varina, NC 27526	919-557-0511;800-626-1511
Sentech, Inc., Cheltenham, PA 19012	215-663-0422
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
Standex Electronics, Standex International, Cincinnati, OH 45209	513-871-3777
§ Vitec, Inc., Cleveland, OH 44122	1-800-321-6384
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992	219-563-2191

Transducers, Magnetostrictive-5500

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900	**D•1152**
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
JEMA, Wilmette, IL 60091	708-251-3600
§ Level Plus, Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404	407-881-3200
Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078	401-762-3800
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100

Transducers, Piezoelectric-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000	**D•1026-1027**
CUI Stack Inc., Beaverton, OR 97005, 503-643-4899	**D•1029**
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1936**
§ **International Components Corp., Melville, NY 11747, 516-293-1500**	**D•1033-1036**
JEMA, Wilmette, IL 60091, 708-251-3600	**D•1042**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1970,1972**
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600	**B•1974**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300**	**D•1054-1055**
§ **NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133**	**A•1665**
§† **Projects Unlimited, Dayton, OH 45414, 513-890-1918**	**D•1057**
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512	**D•1068,1070**
† **Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811**	**B•2025**
Airmar Technology, Milford, NH 03055	603-673-9570
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718	516-694-9000
† Blatek, Inc., State College, PA 16801	814-231-2085;814-231-2086
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
† Channel Industries, Santa Barbara, CA 93111	805-967-0171
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
Delta Controls Corp., Shreveport, LA 71107	318-424-8471
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772	516-758-0700
General Vibrations Mfg. Co., Manchester, CT 06040	203-646-0090
§ IC Sensors, Inc., Milpitas, CA 95035	800-767-1888
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111	805-683-2575
§† Kistler Instruments Corp., Amherst, NY 14228-2171	716-691-5100
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113	505-822-8801
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
§ North American Capacitor Co., Indianapolis, IN 46224	317-273-0090
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
† Pind Testers Inc., Irvine, CA 92718	714-457-1090
Polaroid Corp., Cambridge, MA 02139	800-225-1618
Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
Shogyo International Corp., Great Neck, NY 11021-4799	516-466-0911
§ Stetco, Inc., Franklin Pk., IL 60131	708-671-4208
Stetron International, Inc., Buffalo, NY 14203	716-854-3443
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
† Sundstrand Data Control, Redmond, WA 98073-9701	206-885-3711
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493	708-364-6104
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056	708-803-6100
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748	508-435-6831
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322

Transducers, Position, Linear-5500

§ **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200**	**B•1920**
G.L. Collins Corporation, Long Beach, CA 90805, 310-531-6500	**B•1952**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510**	**D•1176-1177, 1179**
§ **Data Instruments, Inc., Acton, MA 01720, 800-332-3282**	**B•1930**
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261	**A•2078**
Dynamation Transducers Corporation, Holliston, MA 01746, 508-429-8440	**A•2081-2083**
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193, 508-658-6100	**B•1935**
Farrand Controls, Ruhle Companies, Inc., Valhalla, NY 10595, 914-761-2600	**B•1949**
§ **Hamlin Inc., Lake Mills, WI 53551, 414-648-3000**	**B•1953**
Hermetic Switch, Chickasha, OK 73018, 405-224-4046	**B•1954-1955**
† **Humphrey, Inc., San Diego, CA 92123, 619-565-6631**	**B•1956,1958**
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1219**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1970-1971**
Midori America Corp., Fullerton, CA 92631, 714-449-0997	**A•2109**
† **Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244**	**A•2114**
Ocean Motions Co., Barrington, RI 02806, 401-246-1394	**B•1980**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1415**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1337-1338**
Reed Switch Developments, Inc., Racine, WI 53403, 414-637-8848	**B•2006**
§ **Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313**	**B•2016**
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777**	**A•2128-2129**
§ AEMC Corporation, Boston, MA 02111	617-451-0227;800-343-1391
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
Bently Nevada Corp., Minden, NV 89423	800-227-5514,702-782 3611
† Bourns Instruments Inc., Riverside, CA 92507	714-781-5148
Burleigh Instruments, Fishers, NY 14453-0755	716-924-9355
Capacitec, Inc., Ayer, MA 01432	508-772-6033
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91309-7964	818-884-6860
† Component Specialties Corp., Temple City, CA 91780	213-283-0015
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
C-Tek Inc., Wakefield, MA 01880	617-246-1720
CTS Corp., Automotive Products, Elkhart, IN 46514	219-295-3575
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§ Dova Controls, Redmond, WA 98052-5165	206-881-7414
Enprotech Corp., Kalamazoo, MI 49007	616-381-0665
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
HBM, Inc., Marlboro, MA 01752	508-624-4500
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† JDK Controls, Inc., Grass Valley, CA 95945-0512	916-273-4608
Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
§† Kavlico Corp., Moorpark, CA 93021	805-523-2000
Lisk, G. W., Co., Clifton Springs, NY 14432	315-462-2611
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065	805-581-3985
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
Magnetoelastic Devices, Pittsfield, MA 01201	413-445-5608
Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
Motion Sensors, Inc., Cranford, NJ 07701	908-709-0025
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
† Penny & Giles, Santa Monica, CA 90401	310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703	508-226-3008
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Pres-Air-Trol Corp., Mamaroneck, NY 10543	914-698-2026;800-431-2625
Sensotec, Inc., Columbus, OH 43212	614-486-7723
† Sentech, Inc., Cheltenham, PA 19012	215-663-0422

Transducers, Position, Linear-5500 (Cont'd)

† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
TRW Technar, Inc., TRW, Inc., Irwindale, CA 91706	818-334-0250
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
Unimeasure, Inc., Corvallis, OR 97330	503-757-3158
U. S. Digital Corp., Vancouver, WA 98682	206-260-7451
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
Vibrac, Amherst, NH 03031	603-882-6777

Transducers, Position, Rotary-5500

BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161	**B•1917**
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600	**B•1917**
BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414	**B•1917**
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000	**B•1917**
G.L. Collins Corporation, Long Beach, CA 90805, 310-531-6500	**B•1952**
† **Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510**	**D•1176**
Dynamation Transducers Corporation, Holliston, MA 01746, 508-429-8440	**A•2081-2083**
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193, 508-658-6100	**B•1935**
Farrand Controls, Ruhle Companies, Inc., Valhalla, NY 10595, 914-761-2600	**B•1949**
Hamlin Inc., Lake Mills, WI 53551, 414-648-3000	**B•1953**
† **Humphrey, Inc., San Diego, CA 92123, 619-565-6631**	**B•1956,1958**
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	**B•1219**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1971**
Midori America Corp., Fullerton, CA 92631, 714-449-0997	**A•2109**
† **Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244**	**A•2114**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1337-1338**
§ **Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313**	**B•2016**
Transmagnetics, Farmingdale, NY 11735, 516-293-3100	**D•1208**
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777**	**A•2128-2129**
§ Astrosystems, Inc., Lake Success, NY 11042	516-328-1600
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009	619-931-1500
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117	805-968-0782
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
† Computer Conversions Corp., E. Northport, NY 11731	516-261-3300
C-Tek Inc., Wakefield, MA 01880	617-246-1720
CTS Corp., Automotive Products, Elkhart, IN 46514	219-295-3575
§ Dova Controls, Redmond, WA 98052-5165	206-881-7414
§ Dynapar, Gurnee, IL 60031	312-662-2666
Enprotech Corp., Kalamazoo, MI 49007	616-381-0665
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116	918-438-7800
Hecon Corp., Eatontown, NJ 07724	908-542-9200
International Machine & Tool Corp., Warwick, RI 02888	401-467-6905
† JDK Controls, Inc., Grass Valley, CA 95945-0512	916-273-4608
† Kavlico Corp., Moorpark, CA 93021	805-523-2000
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
MagneTek Controls, MagneTek Inc., Clawson, MI 48017	313-435-0700
† Magtech Controls, Vernitron Corporation, San Diego, CA 92173	619-662-2235
Maxmar Controls Inc., Pleasantville, NY 10570	914-747-3540
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
Motion Sensors, Inc., Cranford, NJ 07701	908-709-0025
† Penny & Giles, Santa Monica, CA 90401	310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703	508-226-3008
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410	203-271-6525
Sentech, Inc., Cheltenham, PA 19012	215-663-0422
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607	206-834-2500
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173	708-884-6664
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
† Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
Vibrac, Amherst, NH 03031	603-882-6777

Transducers, Power — See Transducers, Volt, Watt, Currents, etc. (Vol. B)

Transducers, Pressure-5500

§ **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200**	**B•1920-1921**
§ **Data Instruments, Inc., Acton, MA 01720, 800-332-3282**	**B•1928-1930**
Dresser Instrument Div., Dresser Industries, Stratford, CT 06497, 203-378-8281	**B•1933**
† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650**	**B•1936,1940-1941**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1373**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1970-1973**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004-2005**
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA	**B•2014-2015**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1373**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
† A. L. Design, Inc., Buffalo, NY 14217	716-875-6240
Approved Purification Corp., Stamford, CT 06907	203-357-0141
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§ Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058	213-589-6181
§ Bellofram Corporation, Newell, WV 26050	304-387-1200;1-800-733-2356
† Bourns Instruments Inc., Riverside, CA 92507	714-781-5148
Cambridge Aeroflo, Inc., Shirley, MA 01464	508-425-2346
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91309-7964	818-884-6860
† Channel Industries, Santa Barbara, CA 93111	805-967-0171
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
† Computer Instruments Div., Westbury, NY 11590	516-876-8400
§ Crystal Engineering Corp., Los Osos, CA 93402	805-528-2155;800-444-1850
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
Delta Controls Corp., Shreveport, LA 71107	318-424-8471
DJ Instruments, Inc., N. Billerca, MA 01862	508-667-5301
Domino, Inc., Fort Wayne, IN 46899	219-456-5512
§ Dynisco, Sharon, MA 02067	617-784-8400
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342	818-362-7151
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010	708-882-5757
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983	203-848-9271
Gentran, Safetytek Corp., Fremont, CA 94538	510-226-9343
Gould Inc., Test and Measurement Group, Valley View, OH 44125	216-328-7000
GP:50 New York, Grand Island, NY 14072	716-773-9300
§ GSE, Core Inds., Farmington Hills, MI 48024	313-476-7875
HBM, Inc., Marlboro, MA 01752	508-624-4500
§ IC Sensors, Inc., Milpitas, CA 95035	800-767-1888
Instrumentation Northwest, Redmond, WA 98052	206-885-3729
ITT Conoflow, ITT Fluid Technology Corp., St. George, SC 29477	803-563-9281
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Jumo Process Control, Inc., Coatsville, PA 19320	215-380-8002
Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
§ Kavlico Corp., Moorpark, CA 93021	805-523-2000
Keller-PSI, Oceanside, CA 92056	619-967-6066
§† Kistler Instruments Corp., Amherst, NY 14228-2171	716-691-5100
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205	412-788-2830;800-998-1020
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
LEL Co., Cresskill, NJ 07626	201-569-8641
§ Leybold Inficon Inc., E. Syracuse, NY 13057-9714	315-434-1100
Lucas Nova Sensor, Lucas Industries, Fremont, CA 94539	510-490-9100
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065	805-581-3985
Mensor Corporation, San Marcos, TX 78666	512-396-4200
# Meriam Instrument, Scott Fetzer, Cleveland, OH 44102	216-281-1100
§ Metermaster, Tempe, AZ 85282	602-431-0015
MetriCor, Inc., Woodinville, WA 98072	206-483-5577
Midori America Corp., Fullerton, CA 92631	714-449-0997
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
Motorola Inc., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., Northbrook, IL 60062	708-205-2867
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284	602-244-6900
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
NMB Technologies Inc., Chatsworth, CA 91311	818-341-3355
§ Norgren, Littleton, CO 80120-1663	303-794-2611
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696	914-693-9001
† Paine Corporation, Seattle, WA 98144	206-329-8600;800-426-0366
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
† Penny & Giles, Santa Monica, CA 90401	310-393-1497
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
† PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
Pres-Air-Trol Corp., Mamaroneck, NY 10543	914-698-2026;800-431-2625
Pressure Systems, Inc., Hampton, VA 23666	804-865-1243
PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
# Sensor Products, Inc., E. Hanover, NJ 07936	201-884-1755
Sensotec, Inc., Columbus, OH 43212	614-486-7723
† Sensym, Inc., Sunnyvale, CA 94089	408-744-1500
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§† Taber Industries, N. Tonawanda, NY 14120	716-694-4000;800-333-5300
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958
Touch Technology, Austin, TX 78746	512-328-9284
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721

§ Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
§† Trans Metrics, Inc., Solon, OH 44139	216-248-2229
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748	508-435-6831
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710	813-347-2181
Viatran Corporation, Grand Island, NEW YORK 14072	716-773-1700
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322
§ Weed Instrument Co., Inc., Round Rock, TX 78680-0300	512-244-1956

Transducers, Proximity-5500

Aleph International Corp., San Fernando, CA 91340, 818-365-9856;800-423-5622	**B•1662**
Hermetic Switch, Chickasha, OK 73018, 405-224-4046	**B•1954-1955**
IVO Industries, Inc., Eatontown, NJ 07724, 908-542-5151;800-932-0489	**B•1962**
† **Marine Electric Systems, Clifton, NJ 07014-1135, 201-471-6800**	**D•1015**
§† **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1324,1970-1971**
Ocean Motions Co., Barrington, RI 02806, 401-246-1394	**B•1980**
Reed Switch Developments, Inc., Racine, WI 53403, 414-637-8848	**B•2006**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
A M Sensors, Inc., Salem, NH 03079-2839	603-898-1543
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Capacitec, Inc., Ayer, MA 01432	508-772-6033
† Marine Electric Systems Inc., Clifton, NJ 07014-1135	201-471-6800
§ Contaq Technologies Corp., Bristol, VT 05443	802-453-3332
§ Daitron, Inc., Tigard, OR 97223	503-620-2879
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647	402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
§ Eaton Corp, Durant Products, Watertown, WI 53094	414-261-4070;800-289-3866
FSI/Fork Standards, Inc., Lombard, IL 60148-2097	708-932-9380;800-468-6009
† GIC Thermodynamics, Royal Oak, MI 48073	313-280-1648
§ Gordon Products, Brookfield, CT 06804	203-775-4501
§ Hamlin Inc., Lake Mills, WI 53551	414-648-3000
§ HBM, Inc., Marlboro, MA 01752	508-624-4500
Hecon Corp., Eatontown, NJ 07724	908-542-9200
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716	908-291-0500;800-631-2165
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
§ Metermaster, Tempe, AZ 85282	602-431-0015
Metrix Instrument Co., Houston, TX 77043	713-461-2131
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Motion Sensors, Inc., Cranford, NJ 07701	908-709-0025
MULTISENS Inc, Laval, Que., CANADA H7S 2E8	514-973-8228
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056	708-824-1133
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
Polaroid Corp., Cambridge, MA 02139	800-225-1618
§ Redington Counters, Windsor, CT 06095	203-688-6205
§ Relay Specialties, Oakland, NJ 07436	201-337-1000
Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544	510-471-9717
Sentech, Inc., Cheltenham, PA 19012	215-663-0422
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788	516-582-5600
Standex Electronics, Standex International, Cincinnati, OH 45209	513-871-3777
Submarine Signal Division, Raytheon Company, Portsmouth, RI 02871	401-847-8000
§ Sunx Sensors/Imported by Ramco Elect., West Des Moines, IA 50265	515-225-6933
§ Tenor Controls Comp, New Berlin, WI 53151	414-782-3800
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
§ TURCK Inc., Minneapolis, MN 55441-2656	612-553-9224;1-800-328-0580
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992	219-563-2191

Transducers, Sonic-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000	**D•1026-1027**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000	**D•1061-1062**
† Blatek, Inc., State College, PA 16801	814-231-2085;814-231-2086
Delta Controls Corp., Shreveport, LA 71107	318-424-8471
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111	805-683-2575
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113	505-822-8801
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056	708-824-1133
† Ocean Motions Co., Barrington, RI 02806	401-246-1394
Polaroid Corp., Cambridge, MA 02139	800-225-1618
§ Stetco, Inc., Franklin Pk, IL 60131	708-671-4208
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9	905-851-9958

Transducers, Strain Gauge-5500

G.L. Collins Corporation, Long Beach, CA 90805, 310-531-6500	**B•1952**
§ **Data Instruments, Inc., Acton, MA 01720, 800-332-3282**	**B•1930**
† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650**	**B•1936**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1374**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1971**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004-2005**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1374**
A. L. Design, Inc., Buffalo, NY 14217	716-875-6240
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
BLH Electronics, Inc., Canton, MA 02021-9111	617-821-2000
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114	909-781-5500; 801-750-7200
† Bourns Instruments Inc., Riverside, CA 92507	714-781-5148
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
§† Dillon, Weigh-Tronix, Inc., Fairmont, MN 56031	507-238-4461
DJ Instruments, Inc., N. Billerca, MA 01862	508-667-5301
§ Dynisco, Sharon, MA 02067	617-784-8400
† Edcliffe Div., BEI Electronics Co., Sylmar, CA 91342	818-362-7151
GP:50 New York, Grand Island, NY 14072	716-773-9300
§ GSE, Core Inds., Farmington Hills, MI 48024	313-476-7875
HBM, Inc., Marlboro, MA 01752	508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
§† Hersey Measurement Co., Flow Measurement, Inc., Spartanburg, SC 29305	803-574-8960;1-800-845-2102
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
§ Interface, Inc., Scottsdale, AZ 85260	602-948-5555
§† Kistler-Morse, Redmond, WA 98073	206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065	805-581-3985
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
NMB Technologies Inc., Chatsworth, CA 91311	818-341-3355
† Paine Corporation, Seattle, WA 98144	206-329-8600;800-426-0366
† Piezo Electric Products, Inc., Metuchen, NJ 08840	908-548-2800
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670	818-365-0101
Sensotec, Inc., Columbus, OH 43212	614-486-7723
§ Soltec Corp., San Fernando, CA 91340-1597	818-365-0800;800-423-2344
§† Taber Industries, N. Tonawanda, NY 14120	716-694-4000;800-333-5300
§ Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
§† Trans Metrics, Inc., Solon, OH 44139	216-248-2229
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710	813-347-2181
Viatran Corporation, Grand Island, NEW YORK 14072	716-773-1700
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322

Transducers, Temperature-5500

Advanced Thermal Products, Inc., St. Marys, PA 15857, 814-834-1541	**B•1858**
Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000	**B•1860**
Approved Purification Corp., Stamford, CT 06907, 203-357-0141	**B•1916**
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516	**B•1864-1865, 1867-1869**
Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650	**B•1936**
§† **Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000**	**B•1875**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1382**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591	**B•1879,1881-1882**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945	**B•1973**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914;800-NEWPORT**	**B•1978, D•1358-1359**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**B•2004-2005**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200	**B•1336-1338**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2007-2010**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1382**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Airmar Technology, Milford, NH 03055	603-673-9570
§† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
§† Analog Devices, Inc., Norwood, MA 02062-9106	617-329-4700
ARi Industries, Inc., Addison, IL 60101	708-953-9100;800-237-6725
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§ Atkins Technical Inc., Gainesville, FL 32608	904-378-5555
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
Burling Instruments, Inc., Chatham, NJ 07928-0298	201-635-9481
Cambridge Aeroflo, Inc., Shirley, MA 01464	508-425-2346
§ Capintec Instruments, Ramsey, NJ 07446	201-825-9500
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242	402-371-0080
Daytronic Corp., BTR Grp., Miamisburg, OH 45342	513-866-3300
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080	
† DELTA M Corporation, Oak Ridge, TN 37830	615-483-1569
§ EDL, Inc., Danville, VA 24540	804-799-0807;1-800-DIAL EDL
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§ E-Squared Technology Corp., Ventura, CA 93003	805-644-9544
§ Everest Interscience, Inc., Fullerton, CA 92634-3640	800-422-4342
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983	203-848-9271
§ FENWAL Inc., Ashland, MA 01721	508-881-2000
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
General Resistance, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
GP:50 New York, Grand Island, NY 14072	716-773-9300
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ Hades Manufacturing Corp., Farmingdale, NY 11735	516-249-4244
† Harrel, Inc., E. Norwalk, CT 06855	203-866-2573
HBM, Inc., Marlboro, MA 01752	508-624-4500
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179

† Instrulab, Dayton, OH 45404 513-223-2241
International Resistive Company, Boone, NC 28607 704-264-8861
IRC-Shallcross, Smithfield, NC 27577 919-934-5181
Ketema/Rodan Division, Anaheim, CA 92806 714-630-0081
Kobold Instruments Inc., Pittsburgh, PA 15205 ..... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 ..... 412-788-2830;800-998-1020
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007 ..... 215-781-0700; 800-523-8989
Larson-Metercraft, El Cajon, CA 92020 619-258-8990
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
§ Martel Electronics, Windham, NH 03087 603-893-0886
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Metermaster, Tempe, AZ 85282 602-431-0015
§† Mikron Instrument Company, Inc., Wyckoff, NJ 07481 201-891-7330
† Minco Products, Minneapolis, MN 55432 612-571-3121
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390; 800-999-3390
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
MULTISENS Inc, Laval, Que., CANADA H7S 2E8 514-973-8228
§ Nexus Custom Electronics, Inc., Thermocontrol Div., Brandon, VT 05733 802-247-6811
Ogden Manufacturing Co., Arlington Heights, IL 60005 708-593-8050
Philips Components Discrete Products Div,, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053 215-355-6900
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
Princo Instruments, Inc., Southampton, PA 18966 215-355-1500
† Quality Thermistor, Boise, ID 83709 208-377-3373
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ RdF Corporation, Hudson, NH 03051-0490 603-882-5195,800-445-8367
† Relco Products, Denver, CO 80237 303-756-1143
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 510-471-9717
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
Statek Corp., Orange, CA 92668 714-639-7810
† Syscon Intl., Inc., So. Bend, IN 46601-3796 219-232-3900
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538 419-525-8450
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992 219-563-2191
Warren G-V, General Signal Corp., Whippany, NJ 07981 201-386-1200
§† Weed Instrument Co., Inc., Round Rock, TX 78680-0300 512-244-1956
§ West Instrument, A Mark IV Company, E. Greenwich, RI 02818 401-884-4188

Transducers, Temperature, Digital Output-5500

Approved Purification Corp., Stamford, CT 06907, 203-357-0141 ..... B•1916
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ..... D•1380,1382
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1337-1338
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1380,1382
ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
ASC Systems, St. Clair Shores, MI 48080 313-882-1133
Crompton Modutec, Manchester, NH 03109 ..... 603-669-5121;800-METERS-1
§ Elan Technical Corp., Fairfield, CT 06430 203-335-2115
§† FOX METER INC., DeKalb, IL 60115 815-758-7000
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
Kobold Instruments Inc., Pittsburgh, PA 15205 ..... 412-788-2830;800-998-1020
Kobold Instruments Inc., Pittsburgh, PA 15205 ..... 412-788-2830;800-998-1020
§ Land Infrared, Land Instruments Intl. Inc., Bristol, PA 19007 ..... 215-781-0700; 800-523-8989
§ Metermaster, Tempe, AZ 85282 602-431-0015
MetriCor, Inc., Woodinville, WA 98072 206-483-5577
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031 ..... 603-883-3390. 800-999-3390
M. System Technology, Inc., Dallas, TX 75244 800-544-3181
§† Relco Products, Denver, CO 80237 303-756-1143
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ S-Products Inc., Fairfield, CT 06430 203-331-9546
† Williamson Corporation, Concord, MA 01742 508-369-9607

Transducers, Thermoelectric — See Transducers, Temperature (Vol. B)

Transducers, Tilt - Also see Inclinometers-5500

U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451 ..... B•2021-2022, D•1327
Approved Purification Corp., Stamford, CT 06907 203-357-0141
§† Dova Controls, Redmond, WA 98052-5165 206-881-7414
The Fredericks Company, Huntingdon Valley, PA 19006 215-947-2500
§ Hamlin Inc., Lake Mills, WI 53551 414-648-3000
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
† Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
Midori America Corp., Fullerton, CA 92631 714-449-0997
Ocean Motions Co., Barrington, RI 02806 401-246-1394
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008

† Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

Transducers, Torque-5500

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•2004
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2129
† A. L. Design, Inc., Buffalo, NY 14217 716-875-6240
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Daytronic Corp., BTR Grp., Miamisburg, OH 45342 513-866-3300
DJ Instruments, Inc., N. Billerca, MA 01862 508-667-5301
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§† Kistler Instruments Corp., Amherst, NY 14228-2171 716-691-5100
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489 609-662-8000
Magnetoelastic Devices, Pittsfield, MA 01201 413-445-5608
MOTORTEST, Inc., Columbus, OH 43229 614-882-7821
NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
PrimeLine, Soltec Corporation, San Fernando, CA 91341-0670 818-365-0101
Sensor Developments Inc., Lake Orion, MI 48361 313-391-3000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§ Soltec Corp., San Fernando, CA 91340-1597 ..... 818-365-0800;800-423-2344
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Ultrasonic-5500

Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ..... B•1970-1971
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1976-1977
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1665
† Ocean Motions Co., Barrington, RI 02806, 401-246-1394 ..... B•1980
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Accusonic Division, O.R.E. International Inc., Falmouth, MA 02541 508-548-5800
Airmar Technology, Milford, NH 03055 603-673-9570
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
† Blatek, Inc., State College, PA 16801 ..... 814-231-2085;814-231-2086
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
§ Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
Delta Controls Corp., Shreveport, LA 71107 318-424-8471
† Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 708-584-2300
EDO Corporation, Acoustics Division, Salt Lake City, UT 84115 801-486-2115
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
International Microelectronics, Arlington, TX 76003 817-473-1730
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
§† Kay-Ray/Sensall, Inc., Mt. Prospect, IL 60056 708-803-5100
§ Kistler-Morse, Redmond, WA 98073 206-881-8000
Lundahl Instruments, Inc., Ezra C. Lundahl Inc., Logan, UT 84321 801-753-7300
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Panametrics, Waltham, MA 02154-3497 617-899-2719
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
§† Sonicor Instrument Corp., Copiague, NY 11726 516-842-3344
§ Sonobond Ultrasonics Inc., Inductotherm Industries, West Chester, PA 19382 ..... 610-696-4710;800-323-1269
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Transonic Systems Inc., Ithaca, NY 14850 607-257-5300
§ TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580
† Ultran Laboratories, Boalsburg, PA 16827 814-466-6200
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Transducers, Velocity-5500

BEI Motion Systems Company, Chatsworth Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1917
BEI Motion Systems Company, Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1917
BEI Motion Systems Company, Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Needham Hgts., MA 02194, 617-455-1414 ..... B•1917
BEI Motion Systems Company, Precision Systems & Space Division, Little Rock, AR 72203, 501-851-4000 ..... B•1917
G.L. Collins Corporation, Long Beach, CA 90805, 310-531-6500 ..... B•1952
† Humphrey, Inc., San Diego, CA 92123, 619-565-6631 ..... B•1956,1958
Ocean Motions Co., Barrington, RI 02806, 401-246-1394 ..... B•1980
Airmar Technology, Milford, NH 03055 603-673-9570
A M Sensors, Inc., Salem, NH 03079-2839 603-898-1543
BEI Motion Systems Company, Corporate Off., Carlsbad, CA 92009 619-931-1500
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Blatek, Inc., State College, PA 16801 ..... 814-231-2085;814-231-2086
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 909-394-4410
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91309-7964 818-884-6860
† Computer Instruments Corp., Westbury, NY 11590 516-876-8400
† Computer Instruments Div., Westbury, NY 11590 516-876-8400
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
Dresser Instrument Div., Dresser Industries, Stratford, CT 06497 203-378-8281
† Electro Physics Co., Inc., Waukegan, IL 60085 708-249-5801
§ Fenwal Electronics, Inc., Milford, MA 01757 508-478-6000

General Vibrations Mfg. Co., Manchester, CT 06040	203-646-0090
§ HBM, Inc., Marlboro, MA 01752	508-624-4500
§ IC Sensors, Inc., Milpitas, CA 95035	800-767-1888
† Inland Motor, Kollmorgen Corp., Radford, VA 24141	703-639-9045
Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
§ Kavlico Corp., Moorpark, CA 93021	805-523-2000
Kinemetrics, Inc., Pasadena, CA 91107	818-795-2220
† Kurz Instruments Inc., Monterey, CA 93940	800-424-7356
§ Level Plus, Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
† MagneTek, Transducer Products, Simi Valley, CA 93065	805-581-3985
Metrix Instrument Co., Houston, TX 77043	713-461-2131
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701	813-822-2529
§ Monarch Instrument, Monarch International Inc., Amherst, NH 03031	603-883-3390; 800-999-3390
Motion Sensors, Inc., Cranford, NJ 07701	908-709-0025
§ MTS Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617	075-951-9111
Philips Technologies, Airpax Instruments, Cheshire, CT 06410	203-271-6000
PMC/BETA Ltd. Partnership, Natick, MA 01760	617-237-6920
† Sentech, Inc., Cheltenham, PA 19012	215-663-0422
§† Systron-Donner Inertial Div., A BEI Electronics Company, Concord, CA 94518	510-671-6400
† Teledyne Gurley, Troy, NY 12181	518-272-6300;800-759-1844
§ Temposonics Sensors Division, MTS Sys. Corp., Research Triangle Park, NC 27709	919-677-0100
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471	203-481-5721
† Transicoil, Inc., Eagle-Picher, Trooper, PA 19403-5214	215-539-4400
§ Transicoil Inc, Eagle-Picher Inc., Trooper, PA 19403	215-539-4400
Unimeasure, Inc., Corvallis, OR 97330	503-757-3158
Vibrac, Amherst, NH 03031	603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322
Warren G-V, General Signal Corp., Whippany, NJ 07981	201-386-1200
† Wilcoxon Research, Inc., Gaithersburg, MD 20878	301-330-8811

Transducers, Vibration-5500

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200	**D•1243**
† **Entran Devices, Fairfield, NJ 07004, 201-227-1002;800-635-0650**	**B•1936**
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600	**B•1974**
Projects Unlimited, Dayton, OH 45414, 513-890-1918	**D•1057**
§ **Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-U-SENS-IT**	**B•2024**
† **Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811**	**B•2025**
Alpha-M Corp., Dallas, TX 75229	214-406-0424
Bently Nevada Corp., Minden, NV 89423	800-227-5514;702-782-3611
† Bruel & Kjaer Instrs. Inc., Decatur, GA 30035	404-981-6225
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773	909-394-4410
† Channel Industries, Santa Barbara, CA 93111	805-967-0171
† Columbia Resch. Labs., Woodlyn, PA 19094	215-872-3900
§ Dova Controls, Redmond, WA 98052-5165	206-881-7414
† Electro Physics Co., Inc., Waukegan, IL 60085	708-249-5801
§ Endevco Corporation, Meggitt Aerospace, San Juan Capistrano, CA 92675	714-493-8181
General Vibrations Mfg. Co., Manchester, CT 06040	203-646-0090
HBM, Inc., Marlboro, MA 01752	508-624-4500
§ Helm Instrument Co., Inc., Maumee, OH 43537	419-893-4356
§ IC Sensors, Inc., Milpitas, CA 95035	800-767-1888
† Industrial Monitoring Instrumentation, PCB Piezotronics Inc., Depew, NY 14043	716-684-0003
Kaman Instrumentation, Colo Springs, CO 80907	719-599-1132
Kelmet, Inc., San Dimas, CA 91773	714-599-0954
Kinemetrics, Inc., Pasadena, CA 91107	818-795-2220
§† Kistler Instruments Corp., Amherst, NY 14228-2171	716-691-5100
† Knowles Electronics, Inc., Itasca, IL 60143	708-250-5100
Metrix Instrument Co., Houston, TX 77043	713-461-2131
Motion Sensors, Inc., Cranford, NJ 07701	908-709-0025
† PCB Piezotronics, Depew, NY 14043-2495	716-684-0001
PMC/BETA Ltd. Partnership, Natick, MA 01760	617-237-6920
Primo Company Limited, Tokyo, JAPAN 181	0422-43-3121
Sensotec, Inc., Columbus, OH 43212	614-486-7723
† Signal Systems International, Lavalette, NJ 08735	908-793-4668
§ SKF Condition Monitoring, San Diego, CA 92123-1841	619-496-3400
§† Systron-Donner Inertial Div., A BEI Electronics Company, Concord, CA 94518	510-671-6400
Unholtz-Dickie Corp., Wallingford, CT 06492	203-265-3929
§ Vibro-Meter Corp., Billerica, MA 01822-5058	508-663-7322

Transducers, Volt, Watt, Current VAR, Power Factor, Frequency-5500

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000	**D•1149**
† **American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100**	**B•1914-1915**
Bicron Electronics, Canaan, CT 06018, 203-824-5125	**B•1919**
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309, B•1927**
§ **Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235, 614-889-6152**	**A•2357**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1385,1387**
Lem Dynamp Inc., Grove City, OH 43123, 614-871-6900	**B•1963**
LEM U.S.A., Inc., Milwaukee, WI 53218, 414-353-0711	**B•1964-1965**
Magnelab, Boulder, CO 80301-4696, 303-442-6700	**A•2379**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945**	**B•1970-1971,1973**
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561	**B•1982-1990,1992-1996,1998-2000,2002-2003**
Scientific Columbus Co., Columbus, OH 43228-4105, 614-274-0400	**B•2007-2011**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1385,1387**
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811	**B•2025**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803	516-694-6700
§† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563	516-593-5600
Amptec Electronics, San Diego, CA 92128	619-578-7816
§ ARGA Controls, Pasadena, CA 91105	213-682-3314
AYA-Instruments, Inc., Pittsburgh, PA 15213	412-622-5500
Bell, F. W., Inc., Orlando, FL 32807	407-678-6900
Best Technology Inc., Seattle, WA 98109	206-382-1300
† C & C Jetronic, Inc., Allentown, NJ 08501	609-259-8855
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820	603-749-6434
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
† Dielectric Communications, General Signal, Raymond, ME 04071	207-655-4555; 800-341-9678
Dynapower Corporation, S. Burlington, VT 05407	802-860-7200
EWC, Inc., Englishtown, NJ 07726	908-446-3110
§ Fenwal Electronics, Inc., Milford, MA 01757	508-478-6000
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
GMW Associates, Redwood City, CA 94064	415-368-4884
Gutwerk Instruments Inc., McKeesport, PA 15132	412-672-3668
§ Halmar Electronics, Inc., High Voltage Engrg. Corp., Columbus, OH 43204	614-275-0530
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
§ Metermaster, Tempe, AZ 85282	602-431-0015
MOTORTEST, Inc., Columbus, OH 43229	614-882-7821
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577	415-577-7236
Power Measurement Ltd., Victoria, BC, CANADA V8X 3X1	604-652-5118
Rotek Instrument Corp., Waltham, MA 02254	617-899-4611
† Sigma Electronics Inc., Houston, TX 77099	713-933-4700;800-874-7121
Square D Company, Clearwater, FL 34625	813-447-2511
SSAC Incorporated, Baldwinsville, NY 13027	315-638-1300
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854	908-572-9512
† Sundstrand Data Control, Redmond, WA 98073-9701	206-885-3711
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433
§ Time Mark Corp., Tulsa, OK 74116	918-438-1220
Valhalla Scientific, San Diego, CA 92121	619-457-5576

Transformers, AC to AC Adapters-5600 — *See Vol. A*

Transformers, Audio-5600 — *See Vol. A*

Transformers, Autotransformer-5600 — *See Vol. A*

Transformers, Bias — See Transformers, Power (Vol. A)

Transformers, Bridging — See Transformers, Matching (Vol. A)

Transformers, Chopper-5600 — *See Vol. A*

Transformers, Constant Voltage — See Transformers, Ferroresonant (Vol. A)

Transformers, Control — See Transformers, Power (Vol. A), Transformers, Synchro, Control (Vol. A)

Transformers, Converter, DC To DC-5600 — *See Vol. A*

Transformers, Current — See Transformers, Instrument (Vol. A)

Transformers, Data Bus Coupling-Also See Transformers, Telephone Coupling-5600 — *See Vol. A*

Transformers, Decade-5600 — *See Vol. A*

Transformers, Differential-5600 — *See Vol. A*

Transformers, Discriminator-5600 — *See Vol. A*

Transformers, Donut — See Transformers, Toroidal (Vol. A)

Transformers, Driver-5600 — *See Vol. A*

Transformers, External Power Source-5600 — *See Vol. A*

Transformers, Ferroresonant-5600 — *See Vol. A*

Transformers, Filament-5600 — *See Vol. A*

Transformers, Flyback-5600 — *See Vol. A*

Transformers, Foil Wound — See Coils, Foil Wound (Vol. A)

Transformers, 400 Hz-5600 — *See Vol. A*

Transformers, High Voltage (1,000 Volts & Over)-5600 — *See Vol. A*

Transformers, Horizontal Sweep-5600 — *See Vol. A*

Transformers, Hybrid-5600 — *See Vol. A*

Transformers, IF-5600 — *See Vol. A*

Transformers, Input-5600 — ***See Vol. A***

Transformers, Instrument-5600 — ***See Vol. A***

Transformers, Interface & Coupling-5600 — ***See Vol. A***

Transformers, Interstage-5600 — ***See Vol. A***

Transformers, Inverter-5600 — ***See Vol. A***

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Transformers, Isolation, for LANs-5600 — ***See Vol. A***

Transformers, Line-5600 — ***See Vol. A***

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Transformers, Magnetic Amplifier-5600 — ***See Vol. A***

Transformers, Matching-5600 — ***See Vol. A***

Transformers, Microphone-5600 — ***See Vol. A***

Transformers, Mixing-5600 — ***See Vol. A***

Transformers, Modem/Coupler-5600 — ***See Vol. A***

Transformers, Modulation-5600 — ***See Vol. A***

Transformers, Output-5600 — ***See Vol. A***

Transformers, Plate-5600 — ***See Vol. A***

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Transformers, Telephone Coupling-5600 — ***See Vol. A***

Transformers, Toroidal-5600 — ***See Vol. A***

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Transformers, Voltage Regulating-Also See Regulators & Stabilizers, Voltage-5600 — ***See Vol. A***

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Transformers, Wideband-5600 — ***See Vol. A***

Transformers (MIL), Audio, Power, RF-2440

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 .... A•2234
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 .... A•2295
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 .... A•2305
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 .... A•2318,2320
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 .... A•2331,2344,2347
Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 .... A•2355
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 .... A•2360
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 .... A•2377
Magnelab, Boulder, CO 80301-4696, 303-442-6700 .... A•2378,2381-2382
Magnetek Triad, Huntington, IN 46750, 219-356-7100 .... A•2383
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 .... A•2389-2391
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 .... A•2404,2411-2412,2414-2415,2418
† North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 .... A•2441
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 .... A•2455
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 .... A•2508
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 .... A•2527
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 .... A•2533
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 .... A•2573
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 .... A•2583-2584
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 .... A•2594-2596
† Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 .... A•2597
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 .... A•2600-2601
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Bicron Electronics, Canaan, CT 06018 203-824-5125
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
† Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 310-673-3245
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 909-987-3570
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
† Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
§† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 .... 713-933-4700;800-874-7121
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
† Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§† Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 414-253-8200
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Transformers (MIL), Data Bus Coupling-2440

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 .... A•2305
Datatronics, Inc., Romoland, CA 92585, 909-928-7700 .... A•2314
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 .... A•1235
† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 .... A•2412
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 .... A•2533
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 .... A•2594
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Pico Electronics, Inc., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
§† Schott Corp., Wayzata, MN 55391 612-475-1173

Transformers (MIL), Interface & Coupling-2440

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 .... A•2305
Datatronics, Inc., Romoland, CA 92585, 909-928-7700 .... A•2314
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 .... A•2319
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 .... A•1235

† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ... A•2389-2391
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ... A•2429
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•2533
Torelco, Inc., Irvington, NJ 07111, 201-374-8641;800-867-3526 ... A•2581
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•2594
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 ... 718-441-5207
Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 ... 909-987-3570
† Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856

Transformers (MIL), Pulse & Variable-2440

Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ... A•2295
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ... A•2299
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•2305
Datatronics, Inc., Romoland, CA 92585, 909-928-7700 ... A•2314
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ... A•2319
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ... A•2329
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•1235,2331,2344
Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ... A•2355
Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ... A•2360
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ... A•2370,2373
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ... A•2377
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ... A•2378,2381-2382
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ... A•2383
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ... A•2389-2391
† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2411,2414-2415
† North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ... A•2441
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•2455
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 ... A•2508
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•2527
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•2533
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•2572-2573
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•2594
† Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 ... A•2597
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ... A•2227
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 ... 718-441-5207
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
Bel Fuse, Jersey City, NJ 07302 ... 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 ... 607-722-2376
† BH Electronics, Inc., Burnsville, MN 55337 ... 612-894-9590
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 ... 909-987-3570
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
Epco Products Inc., WAllkill, NY 12589 ... 914-895-2033
† Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
† Hyperion Industries Corp., Watertown, MA 02172 ... 617-926-0140
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 ... 310-677-6600
† Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
§† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 ... 818-885-8223
† Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
† Standex Electronics, Standex International, Cincinnati, OH 45209 ... 513-871-3777
§† Technipower, A Penril Co., Danbury, CT 06813 ... 203-748-7001
† Technitrol, Philadelphia, PA 19134 ... 215-426-9105
Tele-Tech Corporation, Bozeman, MT 59715 ... 406-586-0291
† Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
Todd Systems, Inc., Yonkers, NY 10701 ... 914-963-3400
§† Toko America, Inc., Mt. Prospect,, IL 60056 ... 708-297-0070
† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
§† Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856

Transistor Arrays-4800 – *See Vol. A*

Transistor Arrays, Surface Mount-4800 – *See Vol. A*

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Transistors, Bipolar-Also See Transistors, Silicon-4800 – *See Vol. A*

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Transistors, Darlington, Surface Mount-4800 – *See Vol. A*

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Transistors, NPN, Surface Mount-4800 – *See Vol. A*

Transistors, Photo (Incl. Arrays)-3700

† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ... B•1153
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ... B•1328-1329,1332-1335
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ... A•2172
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ... B•1339
I I Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1 ... B•1189
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ... A•2227
§ A E G Corporation, Basking Ridge, NJ 07920 ... 908-204-8900
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ... 214-422-1844; 1-800-872-0044
§ EG & G Vactec, St. Louis, MO 63132 ... 314-423-4900
§† Honeywell Microswitch Div., Richardson, TX 75081 ... 214-470-4271
† Micropac Inds., Inc., Garland, TX 75040 ... 214-272-3571
§ NTE Electronics, Inc., Bloomfield, NJ 07003 ... 201-748-5089
§† Optek Technology Inc., Carrollton, TX 75006 ... 214-323-2200
Opto Diode Corp., Newbury Park, CA 91320 ... 805-499-0335
Opto Technology, Inc., Wheeling, IL 60090 ... 708-537-4277
Raytheon/TAG Semiconductors Ltd., Burlington, MA. 01803 ... 617-272-3704 (3705)
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 ... 201-825-8080
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 ... 408-257-7910
† Silicon Sensors, Dodgeville, WI 53533 ... 608-935-2707

Transistors, PNP, Surface Mount-4800 – *See Vol. A*

Transistors, Power-4800 – *See Vol. A*

Transistors, Power, Bipolar-4800 – *See Vol. A*

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Transistors, Power, FET-4800 – *See Vol. A*

Transistors, Power, Field Effect, Surface Mount-4800 – *See Vol. A*

Transistors, Pressure Sensitive-4800 – *See Vol. A*

Transistors, RF-4800 – *See Vol. A*

Transistors, RF, Surface Mount-4800 – *See Vol. A*

Transistors, Silicon-4800 – *See Vol. A*

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Transistors, Switching, Surface Mount-4800 – *See Vol. A*

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Transistors, Unijunction, Surface Mount-4800 – *See Vol. A*

Transistors (MIL)-2440

§† Advanced Power Technology, Bend, OR 97702 ... 503-382-8028
† Continental Device India Limited, New Delhi, INDIA 110028 ... 536150-53 (4 lines)
§† Germanium Power Devices, Andover, MA 01810-3065 ... 508-475-5982
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 ... 408-433-2222
† International Rectifier Corp., El Segundo, CA 90245 ... 310-322-3331
MACOM, Inc., Lowell, MA 01851 ... 617-272-3000
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 ... 602-244-6900
† New England Semiconductor, Lawrence, MA 01841 ... 508-794-1666;800-446-1158
† PowerTech, Inc., Fair Lawn, NJ 07410 ... 201-791-5050
§† PPC Products Corporation, Riviera Beach, FL 33404 ... 407-848-9606
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 ... 407-848-4311

Translators, Data-2325 – *See Vol. D*

Translators, Frequency Band-2750 – *See Vol. A*

Translators, Time Code-2000 – *See Vol. D*

Transmission Line, Data – See Cable, Data Transmission (Vol. C)

Transmission Line, Wire & Cable – See Cable, Transmission Line (Vol. C)

Transmission Lines (MIL), RF-2440

† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810	203-743-9272; 800-627-7100
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
W.L. Gore & Assocs., Newark, DE 19714	302-738-4880

Transmission Systems, Data-2000 — *See Vol. D*

Transmitters, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1207-1208, C•1163**
§† **Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001**	**B•1215**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751**	**B•1218**
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121**	**B•1223-1227**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621**	**B•1228,1594, D•1319**
§ **S.I. Tech, Batavia, IL 60510, 708-232-8640**	**B•1229**
Abom Electronics Inc., San Jose, CA 95131	408-436-5444
AT&T Microelectronics, Allentown, PA 18103	1-800-372-2447;In Can.:1-800-553-2448
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
CATEL Telecommunications, Fremont, CA 94537	510-659-8988
C-COR Elctrns., Inc., State College, PA 16801	814-238-2461;800-233-2267
§ Codenoll Technology Corp., Yonkers, NY 10701	914-965-6300
† Dymec Inc., Winchester, MA 01890	617-729-7870
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608	201-288-4477; 800-447-5639
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7	418-683-0211; 1-800-663-EXFO
§† Fiberlign, Preform Line Products, Nepean, ON, CANADA K2E 7J6	613-226-4000
Fiberoptic Systems, Inc., Simi Valley, CA 93063	805-583-2088
General Fiber Optics, Inc., Cedar Grove, NJ 07009	201-239-3400
§ GTE Supply, GTE, Irving, TX 75038	800-433-4837
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059	800-452-4844
§† Honeywell Microswitch Div., Richardson, TX 75081	214-470-4271
Interoptics, Purdy Group, Burlingame, CA 94010	415-347-7727
IPAC Grp., Bethel Pk., PA 15102	412-831-9200
LeCroy Corp., Chestnut Ridge, NY 10977	914-425-2000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014	413-592-9123
† Math Assocs. Inc., General Microwave Corp., Amityville, NY 11701	516-226-8950
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086	408-730-5900
§ NEC Electronics, Inc., Mountain View, CA 94039-7241	1-800-366-9782
Omron Electronics, Inc., F A Systems Div., Schaumburg, IL 60173	708-843-7900
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
† Ortel Corp., Alhambra, CA 91803	818-281-3636
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248
§† Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Transmitters, Fixed Frequency-1900 — *See Vol. D*

Transmitters, Infrared remote control transmitters for satellite T.V. receivers-1900 — *See Vol. D*

Transmitters, Laser-3700

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752	**B•1207**
† **Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355**	**B•1210**
BT & D Technologies, Kennett Square, PA 19348	215-444-6888;800-545-4306
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487	201-942-2222
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820	908-549-9001
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
† Ortel Corp., Alhambra, CA 91803	818-281-3636
Tektronix, Inc., Wilsonville, OR 97070	800-835-9433

Transmitters, Position-1900 — *See Vol. D*

Transmitters, Process Control (Temperature, Pressure, Flow, etc.)-5500

CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518	**A•2309, B•1927**
§ **Data Instruments, Inc., Acton, MA 01720, 800-332-3282**	**B•1928,1930**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344	**D•1387**
Omega Engineering, Stamford, CT 06907, 800-826-6342	**D•1166,1314**
§ **OTTOTEK, IMC, Tucson, AZ 85714, 602-748-7900**	**D•1365**
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA	**B•2014-2015**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899	**D•1387**
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550	716-292-6050
Acculex Corporation, Taunton, MA 02780	508-880-3660
Accutech, Adaptive Instrs. Corp., Hudson, MA 01749	508-568-0500
§ Action Instruments, San Diego, CA 92123	619-279-5726
Advanced Process Controls, Woburn, MA 01801	617-932-9262
# A.P.C.S. America, Grand Rapids, MI 49548	616-247-1453
§ ASI Instruments, Inc., Houston, TX 77024	800-245-7056
§ Bristol Babcock Inc., Watertown, CT 06795	203-575-3000;800-395-5497
Brooks Instrument Div., Emerson Elec. Co., Hatfield, PA 19440	215-362-3500
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91309-7964	818-884-6860
§ Chessell Eurotherm, Eurotherm, Intl., Newtown, PA 18940	215-968-0660
Comptus Inc., New Boston, NH 03070	603-487-5512
Computer Instruments Corp., Westbury, NY 11590	516-876-8400
† Computer Instruments Div., Westbury, NY 11590	516-876-8400
Crompton Modutec, Manchester, NH 03109	603-669-5121;800-METERS-1
§ DCT Instruments, Columbus, OH 43212	1-800-328-1028
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080	
Delta Controls Corp., Shreveport, LA 71107	318-424-8471
DGH Corporation, Manchester, NH 03108	603-622-0452
§ Dieterich Standard, A Dover Industries Company, Boulder, CO 80301	303-530-9600
Dresser Instrument Div., Dresser Industries, Stratford, CT 06497	203-378-8281
† EG & G Flow Technology, Inc., Phoenix, AZ 85072	602-437-1315
§ Elan Technical Corp., Fairfield, CT 06430	203-335-2115
§ Endress & Hauser Instruments, Greenwood, IN 46143	317-535-7138;800-428-4344
Entran Devices, Fairfield, NJ 07004	201-227-1002;800-635-0650
† E-T-A Circuit Breakers, Niles, IL 60714	708-647-8303
§ Extech Instruments Corp., Waltham, MA 02154	617-890-7440
Fluid Components, Inc., San Marcos, CA 92069	619-744-6950
§† FOX METER INC., DeKalb, IL 60115	815-758-7000
§† Hy-Cal Engineering, Unit of General Signal, El Monte, CA 91731	818-444-4000
§ International Microtronics, Tucson, AZ 85714	602-748-7900
Johnson Yokogawa Corp., Newnan, GA 30265	404-254-0400
§ Kistler-Morse, Redmond, WA 98073	206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605	201-461-0900
Leeds & Northrup, General Signal, North Wales, PA 19454	215-699-2000
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090	708-541-3232
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Martel Electronics, Windham, NH 03087	603-893-0886
§ Metermaster, Tempe, AZ 85282	602-431-0015
§† Mikron Instrument Company, Inc., Wyckoff, NJ 07481	201-891-7330
Minco Products, Minneapolis, MN 55432	612-571-3121
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
Moore Products Co., Spring House, PA 19477	215-646-7400
§ Newport Electronics, Santa Ana, CA 92704-4426	714-540-4914;800-NEWPORT
§ Pacer Industries, Inc., Chippewa Falls, WI 54729	715-723-1141
† Paine Corporation, Seattle, WA 98144	206-329-8600;800-426-0366
§ Phoenix Contact Inc., Harrisburg, PA 17111	717-944-1300
† PMT Division, A Subsidiary of Ametek, Inc., Feasterville, PA 19053	215-355-6900
Precise Sensors, Inc., Monrovia, CA 91016	818-358-4578
Princo Instruments, Inc., Southampton, PA 18966	215-355-1500
† Relco Products, Denver, CO 80237	303-756-1143
Schlumberger Industries, Tranducers Div., Houston, TX 77082	713-558-2587
§† Seaboard Electronics, New Rochelle, NY 10805	914-235-8073
Sensotec, Inc., Columbus, OH 43212	614-486-7723
§ S-Products Inc., Fairfield, CT 06430	203-331-9546
†# Systec, Inc., Minneapolis, MN 55421	612-788-9701
§† Trans Metrics, Inc., Solon, OH 44139	216-248-2229
Validyne Engineering Corporation, Northridge, CA 91324	818-886-2057
Viatran Corporation, Grand Island, NEW YORK 14072	716-773-1700
§ Wavetek Corp., San Diego, CA 92123	619-279-2200
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811	813-646-3909

Transmitters, Radar — See Radar System Components (Vol. A)

Transmitters, Telemetry-1900 — *See Vol. D*

Transmitters, Tone-1900 — *See Vol. D*

Transmitters (MIL)-2440

† AEROCOM, Miami, FL 33133	305-448-6503
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328	215-968-4271
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100	800-336-2112;703-953-4751
† MCL, Inc., Bolingbrook, IL 60440-4999	708-759-9500
Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998	310-828-7496
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442	315-422-0050
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506	203-753-5840
Servo Corporation of America, Hicksville, NY 11801-5259	516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324	818-993-8257

Transmitters (MIL), Fiber Optic-2440

§† **Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001**	**B•1213**
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1225**
† Analog Modules, Inc., Longwood, FL 32750-3426	407-339-4355
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7	514-424-3300
§† Force, Inc., Christiansburg, VA 24073	703-382-0462
§† Optek Technology Inc., Carrollton, TX 75006	214-323-2200
† Teledyne Microelectronics, Los Angeles, CA 90066	310-822-8229;310-305-0248

Transponders-1900 — *See Vol. D*

Transports, Tape (all kinds)-2000 — *See Vol. D*

TRIACs-4800 — *See Vol. A*

Triggers, SCR — See Controls, SCR (Vol. D)

Trimmers, Capacitor – See Capacitors, Variable, Padders & Trimmers (Vol. A)

Trimmers, Potentiometer – See Potentiometers, Trimmer (Vol. A)

Tubes, Ballast – See Resistors, Ballast (Vol. A)

Tubes, Counting-2200 – ***See Vol. D***

Tubes, Flash-3700

Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960	**B•1162-1163,1317**
† EEV Inc., Elmsford, NY 10523	914-592-6050
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
Shokai Far East Ltd., Peekskill, NY 10566	914-736-3500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830	201-321-3400
§ Xenon Corp., Woburn, MA 01801	617-938-3594

Tubes, Ignitron-2200 – ***See Vol. D***

Tubes, Indicator – See Tubes, Readout (Vol. B)

Tubes, Magnetron – See Tubes, Microwave (Vol. A)

Tubes, Microwave-3450 – ***See Vol. A***

Tubes, Photomultiplier-3700

Ealing Electro-Optics, Holliston, MA 01746	508-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123	619-279-8034
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807	908-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404	407-881-3200
Philips Components Discrete Products Div., Professional Components Grp., Slatersville, RI 02876	401-762-3800
§† Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006	201-575-5586

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-2450

Infodex, Inc., Wolcott, CT 06716, 203-879-4944	**B•1013,1080**
Intronics, Inc., Canton, MA 02021, 800-367-0004	**B•1081**
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782	**B•1088**
† Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300	**B•1108-1109**
§ A E G Corporation, Basking Ridge, NJ 07920	908-204-8900
† Displays, Inc., Lewistown, PA 17044	717-242-2541
† EEV Inc., Elmsford, NY 10523	914-592-6050
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173	708-884-1444
§ IEE (Industrial Electronic Engineer, Inc.), Van Nuys, CA 91409	818-787-0311
Mitsubishi Electronics, Torrance, CA 90502	213-515-3993
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
† Rank Brimar Inc., Valencia, CA 91355-1214	805-295-5770
Rauland-Zenith Electronics Corp., Melrose Pk, IL 60160	708-450-8992
§† Teltron, Inc., Birdsboro, PA 19508	610-582-2711
Video Display Corp., Tucker, GA 30084	404-938-2080,800241-5005

Tubes, Strobe – See Lamps, Stroboscopic Source (Vol. B)

Tubes, TV Camera Pickup-3700

§ ATV Research, Inc., Dakota City, NE 68731	402-987-3771
† EEV Inc., Elmsford, NY 10523	914-592-6050
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN	053-452-2141
Hamamatsu Photonic Systems Corp., Industrial Video, Billerica, MA 01821	508-671-5000
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404	407-881-3200
Philips Components Discrete Products Div., Professional Components Grp., Slatersville, RI 02876	401-762-3800
§† Teltron, Inc., Birdsboro, PA 19508	610-582-2711
Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511	201-812-9000
§ Video Display Corp., Tucker, GA 30084	404-938-2080,800241-5005

Tubes, Transmitting-1900 – ***See Vol. D***

Tubes, X-ray-2200 – ***See Vol. D***

Tubes (MIL), Indicator & Pickup-2440

† EEV Inc., Elmsford, NY 10523	914-592-6050
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
§† Teltron, Inc., Birdsboro, PA 19508	610-582-2711

Tubes (MIL), Microwave-2440

† EEV Inc., Elmsford, NY 10523	914-592-6050
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999	310-517-6000
† Litton Electron Devices, San Carlos, CA 94070	415-591-8411
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511	201-812-9000
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636

Tubes (MIL), Power & Gas, Planar-2440

† EEV Inc., Elmsford, NY 10523	914-592-6050
Litton Electron Devices, San Carlos, CA 94070	415-591-8411
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213
§ TII Industries Inc., Copiague, NY 11726	516-789-5000
† Varian Associates, Electron Device Business, Palo Alto, CA 94304	415-493-4000; 800-544-4636

Tubes (MIL), Receiving, & Tube Shields-2440

Dearborn Wire & Cable, L.P., Wheeling, IL 60090	708-459-1000; 800-323-0198
† EEV Inc., Elmsford, NY 10523	914-592-6050
Litton Electron Devices, San Carlos, CA 94070	415-591-8411
Pacific Microtronics Corp., New York, NY 10021	212-517-5622
† Penta Laboratories, Inc., Chatsworth, CA 91311	818-882-3872;800-421-4213

Tubing, Ceramic-2500 – ***See Vol. C***

Tubing, Expandable-6000 – ***See Vol. C***

Tubing, Fiberglass-2500 – ***See Vol. C***

Tubing, Glass-2500 – ***See Vol. C***

Tubing, Heat Shrinkable-Also See Caps, Forms & Tapes, Heat Shrinkable-2500 – ***See Vol. C***

Tubing, Metal-2500 – ***See Vol. C***

Tubing, Paper-2500 – ***See Vol. C***

Tubing, Plastic-Also See Tubing, Spaghetti-2500 – ***See Vol. C***

Tubing, Shrinkable-6000 – ***See Vol. C***

Tubing, Spaghetti-2500 – ***See Vol. C***

Tubing, Spiral Wrap-2500 – ***See Vol. C***

Tubing, Waveguide-3450 – ***See Vol. A***

Tubing, Zipper-2500 – ***See Vol. C***

Tuners, AM/FM-1300 – ***See Vol. D***

Tuners, Microwave-3450 – ***See Vol. A***

Tuning Circuits, Surface Mount-3130 – ***See Vol. A***

Tuning Forks-2300 – ***See Vol. A***

Tweezers, Manual & Vacuum-5400 – ***See Vol. C***

Ultrasonic Transceivers, High Resolution, Narrow Beam-5500

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300	**B•1976-1977**
† Ocean Motions Co., Barrington, RI 02806, 401-246-1394	**B•1980**
Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311	**A•2219**
Contaq Technologies Corp., Bristol, VT 05443	802-453-3332

Ultraviolet Inspection Lighting-Also See Microscopes, Ultraviolet-4100 – ***See Vol. D***

Unibus Cards – See Board Computers & Subassemblies (Vol. D)

Urea Formaldehyde – See Plastic Raw Materials (Vol. C)

Valve Position Indicators/Transmitters-3500

§ Action Instruments, San Diego, CA 92123	619-279-5726
Applied Display & Control, Arlington Heights, IL 60005	708-228-9690
§ Data Instruments, Inc., Acton, MA 01720	800-332-3282
Highland Technology, Inc., San Francisco, CA 94122	415-753-5814
† Lisk, G. W., Co., Clifton Springs, NY 14432	315-462-2611
Lucas Schaevitz, Inc., Lucas Industries PLC., Pennsauken, NJ 08110-1489	609-662-8000
Magnet Schultz of America, Westmont, IL 60559	708-789-0600
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
§ Norgren, Littleton, CO 80120-1663	303-794-2611
Ocean Motions Co., Barrington, RI 02806	401-246-1394
Transmagnetics, Farmingdale, NY 11735	516-293-3100
§ Weed Fiber Optics Inc., Weed Instrument Co., Round Rock, TX 78664	512-388-2522

Valve Positioners & Actuators-3500

† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670	800-262-4638; 800-525-3536
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009	619-929-0749
Infranor, Naugatuck, CT 06770	203-729-8258;800-BE-SERVO
ITT Conoflow, ITT Fluid Technology Corp., St. George, SC 29477	803-563-9281
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
Moore Products Co., Spring House, PA 19477	215-646-7400
M. System Technology, Inc., Dallas, TX 75244	800-544-3181
Norgren, Littleton, CO 80120-1663	303-794-2611
Parker Hannifin Corp., Cleveland, OH 44112-1290	800-272-7537;800-C-PARKER
Parker Hannifin Corporation, Hydraulic Valve Division, Elyria, OH 44036-2026	216-366-5200
Parker Hannifin Corporation, Rotary Actuator Division, Wadsworth, OH 44281-0450	216-336-3511

Valve Positioners & Actuators-3500 (Cont'd)

Parker Hannifin Corp., Schrader Bellows Division, Cuyahoga Falls, OH 44221	216-923-5202
Rotork Controls, Inc., Rochester, NY 14624	716-328-1550
SCHENCK PEGASUS Corporation, Troy, MI 48083	313-689-9000
Transmagnetics, Farmingdale, NY 11735	516-293-3100
§ Wilkerson Instrument Company Inc., Lakeland, FL 33811	813-646-3909

Valves, Solenoid-4550

Magnet Schultz of America, Westmont, IL 60559, 708-789-0600	**B•1652-1653**
Aerodyne Controls Corporation, Ronkonkoma, NY 11779	516-737-1900
† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670	800-262-4638; 800-525-3536
§† Automatic Switch Co., Florham Park, NJ 07932	1-201-966-2000
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940	815-637-3000
§† Barksdale Controls Div., Imo Industries Inc., Los Angeles, CA 90058	213-589-6181
§# Boston Gear, IMO Industries Inc., Quincy, MA 02171	617-328-3300;1-800-225-5280
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514	216-758-8299
COLE-PARMER Instrument Company, Niles, IL 60714	708-647-7600
§ Crouzet Corporation, Carrollton, TX 75006-2506	214-250-1647;1-800-677-5311
§ Deltrol Controls, Milwaukee, WI 53215	414-671-6800
Edwards High Vacuum International, Div. of the BOC Group, Wilmington, MA 01887	508-658-5410;800-848-9800
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362	818-889-3179
† Lisk, G. W., Co., Clifton Springs, NY 14432	315-462-2611
Lucas Ledex, Lucas Industries, Vandalia, OH 45377-0427	513-898-3621
§† Magnatrol Valve Corp., Hawthorne, NJ 07507	201-427-4341
Mallory Controls, Emerson Electric, Indianapolis, IN 46214	317-328-4010
§† MKS Instruments, Inc., Andover, MA 01810	508-975-2350;800-227-8766
Norgren, Littleton, CO 80120-1663	303-794-2611
Omega Engineering, Stamford, CT 06907	800-826-6342
Parker Hannifin Corp., Cleveland, OH 44112-1290	800-272-7537;800-C-PARKER
Parker Hannifin Corporation, Hydraulic Valve Division, Elyria, OH 44036-2026	216-366-5200
Parker Hannifin Corp., Pneumatic Division, Richland, MI 49083	616-629-5000
Parker Hannifin Corp., Refrigerating Specialties Division, Broadview, IL 60153	708-681-6300
Parker Hannifin Corp., Schrader Bellows Division, Cuyahoga Falls, OH 44221	216-923-5202
§† Snaptite/Allied, Erie, PA 16506	814-838-3190
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643	714-554-4200
Veeco Instruments Inc., Plainview, NY 11803	516-349-8300

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Video/Audio Links, Fiber Optic-2475

† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751	B•1219
Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121	**B•1223**
§ Artel Communications Corp., Hudson, MA 01749	508-562-2100
ASC Systems, St. Clair Shores, MI 48080	313-882-1133
§† Force, Inc., Christiansburg, VA 24073	703-382-0462
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820	908-549-9001
§ Lightwave Communications, Inc., Milford, CT 06460	203-878-9838
3M Private Network Products, 3M, Austin, TX 78726	512-984-3400;800-426-8626
§† Radiant Communications Corp., South Plainfield, NJ 07080	908-757-7444

Viewers (MIL)-2440

ElectroPhysics Corp., Fairfield, NJ 07004	201-882-0211
† IR Scientific, Carlisle, MA 01741	508-667-7110
† Metron Optics Inc., Solana Beach, CA 92075-0690	619-755-4477

Viewing Hoods, Cathode Ray Tube-2975 — *See Vol. D*

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Wall Plates — See Boxes, Junction, Outlet & Wall Plates (Vol. C)

Warning Systems (MIL)-2440

† AEL Defense Corp., Lansdale, PA 19446	215-822-2929
† Digital Radio Corp., Redondo Beach, CA 90277	213-316-4114
† E-Systems, Greenville Div., Greenville, TX 75403-6056	903-455-3450
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709	516-933-3000
† NAVAN Corporation, Media, PA 19063	215-352-8464
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440	513-426-6000

Washers, Lock-2500 — *See Vol. C*

Washers, Plain-2500 — *See Vol. C*

Washers, Shoulder-2500 — *See Vol. C*

Waveguide-Coax Adapters-3450 — *See Vol. A*

Waveguides-3450 — *See Vol. A*

Waveguides (MIL)-2440

† Dielectric Communications, General Signal, Raymond, ME 04071	207-655-4555; 800-341-9678
† Eastern Microwave, Winchester, MA 01890	617-721-9800
Flann Microwave Inc., Cambridge, MA 02139	1-800-937-3772
† International Telecommunications Components, Inc., Deer Park, NY 11729	516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104	800-358-8378
Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139	708-307-7200
Litton Electron Devices, San Carlos, CA 94070	415-591-8411
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3	514-694-6666; 800-724-3911
† Pro Com Technology Inc., Plainview, NY 11803	516-293-4443;800-762-3785
Systron-Donner Microwave Div., Sylmar, CA 91342	818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743	516-549-6415/6428

Wave Soldering Equipment — See Soldering Equip, Printed Circuit (Vol. C)

Wave Traps — See Filters, Antenna (Vol. A), Filters, Microwave (Vol. A), etc.

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Windows, Shielded — See Shields, RF (Vol. C)

Wire & Cable Ties-2500 — *See Vol. C*

Wire, Airframe-2440

§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886	**C•1712**
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
† Brand-Rex Company, BICC Cables Corporation, Willimantic, CT 06226-1128	203-456-8000
§† Cable USA, Inc., Naples, FL 33942-3560	813-643-6400
Champlain Cable Corp., Huber & Suhner(USA)Corp., Colchester, VT 05446	802-655-2121
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
§† Cooper Industries/Belden Div., Richmond, IN 47375	317-983-5200;800-BELDEN-1
§ Custom Cable Corp., Westbury, NY 11590	516-334-3600
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647	201-768-5400
§† Dearborn Wire & Cable, L.P., Wheeling, IL 60090	708-459-1000; 800-323-0198
† Electroweave, Inc., Worcester, MA 01604	508-752-8932
† General Wire Products, Inc., Worcester, MA 01604	617-752-8260
† W.L. Gore & Assocs., Newark, DE 19714	302-738-4880
† GSI Corp., Timonium, MD 21093	410-252-1768
† Harbour Ind. (Canada) Ltd., Farnham, Quebec, CANADA J2N 2X3	514-293-5304
§† Independent Cable, Inc., Hudson, MA 01749	508-562-9913
§† Judd Wire Inc., Turners Falls, MA 01376	413-863-4357;800-545-5833
§† Judd Wire Inc., San Marcos, CA 92069	619-744-7720;800-344-5251
§† Olympic Wire & Cable, Fairfield, NJ 07004	201-227-7996

§† Philadelphia Insulated Wire Co. Inc., General Cable Corporation, Highland Heights, KY 40176	606-572-8306;800-257-8357
† Shamrock Plastics & Rubber, Inc., Indianapolis, IN 46218	317-543-3540; 800-382-4635
§† Specialty Cable Corporation, Wallingford, CT 06492	800-456-SPEC
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220	310-609-1811; 800-326-0006
Storm Products Co., Hinsdale, IL 60521	708-323-9121
† K.L. Tannehill Inc., Bloomington, MN 55431	612-881-6700
Teledyne Thermatics, Teledyne Inds., Inc., Elm City, NC 27822	919-236-4311
§† Tensolite Company, Subsidiary of Carlisle Corp., St. Augustine, FL 32092	904-829-5600
§† Thermax Wire Corp., Flushing, NY 11354-2897	718-939-8300
† United Wire & Cable Corp., Worcester, MA 01604	508-757-3872
† Victor Wire & Cable Corp., Los Angeles, CA 90016	213-870-9933
Weico Wire & Cable, Inc., Edgewood, NY 11717	516-254-2970

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Wire, Bare, Nickel-6000 — *See Vol. C*

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Wire, Litz-6000 — *See Vol. C*

Wire, Magnet-6000 — *See Vol. C*

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Wire, Resistance-6000 — *See Vol. C*

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Wire, Twisted Pair — See Cable, Twisted Pair (Vol. C)

Wire (MIL)-2440

§† ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103	**C•1706,1708**
Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516	**B•1866**
§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886	**C•1712-1713**
Caton Connector Corp., Kingston, MA 02364, 617-585-4315	**C•1725**
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400	**C•1741-1742**
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000	**C•1748**
§† Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357;800-545-5833	**C•1756**
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553	**C•1764**
† National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611	**C•1769-1770,1772**
§† Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761	**C•1807**
Weico Wire & Cable, Inc., Edgewood, NY 11717, 516-254-2970	**C•1818-1820,1823-1825**
# Accu-Tech Corporation, Roswell, GA 30076-3890	404-751-9473;800-221-4767
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711	908-925-8000
§† American Insulated Wire Corp., Leviton Mfg. Co., Pawtucket, RI 02862	401-726-0700
§† American Wire & Electronics, Costa Mesa, CA 92626	714-957-5738
Carol Cable Co., Highland Heights, KY 41076	606-572-8303,606-572-8000
Champlain Cable Corp., Huber & Suhner(USA)Corp., Colchester, VT 05446	802-655-2121
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412	708-455-8830
§ Cooner Wire Co., Chatsworth, CA 91311	818-882-8311
Dearborn Wire & Cable, L.P., Wheeling, IL 60090	708-459-1000; 800-323-0198
† Gavitt Wire & Cable, Brookfield, MA 01506	508-867-6476
§ JSC Wire & Cable, Wayne, NJ 07474-0248	201-694-6200;1-800-572-9473
§† Judd Wire Inc., San Marcos, CA 92069	619-744-7720;800-344-5251
Lynn Electronics, Feasterville, PA 19053	215-355-8200;800-523-6075
Magnet Wire Co., Weico Wire & Cable, Inc., Edgewood, NY 11717	516-667-9315
† Markel Corp., Norristown, PA 19404	215-272-8960
† Molecu-Wire, Farmingdale, NJ 07727	908-938-9473
Mueller Elec. Co., Cleveland, OH 44114	216-771-5225
Shamrock Plastics & Rubber, Inc., Indianapolis, IN 46218	317-543-3540; 800-382-4635
§† Specialty Cable Corporation, Wallingford, CT 06492	800-456-SPEC
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220	310-609-1811; 800-326-0006
§† Whitmor Wire & Cable Corp., Valencia, CA 91355	805-257-2400
§† Wilco Wire & Cable Co., Inc., San Jose, CA 95133	408-926-8880

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Wire Twisters, Manual-5400 — *See Vol. C*

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Work Stations, Laminar Flow-4100 — *See Vol. D*

Work Stations, 3-D Video Microscope-4100 — *See Vol. D*

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X-ray Detector Arrays (For Industrial Inspections)-4100 — *See Vol. D*

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X-ray Inspection Equipment-4100 — *See Vol. D*

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MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

MINIGLOSSARY
OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

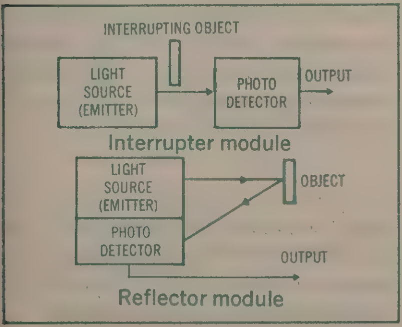
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

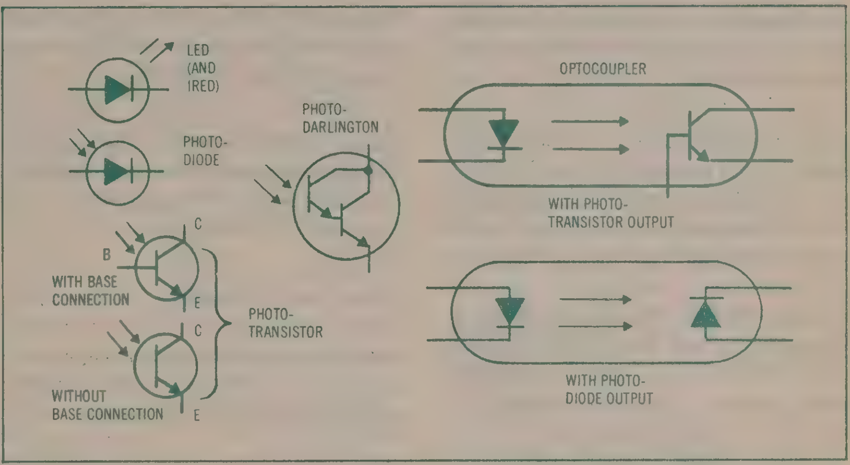
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

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MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

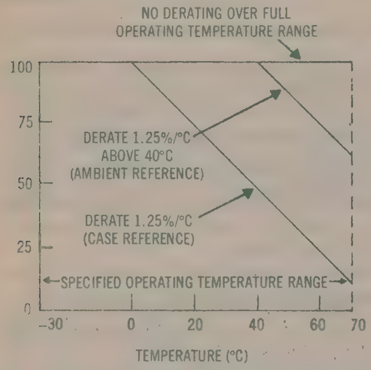

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

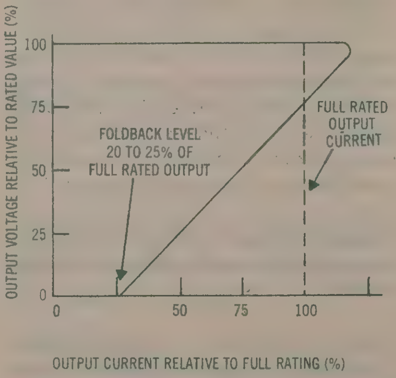

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

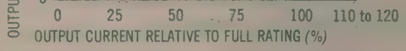

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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MINIGLOSSARY
ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

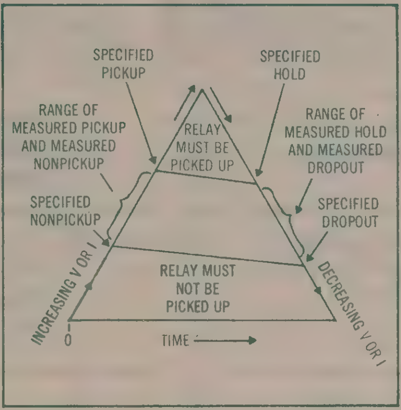
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.


SPECIFIED PICKUP
SPECIFIED HOLD
RANGE OF MEASURED PICKUP AND MEASURED NONPICKUP
RELAY MUST BE PICKED UP
RANGE OF MEASURED HOLD AND MEASURED DROPOUT
SPECIFIED NONPICKUP
SPECIFIED DROPOUT
RELAY MUST NOT BE PICKED UP
INCREASING V OR I
DECREASING V OR I
0
TIME

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

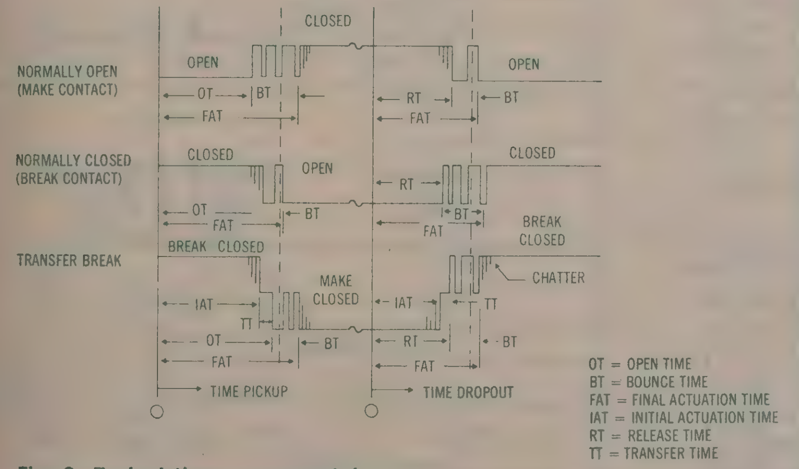

CLOSED
NORMALLY OPEN (MAKE CONTACT)
OPEN
OPEN
OT
BT
FAT
RT
BT
FAT
NORMALLY CLOSED (BREAK CONTACT)
CLOSED
OPEN
CLOSED
RT
OT
BT
FAT
BT
FAT
BREAK CLOSED
TRANSFER BREAK
BREAK CLOSED
MAKE CLOSED
CHATTER
IAT
TT
IAT
TT
OT
BT
RT
BT
FAT
FAT
TIME PICKUP
TIME DROPOUT
OT = OPEN TIME
BT = BOUNCE TIME
FAT = FINAL ACTUATION TIME
IAT = INITIAL ACTUATION TIME
RT = RELEASE TIME
TT = TRANSFER TIME

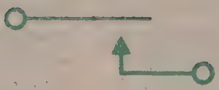
Fig. 2. Typical time vs. current (non-inductive load)

eem

MINIGLOSSARY
RELAY CONTACT FORMS

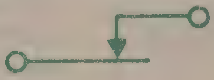
A

Make
SPST-NO



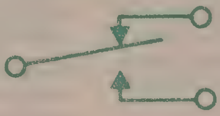
B

Break
SPST-NC



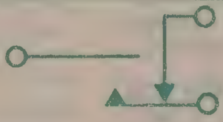
C

Break, Make
(Transfer)
SPDT



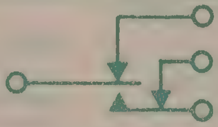
D

Make, Break
(Continuity
Transfer)



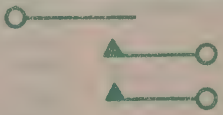
E

Break,
Make,
Break



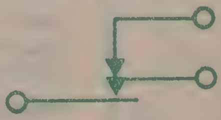
F

Make,
Make



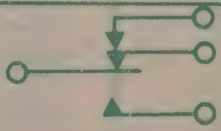
G

Break,
Make



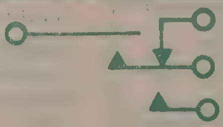
H

Break,
Break,
Make



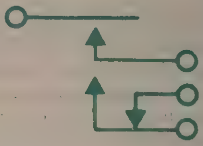
I

Make,
Break,
Make



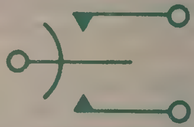
J

Make,
Make,
Break



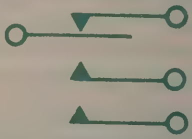
K

Center off
SPDT



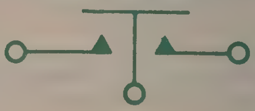
L

Break,
Make,
Make



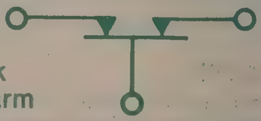
U

Double
make
Contact
on arm



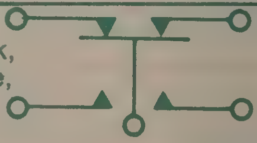
V

Double break
Contact on arm



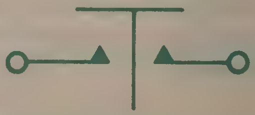
W

Double break,
Double make,
Contact
on arm



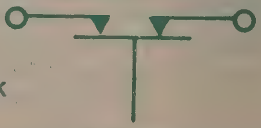
X

Double
make



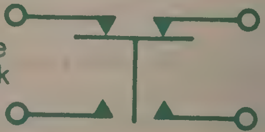
Y

Double break



Z

Double make
Double break
SPDT-DB



93
94 Manufacturers and Sales Offices Directory

Each manufacturer is listed alphabetically with complete address and telephone number of main offices. The names of those with data pages in this edition of EEM are shown in **boldface**

Many manufacturers also show FAX, TWX and Telex numbers, FSC (Federal Supply Code), other pertinent company data, their sales and/or local distributor offices and phones. The page numbers of their data pages in this edition are shown in all volumes.

AAA CIRCUITS, INC., 827 Black Oak Ridge Road, Wayne, NJ 07470, Tel: 201-835-2765, FAX: 201-835-2768; FSC No.: 5998; Empl.: 18; *Sls. Mgr.:* F. J. La Manna; *Dist. Mgr.:* f. J. La Manna

AAK CORP, 747 River St, Haverhill, MA 01832, Tel: 508-373-3769, 800-886-2225, TELEX: 04 26 3109-1, FAX: 508-373-8881; FSC No.: 04 26 3109-1; Empl.: 20; *Sls. Mgr.:* Marie Credit .... **D•2052-2055**

Local Sales Offices & Reps

CA	Los Angeles, Power Partners	213-215-0800
OH	Cleveland, Tiby Co.	216-371-5335

AALPHA PRECISION, Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, 800-835-3355, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt

A & D ELEC. INSTRS., 73-07 88th St, Glendale, NY 11385, Tel: 718-275-6516, FAX: 718-275-6516; FSC No.: 01914; Empl.: 7

A & J MANUFACTURING CO., 14131 Franklin Ave., Tustin, CA 92680, Tel: 714-544-9570, FAX: 714-544-4215; FSC No.: 08060; Empl.: 70; *Sls. Mgr.:* B. M. Evers

FAX: 603-528-1478

AAVID ENGINEERING, INC., One Kool Path, P.O. Box 400, Laconia, NH 03247-0400, Tel: 603-528-3400, TWX: 510-298-1127; FSC No.: 30161; Empl.: 450; *Sls. Mgr.:* Charles Nelson; *Dist. Mgr.:* Patrick SandeFur ... **C•1561**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540, FAX:205-830-1542
AZ	Phoenix, Gregory & Assocs.	602-870-8797, FAX:602-870-8796
CA	Brea, Masco Elctrns.	714-990-6991, FAX:714-990-2053
CA	Julian, Sontronics	619-765-3294, FAX:619-765-0868
CA	Santa Clara, WestRep	408-988-8833, FAX:408-988-3186
CO	Broomfield, SummitWest Mktg.	303-460-9600, FAX:303-460-9074
FL	Apopka, Cartwright & Bean, Inc.	407-889-9100, FAX:407-889-2168
FL	Deerfield Bch., Cartwright & Bean, Inc.	305-429-3400,FAX:305-429-3402
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160, FAX:404-368-0125
IL	Itasca, Beta Technlg. Sls., Inc.	708-250-9586, FAX:708-250-9592
IN	Carmel, Kahsar Sls. Inc.	317-844-9353, FAX:317-844-9353
IA	Des Moines, S P S Assocs.	515-225-0607, FAX:515-225-8713
KS	Olathe, S P S Assocs.	913-764-4460, FAX:913-764-6161
LA	Covington, Cartwright & Bean, Inc.	504-892-2326, FAX:504-892-2326
MD	Sykesville, Eastern Technlg.	410-442-2952, FAX:410-489-7780
MA	Milford, Selmark Assocs., Inc.	508-478-9088, FAX:508-478-5145
MI	Muskegon, Kahsar Sls. Inc.	616-798-4451, FAX:616-798-4451
MI	Sterling Heights, Kahsar Sls., Inc.	313-795-3530, FAX:313-795-4181
MN	Edina, Foster (Mel) Tech. Sls.	612-941-9790, FAX:612-944-0634
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170, FAX:601-981-1171
MO	Earth City, S P S Assocs.	314-291-0520, FAX:314-291-7138
NJ	Berkeley Hgts., Cambridge-Allen & Assocs.	908-464-0203,FAX:908-468-9090
NJ	Medford, McCoy Group	609-953-0770, FAX:609-953-1238
NM	Albuquerque, Ron-Tek, Inc.	505-299-3771, FAX:505-299-3771
NY	Endwell, Reagan/Compar	607-754-2171, FAX:607-754-4270
NY	Rochester, Reagan/Compar Rochester	716-271-2230,FAX:607-754-4270
NY	Syracuse, Reagan/Compar Syracuse	315-432-8232,FAX:607-754-4270
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303, FAX:704-536-0313
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130, FAX:919-876-4130
OH	Cincinnati, Kahsar Sls. Inc.	513-598-1484, FAX:513-598-6870
OH	Columbus, Kahsar Sls. Inc.	614-252-4009, FAX:614-252-4009
OH	Elyria, Kahsar Sls., Inc.	216-365-5219, FAX:216-365-5219
OH	Parma, Kahsar Sls. Inc.	216-845-0103, FAX:216-845-0103
OR	Lake Oswego, S P S Elctrns.	503-697-7768, FAX:503-697-7764
PA	Exton, McCoy Group	215-363-0350
PA	Pittsburgh, Kahsar Sls., Inc.	412-734-8797, FAX:412-734-8797
TN	Germantown, Cartwright & Bean, Inc.	901-758-8113,FAX:901-758-8068
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450, FAX:615-539-6885
TX	Austin, MIL-REP Assocs., Inc.	512-346-6331, FAX:512-346-1975
TX	Houston, MIL-REP Assocs., Inc.	713-444-2557, FAX:713-444-2751
TX	Richardson, MIL-REP Assocs., Inc.	214-644-6731, FAX:214-644-8161
UT	Bountiful, TQ (Butterworth) Mktg.	801-298-8388, FAX:801-298-8840
WA	Mt. Lake Terrace, S P S Elctrns.	206-323-4140, FAX:206-323-4140
WI	Milwaukee, Beta Technlg. Sls., Inc.	414-543-6609, FAX:414-543-9288
PR	Guaynabo, ISLA Caribe Electro Sls.	809-720-4430, FAX:809-720-1097
Can	Calgary, Alb., Intelatech	403-230-3190, FAX:403-230-3183
Can	Mississauga, Ont., Intelatech	416-629-0082, FAX:416-629-1795
Can	Nepean, Ont., Intelatech	613-769-5618, FAX:613-596-2442
Can	Pointe Claire, Que., Intelatech	514-630-6041, FAX:514-630-5612

Local Distributors

AL	Huntsville, Century Fasteners Corp.	205-883-5344
AL	Huntsville, Hammond Elctrns. Inc.	205-830-4764
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Aero-Space Southwest Inc.	602-582-2779
AZ	Phoenix, Future Elctrns. Inc.	602-968-7140
AZ	Scottsdale, Kent Elctrns.	602-998-0399
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates Co. Inc.	501-562-9100
AR	Springdale, Carlton-Bates Co. Inc.	501-756-5012
CA	Chatsworth, Future Elctrns. Inc.	818-772-6240
CA	Chatsworth, Time Elctrns.	508-532-6200
CA	Compton, Time Elctrns.	213-979-5090
CA	Culver City, Time Elctrns.	314-391-6444
CA	Culver City, Time Elctrns.	508-532-6200
CA	Fountain Valley, Comps. Ctr. Inc.	714-979-0437

CA	Fremont, Acacia/Deanco	415-623-7500
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Irvine, Future Elctrns. Inc.	714-260-4141
CA	Los Angeles, Bell Inds. Inc	213-826-6778
CA	Los Angeles, Bell Inds. Inc.	213-826-6778
CA	Los Angeles, Bell Inds. Inc.	310-826-2355
CA	Milpitas, Kent Elctrns./PYR	408-262-5300
CA	Mtn. View, Energy Sls. Inc.	415-969-0800
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Future Elctrns. Inc.	619-625-2800
CA	San Diego, Kent Elctrns./PYA	619-271-5404
CA	San Diego, Kent Elctrns./SHE	619-453-7133
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Future Elctrns. Inc.	408-435-9100
CA	San Jose, Time Elctrns.	408-943-9490
CA	Santa Ana, B D S Elctrns. Inc.	714-662-1050
CA	Santa Ana, Bell Inds. Inc.	714-835-1464
CA	Santa Clara, Comps. Cen.	408-988-3751
CA	Santa Fe Springs, Bell Inds. Inc.	213-826-6778
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Kent Elctrns./PYR	213-691-0561
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Added Value Elctrn.	714-258-9501
CA	Tustin, Added Value Elctrn.	714-259-8258
CA	Tustin, Time Elctrns.	714-669-0100
CO	Broomfield, Future Elctrns.	303-421-0123
CO	Englewood, Kent Elctrns.	303-762-0670
CO	Englewood, N E P Elctrns. Inc.	303-799-9898
CO	Englewood, Time Elctrns.	303-721-8882
CO	Littleton, Indelco Inc.	303-795-3431
CO	Wheat Ridge, Added Value Elctrn. Inc.	303-422-1701
CO	Wheatridge, Acacia/Deanco Inc.	303-421-7004
CO	Wheatridge, Bell Inds. Inc.	303-431-8732
CT	Berlin, Kent Elctrns. Inc.	203-829-2100
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Allied Elctrns.	1-800-433-5700
CT	Oxford, Tower Fasteners Comp.	203-264-3000
CT	South Winds, Car-Lac Elctrns.	203-282-0631
CT	Southbury, Time Elctrns.	203-271-3200
CT	Wallingford, Amold Indl.	203-215-7168
CT	Wallingford, Cronin Elctrns., Inc.	800-982-4449, 203-265-3134
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Altamonte Springs, Bell Inds.	813-541-4434
FL	Altamonte Springs, Future Elctrns.	407-767-8414
FL	Ft. Lauderdale, Hammond Elctrns. Inc.	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Largo, Elctrn./Precepts	813-544-3636
FL	Largo, Future Elctrns.	813-530-1222
FL	Largo, Kent Elctrns.	813-545-0057
FL	Miami, All American	305-621-8282
FL	Orlando, Hammond Elctrns. Inc.	407-849-6060
FL	Orlando, Time Elctrns.	407-841-6565
FL	Pompano Beach, Allied Elctrns.	305-486-0500
FL	Tampa, Century Fasteners Co.	813-886-5770
FL	Tampa, Century Fasteners Corp.	813-886-5770
FL	Winter Park, Servtronics	407-677-8191
GA	Duluth, All American	404-476-0194
GA	Lawrenceville, Century Fasteners	404-516-1620
GA	Norcross, Atlanta Hardware Special	404-449-3000
GA	Norcross, Future Elctrns. Inc.	404-441-7675, 404-441-7676
GA	Norcross, Hammond Elctrns. Inc.	404-449-1996
GA	Norcross, Time Elctrns.	404-368-0969
IL	Elk Grove, Bell Inds.	708-640-1910
IL	Elk Grove, Kent Elctrns.	708-364-1300
IL	Gurnee, N E P Elctrns. Inc.	708-662-0185
IL	Hoffman Estates, Future Elctrns. Inc.	312-882-1255
IL	Lisle, Comps. Inc.	708-852-7707
IL	Rosemont, Advent Elctrns. Inc.	708-297-6200
IL	Schaumburg, Time Elctrns.	708-303-3037
IL	Wood Dale, Allied Elctrns.	312-697-8200
IL	Wood Dale, N E P Elctrns. Inc.	708-595-8500
IN	Ft. Wayne, Bell Inds. Inc.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Mar Elctrns. Inc.	317-633-6699
IN	Indianapolis, P E I Genesis Elctrn.	219-287-2911
IN	Indianapolis, R M Elctrns.	317-291-7110
IN	South Bend, P E I Genesis Elctrn.	219-287-2911
IA	Cedar Rapids, Advent Elctrns. Inc.	319-363-0221
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
KS	Wichita, R S C Elctrns.	316-267-5213
MD	Columbia, Future Elctrns. Inc.	301-995-1222
MD	Columbia, Kent Elctrns.	301-621-8100
MD	Columbia, Time Elctrns.	301-964-3090
MD	Jessup, Treeko Sls. Inc.	301-470-3300
MA	Bolton, Future Elctrns. Inc.	508-366-2400
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Chelsea, Future Elctrns.	617-889-9440
MA	Marlborough, Hardware Specialty Co. Inc.	508-481-8622
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Peabody, Time Elctrns.	508-532-6200
MA	Wilmington, North Star Elctrn.	508-657-5155
MI	Ann Arbor, Bell Inds. Inc.	313-971-9093
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns. Inc.	313-477-1650
MI	Grand Rapids, R M Elctrns.	616-531-9300
MI	Livonia, Future Elctrns.	313-261-5270
MN	Eden Prairie, Allied Elctrns.	612-829-7554
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Edina, Bergquist Co.	612-835-2322
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	St. Paul, Kent Elctrns.	612-642-2828
MN	Thief River, Digi-Key Corp.	218-681-6674
MO	Hazelwood, Kent Elctrns.	314-895-1515
MO	Independence, Kent Elctrns.	816-254-3410
MO	Manchester, Time Elctrns.	314-391-6444
MO	Springfield, Carlton-Bates Co. Inc.	501-562-9100
MO	St. Charles, Finnigan Elctrns.	314-946-6201
MO	St. Louis, Ric-Tronics	314-997-4707
NH	Atkinson, Astrum Elctrns.	603-898-3399
NH	Manchester, Cronin Elctrns., Inc.	800-982-7777
NJ	Blackwood, Hardware Specialty	609-228-6800
NJ	Cherry Hill, Hardware Specialities	609-663-0034
NJ	Fairfield, Bell Inds. Inc.	201-227-6060
NJ	Fairfield, Future Elctrns.	201-299-0400
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Mountainside, Route Elctrns.	908-654-8283
NJ	Parsippany, Future Elctrns.	609-778-7600
NJ	Wayne, Time Elctrns.	201-785-8250
NY	Alexandria Bay, Carsten Elctrns.	416-477-9898
NY	Amherst, Rush Elctrns.	800-343-5247
NY	Baldwin, Accessories for Elec.	516-546-1751
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Buffalo, Irwin Indl.	416-889-9100
NY	Buffalo, Summit Distrs. inc.	716-887-2800
NY	Champlain, Prelco Elctrns.	514-389-8051
NY	Elmhurst, Century Fasteners Co.	718-446-5222
NY	Elmhurst, Century Fasteners Corp.	718-446-5000
NY	Fairport, Allied Elctrns.	1-800-433-5700
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Holtsville, Tower Fasteners	516-289-8800
NY	Long Island City, Hardware Specialties	718-361-9393
NY	Mineola, Hardware Sepc.	516-741-7100
NY	Mt. Sinai, Kent Elctrns.	516-447-2000
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Masline Elctrns. Inc.	716-546-5373
NY	Syracuse, Future Elctrns.	315-451-2371
NY	Syracuse, Hardware Specialty	315-434-9093
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Charlotte, Century Fasteners Corp.	704-554-0444
NC	Charlotte, Future Elctrns.	704-455-9030
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Greensboro, Hammond Elctrns. Inc.	919-275-6391
NC	Raleigh, Allied Elctrns.	1-800-433-5700
NC	Raleigh, Century Elctrn. Comps.	919-782-2116
NC	Raleigh, Century Elctrns.	919-596-2220
NC	Raleigh, Century Fasteners Corp.	919-787-1800
NC	Raleigh, Dixie/Resource Elctrns.	919-724-5961
NC	Raleigh, Time Elctrns.	919-847-9650
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Cleveland, Darrah Elec.	216-631-0912
OH	Columbus, Time Elctrns.	614-794-3301
OH	Columbus, Wedemeyer	614-436-9600
OH	Dayton, Bell Inds. Inc.	513-435-8660
OH	Hooven, Bell Inds. Inc.	513-353-2355
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OH	Warren, REM Elctrns.	216-373-1300
OK	Oklahoma City, R S C Elctrns.	405-631-7729
OK	Tulsa, Carlton-Bates Co. Inc.	918-250-1626
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Comp. Resources	503-641-8488
OR	Beaverton, Future Elctrns. Inc.	503-626-2977
OR	Beaverton, Kent Elctrns.	503-626-8300
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Erie, REM Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Huntingdon, REM Elctrns.	412-864-7423
PA	Norristown, Century Elctrn. Comp.	215-631-5400, 215-631-5404
PA	Philadelphia, P E I-Genesis	215-673-0400
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	Columbia, Dixie Elctrns.	704-377-5413
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Hammond Elctrns. Inc.	803-233-4121
SC	W. Columbia, Century Fasteners Corp.	803-791-1800
TN	Memphis, Carlton-Bates Co. Inc.	901-365-3539
TN	Nashville, Carlton-Bates Co. Inc.	615-885-3232
TN	Oakridge, Dixie Elctrns.	615-481-3393
TX	Austin, Added Value Elctrns.	512-346-6331
TX	Austin, Carlton-Bates Co., Inc.	512-837-9098
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Time Elctrns.	512-346-7346
TX	Austin, Wofford Elctrns., Inc.	512-339-1131
TX	Dallas, Added Value Elctrn.	214-404-1144
TX	Dallas, Allied Elctrns.	1-800-433-5700
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, Carlton-Bates Co. Inc.	817-831-0395
TX	Houston, Carlton-Bates Co. Inc.	817-831-0395
TX	Houston, Carlton-Bates Co., Inc.	817-831-0395
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Kent Elctrns.	713-978-5849
TX	Irving, Time Elctrns.	214-621-0500
TX	Lorado, REM	216-373-1300
TX	Richardson, All American	800-541-1435
TX	Richardson, Kent Elctrns.	713-780-7770
TX	Richardson, R S C Elctrns.	214-644-3444
TX	Richardson, Time Elctrns.	214-644-4644
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Future Elctrn. Inc.	801-972-8489
UT	Salt Lake City, Future Elctrns. Inc.	801-972-8489
UT	West Lake City, Added Value Elctrn.	801-975-9500
UT	West Valley City, Time Elctrns.	801-973-8494
VA	Ashland, Century Fasteners Corp.	804-550-2058
WA	Kent, Comps. Resources	206-340-1646
WA	Kirland, Time Elctrns.	206-820-1525
WA	Redmond, Acacia/Deanco Inc.	206-881-5566
WA	Redmond, Energy Sls. Inc.	206-883-2342
WA	Redmond, Future Elctrns. Inc.	206-881-8199
WA	Redmond, Kent Elctrns./PYR	206-883-7200
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Milwaukee, Progressive Image Inc.	414-321-4722
WI	New Berlin, N E P Elctrns. Inc.	414-785-9100
WI	New Berlin, Rekco	414-784-3430
WI	W. Allis, Advent Elctrns.	414-475-6860
WI	Waukesha, Future Elctrns.	414-700-1004
Can	Edward, Future Elctrns. Inc.	204-786-7711
Can	Galgary, Future Elctrns. Inc.	403-250-5550
Can	Markham, Ont., Carsten Elctrns.	416-477-7705
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280
Can	Nepean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Ottawa, Ont., Carsten Elctrns.	416-495-7705
Can	Pointe Claire, Que., Future Elctrns. Inc.	514-694-7710
Can	Port Royal, Prelco Elctrns.	514-389-8051
Can	Richmond Hill, Ont., Irwin Indl.	416-889-9100
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	Vancouver, BC, Future Elctrns. Inc.	604-294-1166
Can	Victoria, BC, Queale Elctrns. Ltd.	604-388-6111

FAX: 908-526-6866

ABACUS CONTROLS INC., 80 Readington Rd., Somerville, NJ 08876, Tel: 908-526-6010; FSC No.: 54241; Empl.: 30; *Sls. Mgr.:* R.J. Swinger .... **D•2223-2225**

Local Sales Offices & Reps

AL	Gurly, Saber Assocs., Inc.	205-776-9481
CA	Jamul, Power Partners	619-560-0099
CA	Los Angeles, Power Partners	310-215-0800
CA	Sunnyvale, N-S Westronics	408-745-1102
CA	Ventura, Power Partners	805-659-5356
CT	New London, Elctrn. Sls. of New England	203-443-2646
FL	Melbourne, Saber Assocs., Inc.	407-724-0920
FL	Tampa, Saber Assocs., Inc.	813-961-0689
GA	Dacula, Saber Assocs., Inc.	404-962-8740
IN	Fishers, Carter, McCormic & Peirce, Inc.	317-842-9277
MA	N. Dartmouth, Elctrn. Sls. of New England	508-997-8016
MI	Farmington Hills, Carter, McCormic & Peirce, Inc.	313-477-7700
NC	Clayton, Saber Assocs., Inc.	919-553-5009
OH	Englewood, Carter, McCormic & Peirce, Inc.	513-836-0951
OH	Parma, Carter, McCormic & Peirce, Inc.	216-398-0400
PA	Pittsburgh, Carter, McCormic & Peirce, Inc.	412-826-3800
TX	Houston, Scientific Sls. Co.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 718-589-5682, 1-800-888-ABALON, FAX: 718-589-0300; Empl.: 25

ABATRON, INC., 33 Center Dr., Gilberts, IL 60136, Tel: 708-426-2200, 800-445-1754, FAX: 708-426-5966

ABB KENT-TAYLOR INC, Asea Brown Boveri, P.O. Box 20550, Rochester, NY 14602-0550, Tel: 716-292-6050, FAX: 716-273-6207; Empl.: 350; *Dist. Mgr.:* Jim Wicker

ABB SEMICONDUCTOR, See IXYS Corporation

abbott

FAX: 310-836-1027

ABBOTT ELECTRONICS, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 310-202-8820; FSC No.: 6130, 5999, 15755; Empl.: 120; *Sls. Mgr.:* William G. Standen .... **D•1491-1511, 2226-2227**

Local Sales Offices & Reps

MA	Whitinsville, Power Factor & Assoc. ...	508-234-6415
NJ	Ft. Lee, Abbott Elctrns.	201-461-4411
TX	Richardson, Abbott Elctrns.	214-437-0697
Can	Ottawa, Subtec Ltd.	613-738-1470

Abbott TECHNOLOGIES INC

The Powerhouse of Quality

FAX: 818-768-0395/7

ABBOTT TECHNOLOGIES, INC., 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, 1-800-367-8200; FSC No.: 58910; Empl.: 62; *Sls. Mgr.:* Suresh Soni, Sls. Mgr. ...... **A•2234-2253; D•1512-1515, 2228-2229**

Local Sales Offices & Reps

CA	Sun Valley, Abbott Technlgs., Inc.	818-504-0644
NJ	Palisades Pk., Abbott Technlgs., Inc. ..	201-461-4005

ABBOTT TRANSISTOR LABS, Power Supplies, See Abbott Electronics, Power Supplies

AB CONTROLS & TECHNOLOGY INC., 1700 Rockville Pike, Rockville, MD 20852, Tel: 301-984-6020, FAX: 301-981-3270; *Sls. Mgr.:* Andrew Kassman

A.B. CONTROLS & TECHNOLOGY, INC., 255 Pennbright, Ste. 200, Houston, TX 77090, Tel: 713-876-3728, 301-984-6020, FAX: 713-876-4853; Empl.: 15; *Sls. Mgr.:* Andrew Kassman; *Dist. Mgr.:* Andrew Kassman

ABL ELECTRONICS SUPPLY, INC., 11 S. Broad St., Peekskill, NY 10566, Tel: 914-736-1010, 1-800-431-2103, FAX: 914-736-1899; Empl.: 18; *Sls. Mgr.:* George Wiesel .... **C•1287, 1706-1709**

ABLESTIK ELECTRONIC MATERIALS & ADHESIVES-EMCA-REMEX PRODUCTS, 160 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-855-1000, TWX: 710-566-1128, FAX: 215-855-8202; Empl.: 50; *Sls. Mgr.:* Jeff Gausepohl

ABLESTIK LABORATORIES, 20021 Susana Rd., Rancho Dominguez, CA 90221, Tel: 310-764-4600, FAX: 310-764-2545; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* J. Gausepohl

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, FAX: 408-436-0969; FSC No.: 8Z441; *Sls. Mgr.:* V. Lumba

ABRACON CORPORATION, 1010 Calle Cordillera Bldg. 103, San Clemente, CA 92673, Tel: 714-498-4505, FAX: 714-498-1714; *Sls. Mgr.:* Jeff Trusiak; *Dist. Mgr.:* Dean Nessen .... **A•1180, 1330-1331**

ABRAMS INSTRUMENT CORP., 1322 Rensen St., Lansing, MI 48910-3688, Tel: 517-882-7211, FAX: 517-882-3136; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ABSOLUTE FILTER CO., P.O. Box 594, Ambler, PA 19002, Tel: 215-886-9176, FAX: 215-886-9179; Empl.: 2; *Sls. Mgr.:* Ed Borzelleca

ABSOPULSE ELECTRONICS LTD., 110 Walgreen Rd., Carp, Ont., Can K0A 1L0, Tel: 613-836-3511, FAX: 613-836-7488; Empl.: 31; *Sls. Mgr.:* Tony Plangger; *Dist. Mgr.:* Nanno Habets

ABWJ SYSTEMS CORP., 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-481-1001, FAX: 919-460-7664; Empl.: 25; *Sls. Mgr.:* Lino D'Andreti/Dieter Brammer; *Dist. Mgr.:* Max Bachofen

ABW SYSTEMS, CORPORATION, 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-481-1001, FAX: 919-460-7664; Empl.: 25; *Sls. Mgr.:* Lino D'Andreti / Dieter Brammer; *Dist. Mgr.:* Max Bachofen

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, FAX: 316-331-0449; Empl.: 1000; *Sls. Mgr.:* Leon Allen

ACCEL INDUSTRIAL HEAT SINK CORP., 3709 Medford St., Los Angeles, CA 90063, Tel: 213-261-5156, FAX: 213-261-5159; FSC No.: 26701; *Sls. Mgr.:* Ron Ruby

ACCEL TECHNOLOGIES, INC., 6825 Flanders Dr., San Diego, CA 92121, Tel: 619-554-1000, FAX: 619-554-1019; Empl.: 33; *Sls. Mgr.:* Earl Therrien

ACCESSORIES FOR ELECTRONICS, INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751, FAX: 516-867-1922; FSC No.: 54355; Empl.: 27; *Sls. Mgr.:* Bill Harris

ACC RELAYS, Echlin Inc., 1300 West Oak St., Independence, KS 67301-0778, Tel: 316-331-1000, FAX: 316-331-0449; Empl.: 900; *Sls. Mgr.:* Neil Heisler; *Dist. Mgr.:* Gary Ledbetter

ACCULEX CORPORATION, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3660, TELEX: 503989, FAX: 508-880-0179; *Sls. Mgr.:* Richard A. Mullen

ACCULIN, INC., 209 W. Central St., Natick, MA 01760, Tel: 508-650-1012, FAX: 508-650-1457; Empl.: 5; *Sls. Mgr.:* Barry Hilton

ACCUMET ENGINEERING, 518 Main St., Hudson, MA 01749, Tel: 508-568-8311, FAX: 508-562-4384; *Sls. Mgr.:* C. T. Haering

ACCU-NOISE LAB, Marek Technology Inc., 23 Padanaram Rd., Ste. 5, Danbury, CT 06811, Tel: 203-743-3633; *Sls. Mgr.:* R. L. Longo; *Dist. Mgr.:* Robert L. Longo

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 508-745-7878, FAX: 508-745-7922; Empl.: 15; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS CORP., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, 1-800-334-5904, FAX: 216-366-0522; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* Roger M. Mahoney

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 310-903-0200, TWX: 910-586-1632, FAX: 310-903-0208

ACCUSONIC DIVISION, O.R.E. International Inc., Box 709, Falmouth, MA 02541, Tel: 508-548-5800, TELEX: 6817399 OREFAL UW, FAX: 508-540-3835; Empl.: 100; *Sls. Mgr.:* Robert Beede

ACCUSONIC PRODUCTS, Global Market Development, 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-437-6000, FAX: 516-358-2307; FSC No.: 11-3044326; Empl.: 11; *Sls. Mgr.:* Anthony W. Mazzeo; *Dist. Mgr.:* Anthony W. Mazzeo

ACCUTECH, Adaptive Instrs. Corp., 15 Bunazzoli Ave., Riverside Indl. Park, Hudson, MA 01749, Tel: 508-568-0500, FAX: 508-568-9085; *Sls. Mgr.:* Cliff Lewis

ACCUTECH BENCHMARK SERVICES, P.O. Box 252, Brick, NJ 08723, Tel: 1-908-206-0026, FAX: 908-206-0280

ACCU-TECH CORPORATION, 200 Hembree Park Dr., Roswell, GA 30076-3890, Tel: 404-751-9473, 800-221-4767, FAX: 404-475-4659; Empl.: 52; *Sls. Mgr.:* Randy Guhl; *Dist. Mgr.:* Dale Yarber

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

ACCU-TRONICS MFG., INC., 4255 White Bear Pkwy., St. Paul, MN 55110, Tel: 612-653-1961, FAX: 612-653-1041; Empl.: 35; *Sls. Mgr.:* Jeffrey H. Zappa

ACDC ELECTRONICS, DIV. OF ASTEC AMERICA, See Astec America

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, FAX: 313-984-1446; Empl.: 200

ACI COMPONENTS, INC., 23422 Peralta, Ste. D, Laguna Hills, CA 92653, Tel: 714-588-9611, FAX: 714-588-1855; FSC No.: 5930; Empl.: 5; *Sls. Mgr.:* Christian Dwyer

ACL INC., 1960 E. Devon Ave., Elk Grove Village, IL 60007, Tel: 708-981-9212, 1-800-782-8420, TELEX: 4330251, ESYLNK: 708-981-9212; Empl.: 12

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, Tel: 716-968-2400, FAX: 716-968-3948; *Sls. Mgr.:* Dale Guilford

ACME MODEL ENGINEERING CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650, FAX: 201-943-0516; Empl.: 29

ACME TRANSFORMER, Acme Electric Corporation, 4815 West 5th St., Lumberton, NC 28358, Tel: 919-738-1121, FAX: 919-739-0024; *Sls. Mgr.:* George Mergel

ACME-URDC, INC., 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Al Haag

ACON, INC., 22 Bristol Dr., South Easton, MA 02375, Tel: 508-230-8022, FAX: 508-230-2371; Empl.: 15; *Sls. Mgr.:* Frank Gurley .... **D•2058-2066**

Local Sales Offices & Reps

CA	Carlsbad, Zerimar Sls.	619-436-3379
CA	San Jose, Silicon Valley Sls.	408-432-1967
FL	Oldsmar, Suncoast Elctrn. Sls.	813-787-9221
IN	Columbus, High Tech Assocs.	812-378-4835
MA	Tyngsboro, AMS Mktg.	508-263-9712
MI	Rochester Hills, Geotronix	313-373-4334
MN	Minneapolis, Electro-Serv Co.	612-338-3475
OH	Richfield, Geotronix	216-659-6100
OK	Tulsa, Advance Tech Sls.	918-664-0482
PA	Drexel Hill, DNE Sls.	215-789-6822
TX	Austin, Advance Tech. Sls.	512-331-9979
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
Can	Don Mills, Ont., Canadian Source Corp.	416-445-0211

ACOPIAN TECHNICAL COMPANY, Box 638, Easton, PA 18044, Tel: 215-258-5441, FAX: 215-258-2842; FSC No.: 14749; *Sls. Mgr.:* T. Skopal .... **D•1517-1548**

Local Sales Offices & Reps

FL	Melbourne, Acopian	407-727-1172

ACRODYNE CONTROLS, See Accudyne Corp.

ACROLOOP MOTION CONTROL SYSTEMS, INC., 7801 Park Dr., Chanhassen, MN 55317, Tel: 612-474-4500, FAX: 612-474-7674; Empl.: 13; *Sls. Mgr.:* Mike Wagner; *Dist. Mgr.:* Mike Wagner

ACROMAG INC., 30765 Wixom Rd., P.O. Box 437, Wixom, MI 48393-7037, Tel: 313-624-1541, FAX: 313-624-9234; Empl.: 75; *Sls. Mgr.:* L. Anderson

ACR SYSTEMS INC., 8561-132nd St., Surrey,B.C., Canada V3W 4N8, Tel: 604-591-1128, FAX: 604-591-2252; Empl.: 5; *Sls. Mgr.:* Rick Schellenberg; *Dist. Mgr.:* Rick Schellenberg

ACTEL CORPORATION, 955 E. Arques Ave., Sunnyvale, CA 94086, Tel: 408-739-1010, FAX: 408-739-1540; Empl.: 86; *Sls. Mgr.:* Bob Duyn

ACTION INSTRUMENTS, 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726, FAX: 619-279-6290; Empl.: 230; *Sls. Mgr.:* Frank Williams, Sls. VP

ACTION USA, 6 Brightwater Cir., St. Petersburg, FL 33704, Tel: 813-821-5000, 800-821-5001, FAX: 813-822-8800

ACTIVE CONTROL INSTRUMENTATION, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000, FAX: 305-451-3232; FSC No.: 55116; Empl.: 6 .... **D•1149**

ACTIVE ELECTRONICS, Future Electronics, 237 Hymus Blvd., Pointe-Claire, Que., Canada H9R 5C7, Tel: 514-694-7710, 1-800-677-8899, FAX: 514-697-8112; Empl.: 1700; *Dist. Mgr.:* Mike Zuppa (USA), Doug Kisway (CAN)

ACTOWN-ELECTROCOIL, INC., 2414 Highview, Spring Grove, IL 60081, Tel: 815-675-6641, FAX: 815-675-2050; Empl.: 200; *Sls. Mgr.:* Les Friedman; *Dist. Mgr.:* Bill Karmell

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574, FAX: 201-589-3155; FSC No.: 3677; Empl.: 13; *Sls. Mgr.:* George Giangrande, Sls. Conslt.

ADAC CORPORATION, 70 Tower Office Pk., Woburn, MA 01801, Tel: 617-935-6668, FAX: 617-938-6553; Empl.: 40

ADALET-PLM/DIV. OF SCOTT & FETZER CO., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, TELEX: 98-5349, FAX: 216-267-1681; FSC No.: 73389; Empl.: 177

ADAMS RITE PRODUCTS, INC., 540 W. Chevy Chase Dr., Glendale, CA 91204, Tel: 818-241-5121, TELEX: 62262290, FAX: 818-500-7239; Empl.: 150; *Sls. Mgr.:* Jonas Williams

ADAM TECHNOLOGIES INC., 211 Clay Ave. W., Roselle Park, NJ 07204, Tel: 908-245-4000, FAX: 908-245-4455; Empl.: 152; *Sls. Mgr.:* Brett Hammerschmidt

ADAPTEC, INC., 691 South Milpitas Blvd., Milpitas, CA 95035, Tel: 408-945-8600, TELEX: 910-338-0060, FAX: 408-262-2533; Empl.: 6000; *Sls. Mgr.:* Wayne Gartin; *Dist. Mgr.:* Roy Safire

ADAPTIVE NETWORKS, P.O. Box 1020 Kendall Sq., Cambridge, MA 02142, Tel: 617-497-5150; Empl.: 20; *Sls. Mgr.:* Sumin Tchen

ADATEK, INC., 700 Airport Way, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343, TELEX: 62903932, FAX: 208-263-6596; Empl.: 18; *Sls. Mgr.:* William Chambers; *Dist. Mgr.:* Carolyn Pennington/Lynn LaDuca

ADCOUR, INC., 18 Billings St., PO Box 277, Sharon, MA 02067, Tel: 617-784-8123, FAX: 617-784-5563; Empl.: 16; *Sls. Mgr.:* William O'Connell; *Dist. Mgr.:* William O'Connell

ADC TELECOMMUNICATIONS, INC., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-938-8080, TELEX: 290321, FAX: 612-946-3292; Empl.: 2000; *Sls. Mgr.:* Larry Asten

ADDACON GREENSBORO, 3702-C Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, FAX: 919-852-6256; *Sls. Mgr.:* Lynn Cummings

A.D. DATA SYSTEMS CORP., Photographic Sciences Corp., 770 Basket Rd., Webster, NY 14580-0478, Tel: 716-265-1600, FAX: 716-872-6142; FSC No.: 23389; Empl.: 11; *Sls. Mgr.:* J. Cessna, J. Butters; *Dist. Mgr.:* Jack Petz

Local Sales Offices & Reps

CA	Torrance, AMASCO-South	213-781-9494
FL	Melbourne, Saber Assocs.	800-327-0853
MD	Landover, Sel-Tronics	301-341-2700
MA	Hopkinson, Eastern Sys.	508-435-2151
MN	Minneapolis, Engineering Prods. Assoc.	612-835-9022
NJ	Newark, Rical Assocs.	201-643-0880
NM	Albuquerque, Trembly Assocs.	505-266-8616
OH	Westlake, TMS, Inc.	216-327-3527
PA	N. Wales, Scientific Devs.	215-699-7707
TX	Richardson, Scientific Devs. (SW)	214-231-8106
WA	Woodinville, Test & Measurement, Inc.	206-485-1111
EXP	Leport Marly, France, Euromeasure, SA	33 160 131110
Intl	Ramat-Gan, Isreal, IES	972 37526333
Intl	Warwickshire, England, Fozmula Ltd.	926 335411
Can	Quebec, Interfax Sys.	514-336-0392

ADE, INC., 1430 E. 130th St., Chicago, IL 60633, Tel: 312-646-3400, FAX: 312-646-3919; FSC No.: 62049

ADIRONDACK WIRE & CABLE, ACS Industries Inc., 160 Hamlet Ave., Woonsocket, RI 02895, Tel: 1-401-769-1600, FAX: 1-401-769-1607; Empl.: 650; *Sls. Mgr.:* Julian Caduto

ADTECH POWER

FAX: 714-634-0802

ADTECH POWER INC., 2220 S. Dupont Dr., Anaheim, CA 92806, Tel: 714-634-9211; FSC No.: 56410; Empl.: 55; *Sls. Mgr.:* Bernie Smilak; *Dist. Mgr.:* Bernie Smilak .... **D•1549-1551**

Local Sales Offices & Reps

NY	New York, Morgan Elctrn. Sls.	516-549-5180

Local Distributors

AL	Birmingham, Industrial Elec. Supp.	205-956-8504
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	San Francisco, Zack Elctrns.	415-626-1444
LA	Lafayette, Ralph's of Lafayette	318-233-0105
MD	Gaithersburg, M S Elctrns.	301-921-0200
MA	Woburn, Mac Bearing	617-933-2110
PA	Philadelphia, Philadelphia Elctrns.	215-673-0400
TX	Ft. Worth, Allied Elctrns.	1-800-433-5700

ADTRON CORPORATION, 3050 S. Country Club Dr., # 24, Mesa, AZ 85210, Tel: 602-926-9324, FAX: 602-926-9359; Empl.: 10; *Sls. Mgr.:* Tony Giallella

ADTRON INSTRUMENTS, 13801 N. 7th St., Ste. 201, Phoenix, AZ 85022, Tel: 602-863-2250, FAX: 602-863-0914; Empl.: 2; *Sls. Mgr.:* H. Painter

ADVACOM, INC., 5620 West Rd., McKean, PA 16426, Tel: 1-800-458-0512, 814-476-7774

ADVANCE CONVERSION DEVICES CO.UNIT OF TRANSITOR DVCS., INC., 85 Horsehill Rd., Cedar Knolls, NJ 07927, Tel: 201-267-1900, FAX: 201-267-2047; FSC No.: 52298; Empl.: 100; *Sls. Mgr.:* Ron Zeman .... **D•2230-2231**

Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs., Inc.	205-539-1485
AZ	Scottsdale, Dave Menegay & Assocs.	602-994-9519
AR	El Dorado, Kemp Instrs. Co., Inc.	501-862-5869
CA	Bakersfield, FLW, Inc.	805-398-0720
CA	Campbell, SMA	408-370-6900
CA	Canoga Park, FLW, Inc.	818-719-0037
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW Inc.	714-751-7513
CA	Costa Mesa, FLW, Inc.	714-751-7512
CO	Denver, Elcom, Inc.	303-337-2300
CT	Watertown, May Technlg.	203-274-3777
FL	Ft. Lauderdale, Reynolds & Assocs., Inc.	305-344-4536
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
FL	Tampa, Reynolds & Assocs., Inc.	818-372-8369
GA	Duluth, Reynolds & Assocs.	404-476-4992
IL	Wheeling, Ed Joyner & Co.	708-520-1200
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Kansas City, MTS	913-888-5100
MD	Hunt Valley, Elctrn. Resources, Inc.	301-584-8157
MA	Lexington, E.F. Delfino,Inc.	617-862-1118
MI	Ann Arbor, Ashby Assocs., Inc.	313-995-4082
MN	St. Louis Pk., Elctrn. Innovation, Inc.	612-922-2945
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NY	Endicott, Advanced Comp. Corp.	607-785-3191
NY	Kingston, Advanced Comp. Corp.	914-339-1730
NY	N. Syracuse, Advance Comps.	315-699-2671
NY	Rochester, Advanced Comps. Corp.	716-544-7017
NY	Scottsville, Advanced Comps. Corp.	716-889-1429
NC	Raleigh, Reynolds & Assocs., Inc.	919-876-0282
OH	Arcanum, Ashby Assocs., Inc.	513-692-8713
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
OK	Tulsa, Kemp Instrs.,Inc.	918-663-4501
PA	Pittsburgh, Ashby Assocs., Inc.	412-343-5105
PA	Southampton, Campbell Assocs.	215-322-6630
PA	West Chester, Elctrn. Resources, Inc.	215-431-0198
SC	Greenville, Reynolds & Assocs., Inc.	803-288-8701
TX	Lewisville, J. Hughes Co.	214-221-1536, 214-221-1538
UT	Murray, Elcom	801-262-2400,801-262-2472
VA	Alexandria, Dyna-Rep Co.	703-354-1222
VA	Harrisburg, Elctrn. Resources, Inc.	703-289-5571
VA	Norfolk, Elctrn. Resources, Inc.	804-583-4859
EXP	NY/New York, Roburn Agencies, Inc.	914-968-1016
Can	Weston, Ont., Duncan Instrs., Canada Ltd.	416-742-4448

Advanced Analog
a division of Intech

FAX: 408-988-2702

ADVANCED ANALOG, Intech, 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-4930; FSC No.: 52467; Empl.: 200; *Sls. Mgr.:* Michael Sullivan .... **D•2067**

Local Sales Offices & Reps

AL	Huntsville, Sides Assocs.	205-859-9395, FAX:205-851-8785
AZ	Tempe, Thor Engrg.	602-438-8494, FAX:602-438-6879
CA	La Jolla, Keller-Simonsen Assocs.	619-453-5720, FAX:619-453-1695
CA	Manhattan Bch., Pacific Edge	310-546-9009, FAX:310-546-3005
CA	Sunnyvale, Pass Assocs.	408-735-9040, FAX:408-735-0882
FL	Coral Springs, CBC Elctrns.	305-755-1111, FAX:305-341-8379
FL	Longwood, CBC Elctrns.	407-831-5380, FAX:407-831-0965
FL	Tampa, CBC Elctrns.	813-969-1901, FAX:813-264-2744
GA	Lilburn, Adams Elctrns. Inc.	404-925-9115, FAX:404-925-4116
IL	Berkeley, ESA Tech. Mktg.	708-544-0120, FAX:708-544-0266
IN	Indianapolis, CC Electro Sls.	317-921-5000, FAX:317-921-5005
IA	Cedar Rapids, Delltron	319-393-0075, FAX:319-393-0058
KS	Wichita, Miller Aerospace	316-689-8292, FAX:316-689-8247
MD	Randallstown, Beacon North	703-478-2480
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Madison Hgts., Pine Sls.	313-589-0350, FAX:313-589-3420
MN	Eden Prairie, Electro Mark	612-944-5850, FAX:612-944-5855
MO	St. Louis, Acorn	314-421-1751,FAX:314-421-1752
NH	Nashua, Bell Controls	603-882-6984, FAX:603-882-9049
NJ	Elberon, Compar	908-229-3666, FAX:908-229-3687
NJ	Wood-Ridge, Compar	201-460-3569
NY	Bellmore, Compar New York	516-221-7300, FAX:516-221-7600
NC	Sanford, Adams Elctrns. Inc.	919-774-8816
OH	Beachwood, Thompson & Assocs., Inc.	216-831-6277,FAX:216-831-2553
OH	Dayton, Thompson & Assocs., Inc.	513-435-7733, FAX:513-435-1898
OH	Orient, Thompson & Assocs., Inc.	614-877-4304, FAX:614-877-0872
OR	Beaverton, Micro Sls.	503-645-2841, FAX:503-645-3754
PA	Carnegie, Del Steffen & Assocs.	412-276-7366, FAX:412-276-4616
TX	Dallas, Converter Elctrns.	214-333-2028, FAX:214-333-2028
UT	Ogden, Taylor Mktg.	801-546-9570, FAX:801-546-9590
VA	Sterling, Beacon North	703-478-2480, FAX:703-435-7115
WA	Bellevue, Micro Sls.	206-451-0568, FAX:206-453-0092

ADVANCED CIRCUIT TECHNOLOGY, 118 Northeastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, TWX: 710-228-8961, FAX: 603-880-1785; FSC No.: 57034; Empl.: 130; *Sls. Mgr.:* David Bouley, V.P. of Sls.

ADVANCED
COMPONENTS
INDUSTRIES,
INC.

FAX: 310-328-0062

ADVANCED COMPONENTS INDS., INC., Div of Kaschke, 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 310-328-0060; *Sls. Mgr.:* Irma Spreitzer .... **A•1318, 2254-2255; B•1403**

Local Sales Offices & Reps

CT	Hopkinton, Berkshire Elctrns.	508-435-9356
IL	Schaumburg, Terry McNulty & Assocs.	708-780-9868
MA	Hopkinton, Berkshire Elctrns.	508-435-9356

ADVANCED CONNECTOR TECHNOLOGY, 2368 Eastman Ave., # 5, Ventura, CA 93003, Tel: 805-644-9990, FAX: 805-644-9664; Empl.: 5; *Sls. Mgr.:* Karin Kalli

ADVANCED CONTROL SYS., 10 Old Mine Rock Way, Hingham, MA 02043, Tel: 617-740-0223, FAX: 617-740-4227; Empl.: 13; *Sls. Mgr.:* Leopold Bric .... **D•1150**

ADVANCED CONTROL SYSTEMS, 1117 Baker St., Ste. C, Costa Mesa, CA 92626-4114, Tel: 714-540-9010, FAX: 714-540-5313; Empl.: 7; *Sls. Mgr.:* Gary Rasmussen

ADVANCED CONVERSION TECH., 2001 Fulling Mill Rd. P.O.B. 70, Middletown, PA 17057, Tel: 717-939-2300, FAX: 717-939-7170; FSC No.: 60642; Empl.: 100; *Sls. Mgr.:* L.M. Reis

ADVANCED ELECTRONIC PACKAGING, 21562 Surveyor Circle, Huntington Beach, CA 92646, Tel: 714-969-1150, FAX: 714-536-0936; Empl.: 8; *Sls. Mgr.:* Douglas A. Hill

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009, Tel: 619-438-2074, FAX: 619-438-5937; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HARDWARE ARCHITECTURES, INC., P. O. Box 9669, Moscow, ID 83843, Tel: 208-883-8000, FAX: 208-883-8001; Empl.: 50; *Sls. Mgr.:* Jack Maynard

ADVANCED HARDWARE MANUFACTURING, INC., 925 Horan Drive, Fenton, MO 63026, Tel: 314-343-3850, FAX: 314-343-3937; Empl.: 16

ADVANCED HIGH VOLTAGE COMPANY, P.O. Box 32408, Tucson, AZ 85751, Tel: 602-721-2424, 818-997-7222, FAX: 602-721-2322; *Sls. Mgr.:* John Richardson .... **D•1553**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, 800-444-5923, FAX: 208-772-7613; FSC No.: 95666; Empl.: 300; *Sls. Mgr.:* Jeff Petkevicius .... **B•1819**

ADVANCED INTERCONNECTIONS CORP., P.O. Box 1019, West Warwick, RI 02893, Tel: 401-823-5200, TWX: 910-240-3454, FAX: 401 823-8723; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED LINEAR DEVICES, INC., 1180F Miraloma Way, Sunnyvale, CA 94086-4606, Tel: 408-720-8737, FAX: 408-720-8297; Empl.: 10

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED METALLURGY, 1003 Corporate Dr., Murray Corp. Park, Export, PA 15632, Tel: 412-733-8332, FAX: 412-733-2880

ADVANCED MICRO COMPUTER, 1321 NW 65th Pl, Ft. Lauderdale, FL 33309, Tel: 305-975-9515, FAX: 305-975-9698; Empl.: 20; *Sls. Mgr.:* Lee Maxey

ADVANCED MICRO DEVICES, INC., 901 Thompson Place, Sunnyvale, CA 94088, Tel: 408-732-2400, TELEX: 34-6306

ADVANCED MICRO SYSTEMS, INC., 2 Townsend West, Nashua, NH 03063-1277, Tel: 603-882-1447, FAX: 603-881-7600; Empl.: 50

ADVANCED MOTION CONTROLS, INC., 518 W. Water St., P.O. Box 64, Princeton, WI 54968, Tel: 414-295-3500, FAX: 414-295-3504

ADVANCED PHOTONIX, INC., 1240 Avenida Acaso, Camarillo, CA 93012, Tel: 805-484-2884, FAX: 805-484-9935; Empl.: 90; *Sls. Mgr.:* D. Tingley, W. Bandel, R. Dahl

ADVANCED POWER DESIGNS INC., 17744 Skypark Circle No. 250, Irvine, CA 92714, Tel: 714-263-8605, FAX: 714-263-8607; Empl.: 23

ADVANCED POWER PRODUCTS, 32249 Murrieta Rd., Menifee, CA 92584, Tel: 714-672-7704; Empl.: 2

APS ADVANCED POWER SOLUTIONS

FAX: 510-460-5498

ADVANCED POWER SOLUTIONS, M & L Enterprises, 5994 W. Las Positas Blvd., Ste. 117, Pleasanton, CA 94588, Tel: 510-734-3060; Empl.: 15; *Sls. Mgr.:* Bill Smith; *Dist. Mgr.:* Bill Smith .... **D•1554-1556**

Local Sales Offices & Reps

CA	West Lake Village, MPL Assoc.	805-379-9251
FL	Del Ray Beach, Phelps Assoc.	407-276-7591
MA	Bellingham, OEM Mktg.	508-528-4983
MO	Bridgeton, Dytronix	314-291-4777
NH	Salem, OEM Mktg.	603-893-0009
NY	Hauppauge, Sticom	516-366-4221
PA	Pittsburgh, Catalyst Sls.	412-826-3434
UT	Layton, Taylor Mktg.	801-546-9570
VA	Vienna, The Walters Grp.	703-660-3799

ADVANCED POWER TECHNOLOGY, 405 S.W. Columbia Street, Bend, OR 97702, Tel: 503-382-8028, FAX: 503-388-0364; Empl.: 106; *Sls. Mgr.:* Tom Loder; *Dist. Mgr.:* Tom Loder

ADVANCED PROCESS CONTROLS, 500 West Cummings Park, Woburn, MA 01801, Tel: 617-932-9262, FAX: 617-932-0939; *Sls. Mgr.:* Richard Smith

ARC ADVANCED RUBBER CONCEPTS, INC.
P. O. BOX 489 - HWY. 77 SOUTH
PAULS VALLEY, OKLA. 73075

FAX: 405-238-3029

ADVANCED RUBBER CONCEPTS, Formerly Glolite Sales Ltd., Hwy 77 South, Pauls Valley, OK 73075, Tel: 405-238-5541, 800-654-3662; Empl.: 10 .... **B•1820**

Local Sales Offices & Reps

AZ	Peoria, Sem of Arizona	602-486-1191
CA	Mission Viejo, Champa Assocs.	714-581-3459
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
MD	Baltimore, Chesapeak Ind. Mktg.	410-653-0476
NY	Hauppauge, Aurora-Schmitt	516-434-1313

ADVANCED TECHNICAL MATERIALS, INC., 20 River Ave., Patchogue, NY 11772, Tel: 516-363-9018, 516-289-0363, FAX: 516-363-8002; FSC No.: OR8N4; *Sls. Mgr.:* Mike Geraci

FAX: 619-727-4436

ADVANCED TECHNOLOGY COMPANY, 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7430; Empl.: 10; *Sls. Mgr.:* Bill Linko .... **C•1562-1573**

ADVANCED THERMAL PRODUCTS, INC., P.O. Box 249, St. Marys, PA 15857, Tel: 814-834-1541, FAX: 814-834-1556; Empl.: 22; *Sls. Mgr.:* John M. Sidoni .... **B•1858-1859**

Local Sales Offices & Reps

GA	Atlanta, DHR Mktg.	404-564-0529
MA	Andover, Crawford & Assoc.	508-470-2122
NY	Syracuse, John R. Costello	315-472-0322
NC	Raleigh, DHR Mktg.	919-829-1970
TX	Dallas, Eatman Engineering	214-771-1903
WI	New Berlin, Thomas Labant	414-425-7157
Can	Dundas, Ontario, D.J. Hyslop & Co.	416-628-0266

ADVANCED THERMISTOR DIV.
U.S. SENSOR

FAX: 714-639-1220

ADVANCED THERMISTOR DIV., U.S. Sensor Corp., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000; Empl.: 25 .... **B•1860-1862**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls. Inc.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls. Inc.	602-577-0580
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Englewood, Compass Mktg. & Sls., Inc.	303-721-9663
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
IL	Downers Grove, Richmar Elctrns. Corp.	708-968-0118
IN	Indianapolis, Richmar Elctrns. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MA	Canton, John Ferrari Co.	617-821-4599
MI	Brighton, AP Assocs., Inc.	313-229-6550
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-344-9990
NY	North Syracuse, Entec Grp.	315-458-7936
OH	Rocky River, Hiltebrant Indl. Sls.	216-333-5600
PA	Downington, Grasso Tech. Sls.	215-458-8967
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp.	512-255-2551
WI	Butler, Richmar Elctrns. Corp.	414-781-1730

ADVANCED VIDEO PRODUCTS, E-Systems, 2 Robbins Rd., Westford, MA 01886, Tel: 508-692-2020, FAX: 508-692-2140; Empl.: 65; *Sls. Mgr.:* Christopher Mohen

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, FAX: 219-223-2524; FSC No.: 50788; Empl.: 31; *Sls. Mgr.:* Kay Nixon .... **C•1682**

Local Sales Offices & Reps

CA	El Cajon, ATronix Technlg.	619-444-1501
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Solvang, ATronix Technlg.	805-686-4366
CO	Arvada, Arrowhead	303-423-5556
FL	Davie, DAN-Tech Sls., Inc.	305-581-2884
IL	Elk Grove, W. G. Brouillette & Assoc.	708-290-1313
KY	Frankfort, Fred A. Dorsey Assoc.	502-695-2250
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235, 800-631-9362
OR	Lake Oswego, Caruso & Assocs., Inc.	503-635-5282
PA	W. Conshohocken, Eastern Comps.	215-825-8610
MD	Baltimore, Eastern Comps. Sls. Corp.	301-788-7050
TX	Dallas, Materials Technlgy. Co.	214-484-4677
UT	Ogden, Arrowhead	801-479-7151
Can	Nepean, Ont., Subtec Ltd.	613-723-7720
WA	Bellevue, Caruso & Assocs.	206-455-8811

ADVANCE POWER SUPPLIES, INC., See Farnell Advance Power, Inc.

ADVANCE WIRE & CABLE ASSEMBLY, Electrical Insulation Suppliers, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, TELEX: 334475, FAX: 415-593-8859; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

ADVANTEST AMERICA, INC., 1100 Busch Parkway, Buffalo Grove, IL 60089-4503, Tel: 800-441-0852, FAX: 708-634-2610; Empl.: 233; *Sls. Mgr.:* Atlee Jacobson

Instruments

ADVANTEST CORPORATION, NS Bldg. 2-4-1, Nishi-Shinjuku, Tokyo 163, Japan, Tel: 03-3342-7500, TELEX: 232-4914 ADVAN, FAX: J:03-3342-7510; Empl.: 1827; *Sls. Mgr.:* Shinpei Takeshita

ADVIN SYSTEMS INC., 1050-L East Duane Ave., Sunnyvale, CA 94086, Tel: 408-243-7000, FAX: 408-736-2503; *Sls. Mgr.:* Wing Hui

ADVOTECH, INC., 422 North Main St., Butler, PA 16001, Tel: 412-283-4497, FAX: 412-283-8830

A E G CORPORATION, Mt. Airy Corners III, 180 Mt. Airy Rd., Basking Ridge, NJ 07920, Tel: 908-204-8900, FAX: 908-231-8353; Empl.: 200; *Dist. Mgr.:* Don Walsh

AEG TELEFUNKEN, SEMICONDUCTOR GRP., See AEG Corp.

AEL DEFENSE CORP., 305 Richardson Rd., Lansdale, PA 19446, Tel: 215-822-2929, FAX: 215-822-9165; FSC No.: 93346; Empl.: 1,600; *Sls. Mgr.:* Denis Ritchie

AEMC CORPORATION, 99 Chauncy Street, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, FAX: 617-423-2952; *Sls. Mgr.:* George Wood; *Dist. Mgr.:* Daniel Wiswell .... **D•1223**

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, FAX: 305-448-6916; FSC No.: 81535; Empl.: 55; *Sls. Mgr.:* Wladimir Dorta

AERODYNE CONTROLS CORPORATION, 30 Haynes Court, Ronkonkoma, NY 11779, Tel: 516-737-1900, FAX: 516-737-1912; FSC No.: 14923; Empl.: 80; *Sls. Mgr.:* Anthony R. Pipitone

AEROFLEX LABORATORIES INC., ARX, Inc., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417, FAX: 516-694-6771; FSC No.: 88379; Empl.: 490

AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, FAX: 817-654-3405; Empl.: 60; *Sls. Mgr.:* Ben L. Fryrear

AEROSPACE PRODUCTS DIV, A Subsidiary of Ametek, Inc., 50 Fordham Rd., Wilmington, MA 01887, Tel: 508-988-4947, FAX: 508-988-4944

AEROSPACE SYSTEMS, Communication Cable Inc., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, FAX: 507-235-6088; FSC No.: 24600; Empl.: 170; *Sls. Mgr.:* Robert L. Johnson

AEROSPACE WIRE & CABLE INC., 129-09 18 Ave., College Point, NY 11356, Tel: 718-358-2345, 1-800-395-0200, FAX: 718-358-2522; Empl.: 15

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125, FAX: 412-963-7459; Empl.: 156; *Sls. Mgr.:* K. Wyman; *Dist. Mgr.:* K. Ross

AEROVOX INC., 370 Faunce Corner Rd., North Dartmouth, MA 02747-1217, Tel: 508-995-8000, FAX: 508-995-3000; FSC No.: 4K459; Empl.: 1500 Worldwide; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Jack Chmura .... **A•1008-1009, 1585**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
AZ	Pheonix, Interstate Mktg.	602-263-8044
CA	Santa Clara, Ross Mktg.	408-988-8111
CA	Woodland Hills, Interstate Mktg.	818-883-7606
CO	Englewood, Elcom, Inc.	303-792-3330
CT	Wallingford, J.E. Boeing Co.	203-265-1318
DE	Greenville, H. Anderson	302-655-2917
FL	Margate, E.P.M. Corp.	305-977-0331
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Chicago, Rowe Mktg.	312-664-3744
IL	Elk Grove Vl., Carlson Elctrns. Sls.	708-956-8240
IN	Ft. Wayne, F.J. Campisano Co.	219-486-6443
IN	Indianapolis, F.J. Campisano Co.	317-577-0319
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
KS	Overland Park, Beneke & McCaul Inc.	913-765-2298
MA	Chelmsford, J.E. Boeing Co.	508-256-5800
MA	Marion, R.F. Swoish Co.	508-748-2536
MI	Farmington Hills, Carrier & Gable, Inc.	313-477-8700
MN	Minneapolis, Comstrand Inc.	612-574-9480
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
NC	Raleigh, 20th Century Mktg.	919-790-9383
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OH	Columbus, F.J. Campisano Co.	614-538-1176
OH	Mentor, F.J. Campisano Co.	216-975-9300
OK	Tulsa, Ammon & Rizos Co.	918-749-6116
OR	Beaverton, Luscombe Engrg. Co.	503-636-6664
PA	Leechburg, F.J. Campisano Co.	412-845-2577
TN	Knoxville, 20th Century Mktg.	615-539-0676
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	El Paso, Ammon & Rizos Co.	915-534-7533
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
TX	San Antonio, Welaire	210-666-1800
WA	Bellevue, Luscombe Engrg. Co.	206-223-1541
WI	Milwaukee, Carlson Elec. Sls.	414-476-2790
Can	Mississauga, Ont., Longman Sls.	416-670-8100

Local Distributors

AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Garden Grove, National Elctrns.	714-892-7749
CA	Milpitas, California Cap.	408-262-6000
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Riverside, Elctrn. Supply Co.	714-683-7300
CA	Sacramento, IEC Sacremento	916-363-6030
CA	San Diego, Elctrn. Supply Co.	619-693-8222
CA	San Diego, Projections Unltd.	619-453-8444
CA	San Jose, Elctrn. Supply Co.	408-453-3770
CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Tustin, Projections Unltd.	714-544-2700
CA	Westlake Vlge., Jaco Elctrns.	805-495-9998
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, IEC Headquarters	303-292-5537
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Hoffman Estates, IEC Chicago	708-843-2040
IL	Schaumburg, Marsh Elctrns.	708-240-9290
IN	Indianapolis, R.S. Elctrns.	800-488-9065
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Overland Pk., R.S. Elctrns.	800-251-0067
MD	Columbia, Jaco Elctrns.	301-995-6620
MA	Andover, Bell Inds.	508-474-8880
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MI	Grand Rapids, R.S. Elctrns.	800-776-1155
MI	Livonia, R.S. Elctrns.	800-366-7750
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Jaco Elctrns.	919-876-7767
OH	Akron, Aesco Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	800-962-0191
OH	Maumee, R.S. Elctrns.	800-472-3231
OR	Beaverton, IEC Portland	503-641-1690
PA	McKean, Advacom	814-476-7774
TX	Austin, Jaco Elctrns.	512-835-0200
UT	W. Valley City, Salt Lake Beta Wintronics	801-966-0236
WA	Bellevue, IEC Seattle	206-455-2727
WI	Milwaukee, Marsh Elctrns.	414-475-6000

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AES CORP., 285 Newbury St., Peabody, MA 01960, Tel: 508-535-7310, TELEX: 387852 AES CORP INTL, FAX: 508-535-7313; Empl.: 25; *Sls. Mgr.:* Brian Rockett

AETNA ENGINEERING, P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-831-0607, FAX: 818-363-6292; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AFE TECHNOLOGIES INC., 3046A Berkmar Dr., Charlottesville, VA 22901, Tel: 804-974-7801, FAX: 804-974-7803; Empl.: 7(USA) 75(UK); *Sls. Mgr.:* Rob Brooks; *Dist. Mgr.:* Rob Brooks

AFI/DATATROL, See Datatrol, Div. of Data Card Corp.

AFP ISOREG, AFP Transformers, Inc., 234 Taylor St., P.O. Box 486, Littleton, MA 01460, Tel: 508-486-9483, FAX: 508-486-3539; FSC No.: 7Y052; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

AHAMTOR INC., 999 Inc., 27901 Front St., Temecula, CA 92589-9019, Tel: 714-676-4151, FAX: 714-676-3031; *Sls. Mgr.:* John Markley

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AIL SYSTEMS, INC., Eaton Corp., Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 1700; *Sls. Mgr.:* J.B. Migliaccio

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., Cheler Corp., 5707 Airport Way So., Seattle, WA 98108, Tel: 206-762-8014, 800-426-0244, TWX: 910-444-1333, FAX: 206-762-8394; FSC No.: 3D536; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* Carl Teichman

AIPHONE, 1700 130th Ave. NE, Bellevue, WA 98005, Tel: 206-455-0510, FAX: 206-455-0071; Empl.: 44; *Sls. Mgr.:* Clyde Pfifer

AirBorn

FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200; FSC No.; 10400;Multiple; Empl.: 313; *Sls. Mgr.:* Win Clark; *Dist. Mgr.:* Win Clark .... **C•1147**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623
AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Downey, Buffa Co., Inc.	310-923-4618
CA	Sunnyvale, Advanced Tech. Sls.	510-847-2060
CO	Aurora, Piper Sls.	303-340-1300
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
NH	Nashua, Solla - Tronics	603-882-7146
NY	Glen Cove, Dynorep	516-676-1598
NJ	Sommerville, Dynorep	908-874-4670
NY	Port Jefferson Sta., Dynorep	516-928-5135
OH	Kettering, Electro-Com	513-299-0864
OR	Tigard, Eltech, Inc.	503-684-3458
UT	Salt Lake City, Piper Sls.	801-466-9336
VA	Powhatan, Eagle Sls.	804-492-9027
WA	Bellevue, Eltech Inc.	206-643-4330
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
Can	Montreal, Source Elctrns. Ltd.	514-388-8979

Local Distributors

MD	Timonium, D.C. Elctrns.	410-252-6576
NY	Elmsford, Gemini Elect	914-592-5252
TX	Dallas, Hall Mark Elctrns.	214-343-5000
CA	Monrovia, Erik-A-Elect	818-574-1020
AZ	Scottsdale, Spirit Elctrns.	602-998-1533

AIR ELECTRO INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794, FAX: 818-988-4746

AIR FILTRATION PRODUCTS, INC., 707 No. Main Ave., Tuscon, AZ 85705, Tel: 602-624-2272, FAX: 602-624-2279; Empl.: 10; *Sls. Mgr.:* Ike Campos .... **C•1612**

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060, FAX: 1-818-579-7063; FSC No.: 22782; *Sls. Mgr.:* Brett Hoffman

airflyte ELECTRONICS CO.

FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 85; *Sls. Mgr.:* John Piret .... **B•1234-1239**

Local Sales Offices & Reps

CA	Mountain View, Thorson-West	415-964-9300
CA	Signal Hill, Thorson Co.	310-595-0361
CT	No. Haven, Kitchen & Kutchin	203-239-0212
FL	Naples, Techtron Sls. Corp.	813-566-3800
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
MN	St. Paul, Motion Technlg., Inc.	612-481-8691
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, Milton C. Matthews Co.	716-271-1910
PA	Downingtown, Budd Elctrns. Corp.	215-458-8258
TX	Austin, Electra Reps., Inc.	512-339-1163
TX	Dallas, Electra Reps., Inc.	214-248-3852

AIRMAR TECHNOLOGY, 69 Meadowbrook Dr., Milford, NH 03055, Tel: 603-673-9570, FAX: 603-673-4624; Empl.: 75; *Sls. Mgr.:* Cindy Russell

AIR-O-TRONICS, Pelco Electronics, 2747 Rt 20 E., P.O. Box 326, Cazenovia, NY 13035, Tel: 315-655-2387, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15; *Sls. Mgr.:* Randy Page, Dave Dice

AIRPAX-CAMBRIDGE DIV., See Philips Technologies, Airpax Protector Grp.

AIRPAX-CHESHIRE DIV., See Philips Technologies, Automotive Elctrns. Grp.

AIRPAX-FREDERICK DIV., See Philips Technologies, Airpax Protector Grp.

AIRPAX-INTERNATIONAL DIV., See Philips Technologies, Airpax Mechatronics Grp.

AIRPAX SENSOR DIV., See Philips Technologies, Sensor Prods.

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44483, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500; *Sls. Mgr.:* Dan Gagliano V.P. Sls.

AJ'S POWER SOURCE, INC.

FAX: 813-996-5037

A.J.'S POWER SOURCE, INC., 4105 Cox Dr., Land-O-Lakes, FL 34639, Tel: 800-933-7725; Empl.: 10; *Sls. Mgr.:* Allen L. Johnson Jr. **D•1557-1559**

Local Sales Offices & Reps

AZ	Phoenix, Hartland Sls.	602-492-0012
CA	Mission Viejo, Champa Assocs.	714-581-3459
CA	San Diego, Power Assocs.	619-275-0641
FL	Land O'Lakes, AJ's Power Source	813-996-2583
KS	Lenexa, The Beams Co.	913-541-9197
NH	Salem, OEM Mktg.	603-893-1197
NY	Pittsford, Franklin Sls.	716-248-8251
TX	Richmond, Jim D. Gray & Assoc., Inc.	713-342-1710
VA	Sterling, Beacon North, Inc.	703-478-2480

AKG ACOUSTICS, INC., 1525 Alvarado St., San Leandro, CA 94577, Tel: 510-351-3500, FAX: 510-351-0500; Empl.: 120; *Sls. Mgr.:* David Angress

AKRO-MILS, Myers Industries, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321, FAX: 216-253-9801; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47202, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave. #7, Belmont, CA 94002, Tel: 415-595-4100, FAX: 415-595-0298; FSC No.: 13862; Empl.: 25

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, 800-822-5227, FAX: 206-771-2163; Empl.: 50 **A•1181, 2256; D•1560**

Local Sales Offices & Reps

OR	Portland, Halbar RTS	503-244-4123
PA	Newtown, Indl. Sls. Assocs.	215-860-2076
WA	Redmond, Halboar RTS	206-882-0990

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 508-995-1725, FAX: 508-995-6954; Empl.: 180

ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441, FAX: 517-629-9501; *Sls. Mgr.:* Dale A. Bash

ALCATEL CANADA WIRE INC., 10376 Battleview Parkway, Manassas, VA 22024, Tel: 703-369-0440, FAX: 703-369-4087; Empl.: 5,000; *Sls. Mgr.:* John Murphy

ALCATEL CHESTER CABLE CORP., 15 Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, FAX: 914-469-9035

ALCOMET, INC., 110 Mary Ann Rd., Beaver Dam, WI 53916, Tel: 414-885-9200, FAX: 414-885-5078; Empl.: 12; *Sls. Mgr.:* Philip F. Lauf

ALDEC, INC., 3525 Old Conejo Rd., , Newbury Park, CA 91320, Tel: 805-499-6867, TELEX: 239-447, FAX: 805-498-7945; Empl.: 57; *Sls. Mgr.:* Harry Tosado

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 508-744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 508-366-8851, TELEX: 94-8404, FAX: 508-898-2427; Empl.: 125; *Sls. Mgr.:* L. A. Farrington

ALDEN PRODUCTS CO., P.O. Box 510, 117 N. Main St., Brockton, MA 02403, Tel: 508-583-0160, FAX: 508-583-0164; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul **C•1148-1151**

ALDEN SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 508-583-0160, FAX: 508-583-0164; Empl.: 150; *Sls. Mgr.:* D. Paul

A. L. DESIGN, INC., 1411 Military Rd., Buffalo, NY 14217, Tel: 716-875-6240, FAX: 716-875-2404; Empl.: 25

ALEPH INTERNATIONAL®

FAX: 818-365-7274

ALEPH INTERNATIONAL CORP., 1026 Griswold Ave., San Fernando, CA 91340, Tel: 818-365-9856, 800-423-5622; Empl.: 15; *Sls. Mgr.:* Frank Mastrolonardo; *Dist. Mgr.:* Janis Dingman **B•1404-1405, 1662**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Mesa, Sys. Sls. of Arizona	602-464-9989
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CO	Englewood, Omega Ltd.	303-762-1921
FL	Longwood, Beacon Elctrns.	407-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, Meca Sls.	312-334-4020
IA	Marian, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Randallstown, Beacon North	703-478-2480
MA	Taunton, Focus Sls.	508-824-2480
MI	Lathrup Village, RC Nordstrom & Co.	313-559-7373
MN	Minneapolis, Intl. Elctrns.	612-571-0000
MO	St. Louis, MSB Assocs.	314-946-5577
NM	Albuquerque, Sys. Sls. of Arizona	505-889-2901
NY	Fairport, TAC Sls.	716-223-7610
NY	Glencove, Dynorep	516-676-1598
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Centerville, Engrg. Mktg. Assoc.	513-433-2800
SC	Greenville, Beacon Elctrns.	803-297-7830
TN	Knoxville, Beacon Elctrns.	615-691-0062
TX	Irving, Aid Elctrns.	214-790-4761
VA	Sterling, Beacon North	703-478-2480
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

AZ	Tempe, Acacia Sls.	602-894-2874
CA	Fremont (North), Acacia Sls.	510-623-7500
CA	Los Angeles, Bell Inds.	310-826-2355
CA	San Jose, Spectra Elctrns.	408-955-7800
CA	Santa Monica (South), Master Distrs.	310-452-1229
CO	Englewood, Comp. Distrs.	303-770-6214
CO	Wheatridge, Acacia Sls.	303-421-7004
CT	Hartford, Wes-Garde Comps.	203-527-7705
FL	Clearwater, Comp. Distrs.	813-796-0466
FL	Lakeland, Wes-Garde Comps.	813-644-7564
IL	Chicago, Leeds Electro Comps.	312-625-3800
IN	Indianapolis, Bell Inds.	317-875-8200
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Woburn, Control Design	317-932-9404
MI	Grand Rapids, SF Elctrns.	616-459-0216
MN	Plymouth, Leeds Electro Comps.	612-557-1277
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Nashua, Wes-Garde Comps.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
OR	Wilsonville, Wes-Garde Comps.	503-682-1333
PA	Malvern, Control Design	215-296-0150
TX	Dallas, Off the Shelf	214-247-0052
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Acacia Sls.	206-881-5566

A.L.E. SYS., INC., 150 Homer Ave., Ashland, MA 01721, Tel: 508-881-5252, FAX: 617-235-6588; Empl.: 60; *Sls. Mgr.:* Tom Conklin/John Boyd; *Dist. Mgr.:* Tom Conklin/John Boyd

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92198, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 390; *Sls. Mgr.:* Dave Zeman **D•1423**

Local Sales Offices & Reps

CA	San Diego, Alexander Batteries;New Prod./OEM Div.	619-480-4445,,,619-480-1351

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50402, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855, FAX: 515-423-1644; Empl.: 350 **D•1423**

ALEXANDRIA EXTRUSION CO., P.O. Box 847 Cty. Rd. 22 North, Alexandria, MN 56308, Tel: 612-763-6537, FAX: 612-763-6530; Empl.: 175; *Sls. Mgr.:* Brian L. Bloedorn

ALEXANDRIA METAL FINISHER, INC., 9418 Gunston Cove Rd., Lorton, VA 22079, Tel: 703-643-1636, FAX: 703-690-6731; Empl.: 75; *Sls. Mgr.:* Larry Capoccia

ALFA ELECTRONICS, INC., P. O. Box 8089, Princeton, NJ 08543-8089, Tel: 609-275-0220, FAX: 609-275-9536; Empl.: 9; *Sls. Mgr.:* Jeff Kao

ALFCO, Div. of Air Maze, 1000 Cindy Lane, Carpinteria, CA 93013, Tel: 805-684-7651, FAX: 805-684-3654; FSC No.: 17504; Empl.: 100; *Sls. Mgr.:* Barbara McIntyre

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, FAX: 203-874-5063; Empl.: 255

ALLEGRO MICROSYSTEMS, INC., formerly Sprague Semiconductor Grp., 363 Plantation St., Worcester, MA 01605, Tel: 508-795-1300, FAX: 508-792-9024; FSC No.: OCVK3; Empl.: 2000; *Sls. Mgr.:* D. Ax; *Dist. Mgr.:* K. Gutkowski

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-6724; Empl.: 300; *Sls. Mgr.:* Jeffrey Buchman **A•1514, 1619**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Adtek Assocs.	415-323-5414
CA	San Diego, Van Gott & Assocs.	619-308-0667
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
MA	Scituate, D&M Tech. Sls.	617-545-9369
MI	Ann Arbor, Tech. Sls. Assocs.	313-995-4082
OH	Cleveland, Tech. Sls. Assocs.	216-461-0826
OH	Dayton, Tech. Sls. Assocs.	513-298-2062
NC	Raleigh, Reynolds Assocs.	407-259-7000
PA	W. Conshohocken, Eastern Comp. Sls. Inc.	215-270-9530
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

ALLEN- BRADLEY CO., Div. of Industrial Control Grp., 1201 S. Second St., Milwaukee, WI 53201, Tel: 414-382-2000, TELEX: 26699, TWX: 4311016, FAX: 414-382-4444; Empl.: 1600; *Dist. Mgr.:* Dick Zajork

RGA

FAX: 818-765-2387

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-827-7422; Empl.: 35; *Sls. Mgr.:* Brad Hammarquist **A•1010-1013, 1860-1863**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-565-4019
AR	Little Rock, Design Mktg.	501-336-8122
CA	Cupertino, Prism Technical Sls., Inc.	408-435-7377, fx:408-257-8847
CA	Irvine, Gravley & Assocs., Inc.	714-852-9339
CT	Windsor, Janeco	203-688-4513
GA	Atlanta, JWL Assocs.	404-518-8500
IL	Chicago, Rendell Sls.	312-967-1513
IN	Indianapolis, Century Tech. Sls.	513-677-5088
MI	Warren, Burcaw Co.	313-573-4605
NJ	Cooper-Simon	201-428-0600
NY	Franklin Square, Cooper-Simon	516-489-0404
NC	JWL Assocs.	919-414-8887
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Cincinnati, Century Tech. Sls.	513-677-5088
OK	Oklahoma, Design Mktg.	405-789-5911
MN	Oakdale, Complete Sls.	612-731-2923
TX	Austin, Design Mktg.	512-263-9151
TX	Houston, Design Mktg.	713-469-7949
WA	Redmond, Interstate Elctrns.	206-885-5257
WA	Seattle, Interstate Elctrns.	206-885-5257
EXP	Dublin, Ireland, Standard Comps. Ltd.	375-25025

Local Distributors

CA	Costa Mesa, Orange Ctny. Comps.	714-979-3597
CA	Oakland, Brill Elctrns.	405-834-5888
CA	San Diego, Mock III	619-560-0515
CA	San Jose, Spectra	408-955-7800
CA	Santa Clara, Bravo	408-980-8500
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Itasca, Voyager Elctrns. Corp.	312-773-4900

MN	Hibbing, Minntech Elctrns.	218-262-5227
NJ	Garfield, B & R Elctrns.	201-470-0700
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, FAX: 603-893-9042; *Sls. Mgr.:* Tom Allen

ALLEN SYSTEMS, 2346 Brandon Rd., Columbus, OH 43221, Tel: 614-488-7122; Empl.: 10

ALLEN TECHNOLOGY, PO Box 575, Sutton, NE 68979, Tel: 402-773-5285

ALLIANCE ELECTRONICS CORP., 8560 SW Salish Lane, Wilsonville, OR 97070-0503, Tel: 503-682-4976, FAX: 503-682-0390; Empl.: 21; *Sls. Mgr.:* Nate Olson

ALLIANCE LABORATORIES, INC., 555 Price Ave., Redwood City, CA 94063, Tel: 415-366-8220, FAX: 415-366-0634; Empl.: 10; *Sls. Mgr.:* Michael Munroe

ALLIED CONTROLS INCORPORATED, 562 Captain Neville Dr., Waterbury, CT 06705-3827, Tel: 203-757-4200, FAX: 203-757-4202; FSC No.: 5945; *Sls. Mgr.:* John T. Kryjak, VP Sls. & Mktg.; *Dist. Mgr.:* J. Kronenberger

ALLIED ELCTRNS., Subsidiary of Hall-Mark, 7410 Pebble, Fort Worth, TX 76118, Tel: 800-433-5700, FAX: 817-595-6470; Empl.: 250; *Sls. Mgr.:* Ed Bridges

ALLIEDSIGNAL AEROSPACE, Aerospace Systems & Equipment, 118 Hwy. 35, Eatontown, NJ 07724, Tel: 908-389-7761, TELEX: 132-444, FAX: 908-389-7301; FSC No.: 83298;Multiple; Empl.: 1,000; *Sls. Mgr.:* R. Freeman

ALLIEDSIGNAL INC., Communications Systems, 1300 E. Joppa Rd., Towson, MD 21286-5999, Tel: 410-583-4000, TWX: 710-232-1823, FAX: 410-337-7485; FSC No.: 06845; Empl.: 1500; *Sls. Mgr.:* Jack L. Shagena

ALLIGATOR TECHNOLOGIES, 17150 Newhope St., Ste. 114, Fountain Valley, CA 92708, Tel: 714-850-9984, FAX: 714-850-9987; Empl.: 10; *Sls. Mgr.:* Bertil Wanner

A-L-L MAGNETICS INC./THE MAGNET SOURCE, 930 S. Placentia Ave., Placentia, CA 92670, Tel: 800-262-4638, 800-525-3536, FAX: 714-632-1754,714-632-1757; FSC No.: 5999; Empl.: 43; *Sls. Mgr.:* Tim Pollett; *Dist. Mgr.:* Steve Alexander .... **A•1319**

ALL-STATES, INC., 1801 W. Foster Ave., Chicago, IL 60640, Tel: 312-728-0525, TELEX: 317027, FAX: 312-728-6410; FSC No.: 26863

ALMOND INSTRUMENTS, See EG & G Almond Instruments

ALPHA COMPONENTS, 1106 E. Simpson Rd., Mechanicsburg, PA 17055, Tel: 717-697-8595, FAX: 717-697-8608; FSC No.: 52748; *Sls. Mgr.:* Jerry Buckwalter

ALPHA-CORE INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-335-6805, FAX: 203-384-8120; Empl.: 20; *Sls. Mgr.:* Sandu Pescaru

ALPHA DIST. CORP., 3554 Brecksville Rd., Richfield, OH 44286, Tel: 216-659-7100, 1-800-628-0841, FAX: 216-659-3459

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ALPHA INDUSTRIES, INC., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, TELEX: 949436, TWX: 710-393-1236; FSC No.: 17540; Empl.: 1400; *Sls. Mgr.:* David Barker

ALPHA-M CORP., 11518 Reeder Rd S.W., 115, Dallas, TX 75229, Tel: 214-406-0424, FAX: 214-241-6778; Empl.: 8; *Sls. Mgr.:* W. L. Cowley

ALPHA METALS, 600 Rte 440, Jersey City, NJ 07304, Tel: 201-434-6778, FAX: 201-434-7508; Empl.: 350; *Sls. Mgr.:* Dave Zerfoss, VP Assembly Prods.

ALPHA OMEGA COMPUTER SYSTEMS, 33815 Eastgate Circle, Corvallis, OR 97333, Tel: 503-754-1911, FAX: 503-754-1913; Empl.: 8; *Sls. Mgr.:* Gary Oliver; *Dist. Mgr.:* Gary Oliver

ALPHA PRODUCTS, INC., 5740 Corsa Ave. #104, Westlake Village, CA 91362, Tel: 818-889-9304, TELEX: 215-305, FAX: 818-706-8986

ALPHA-TECH INC., P.O. Box 209, Riverdale, NJ 07457, Tel: 201-838-1188, FAX: 201-838-1188; FSC No.: 1X300; Empl.: 8; *Sls. Mgr.:* M. Rice

ALPHATEST CORP., 557 E. Juanita Ave., # 6, Mesa, AZ 85204-6597, Tel: 602-545-5518, FAX: 602-545-5521; FSC No.: 07-411732-F; Empl.: 6; *Sls. Mgr.:* Dan Rodgers; *Dist. Mgr.:* Dan Rodgers

ALPHA THERMISTOR, INC., 7181 Construction Ct., San Diego, CA 92121, Tel: 619-549-4660, 800-235-5445, FAX: 619-549-4791; Empl.: 30; *Sls. Mgr.:* David Pyle

ALPHA WIRE CORP., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711, Tel: 908-925-8000, TELEX: 6853017, TWX: 710-996-5895, FAX: 908-925-7938; Empl.: 376; *Sls. Mgr.:* Linda Smith

ALTAIR EXCHANGE CORPORATION, 24907 Avenue Tibbetts Unit-C, Valencia, CA 91355, Tel: 805-257-6964, FAX: 805-257-6490

ALTECH CORP., 35 Royal Rd., Flemington, NJ 08822-6000, Tel: 908-806-9400, FAX: 908-806-9490; Empl.: 35; *Sls. Mgr.:* Steve Stahovic, VP Sls.; *Dist. Mgr.:* Mort Gelfand, VP Opers. ... **B•1342; C•1006-1007, 1138, 1152-1159**

ALTEK CO., P.O. Box 1128, Torrington, CT 06790, Tel: 203-482-7626, FAX: 203-496-7113; FSC No.: 53939; Empl.: 65; *Sls. Mgr.:* Stephen Altschuler

ALTEK CORPORATION, 12210 Plum Orchard Dr., Silver Springs, MD 20904-7802, Tel: 301-572-2555, TWX: 710-825-0422, FAX: 301-572-2510; FSC No.: 7D336; Empl.: 46; *Sls. Mgr.:* Frank D. Augustino; *Dist. Mgr.:* Frank D. Augustino

ALTERA CORPORATION, 2610 Orchard Parkway, San Jose, CA 95134-2020, Tel: 408-894-7000, TELEX: 888496, FAX: 408-248-7097

ALTERNATIVE MANUFACTURING, INC., 8 Summer St., P.O. Box 200, Winthrop, ME 04364-200, Tel: 207-377-9377, FAX: 207-377-9379; Empl.: 20

altran
ALTRAN CORP
FAX: 815-455-3171

ALTRAN CORPORATION, 6101 Factory Rd., Crystal Lake, IL 60014, Tel: 815-455-5650 .... **A•2257-2259**

ALTRON, INC., 6700 Industry Ave., N.W., Anoka, MN 55303, Tel: 612-427-7735, FAX: 612-427-3980; Empl.: 185; *Sls. Mgr.:* Jim Ruid

AlumaPak

ALUMAPAK, Electronic Precepts of Florida, 11651 87th St., N., Largo, FL 34643, Tel: 800-775-6077; Empl.: 7; *Sls. Mgr.:* Roy Bloomquist .... **C•1009**

Local Distributors

FL	Largo, Elctrn. Precepts of Fl.	800-367-4649

ALUSETT U.S.A., INC., 200 N. Water St., Peekskill, NY 10566, Tel: 914-737-0120, FAX: 914-737-8697; Empl.: 35

AMADOR, 1775 Old Highway 8, New Brighton, MN 55112-1891, Tel: 612-631-2487, TELEX: 5106007012, ESYLNK: 62911738, FAX: 612-631-3515; Empl.: 44; *Sls. Mgr.:* Gene A. Panger

AMASCO, 370 Amapola, Torrance, CA 90501, Tel: 310-781-9494, FAX: 310-781-9059; Empl.: 20; *Sls. Mgr.:* William Barten

AMATOM ELECTRONIC HARDWARE, 446 Blake St., New Haven, CT 06515, Tel: 203-397-3311, TELEX: 963-419, FAX: 203-387-4101; FSC No.: 06540; Empl.: 125; *Sls. Mgr.:* James Marshall

AMBER ELECTRIC DESIGN, 6969 Trans-Canada Hwy., St. Laurent, PQ,, Canada H4T 1V8, Tel: 514-333-8748, 800-361-3697, TELEX: 514-333-1388; FSC No.: 38047; Empl.: 40; *Sls. Mgr.:* Wayne Jones

AMBER INDS., INC., 3312 Wiley Post Rd., Carrollton, TX 75006, Tel: 214-490-9801, FAX: 214-980-0329; *Sls. Mgr.:* Paul Russell .... **B•1343**

Local Sales Offices & Reps

CO	Englewood, Dynatech	303-773-2830
IL	Park Ridge, G. McL. Cole Co.	708-827-6040
TX	Dallas, Seaton Corp.	214-980-9860
TX	Houston, Seaton Corp.	713-731-2649

AMBIT ASSOCIATES, 2038 San Rafael Ct., Santa Clara, CA 95051-2311, Tel: 408-241-5767, FAX: 408-241-4051

AMBI-TECH INDS., 319 Knickerbocker Ave., Hillsdale, NJ 07642, Tel: 201-666-0504, FAX: 201-666-0597; Empl.: 20; *Sls. Mgr.:* Al Nagler; *Dist. Mgr.:* Al Nagler

AMBROID CO., P.O. Box 38, Springfield, VT 05156, Tel: 802-885-9244, FAX: 802-885-9223; Empl.: 5; *Sls. Mgr.:* Manuel F. Usle

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FAX: 708-671-9469

AMCO ENGINEERING, 3801 N. Rose St., Schiller Pk., IL 60176, Tel: 708-671-6670, 800-833-3156; Empl.: 350; *Sls. Mgr.:* Tom Ligman .... **C•1010-1013, 1574**

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Phoenix, C. T. Carlberg	602-468-0750
CA	Los Angeles, Knight Co.	310-670-2833
CA	Orange County, Knight Co.	714-833-8250
CA	Santa Clara, Interconnect Sls. Grp.	408-980-1166
CA	Temecula, The Knight Co.	714-699-2495
CO	Englewood, FG Mktg. Co.	303-795-9176
CT	Bethel, Instr. Dynamics	203-743-5045
FL	Tampa, Temco Sls. Inc.	813-855-7566, 800-282-6815
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Bensenville, Electronic Solutions, Inc.	708-766-3667
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
IA	Cedar Rapids, Dy-Tronix Inc.	319-377-8275
KS	Leawood, Dy-Tronix Inc.	913-339-6333
KS	Wichita, Dy-Tronix Inc.	316-838-0884
LA	Lafayette, Kemp Instruments	318-269-9452
MD	Columbia, L. G. White & Co.	410-290-8880
MA	Wakefield, Instr. Dynamics	617-245-5100
MI	Livonia, Electro Sls. Assocs.	313-421-7500
MI	Portage, Electro Sls. Assocs.	616-323-2416
MN	St. Paul, Heyda/Hanks Assoc.	612-484-8531
MO	Bridgeton, Dy-Tronix Inc.	314-291-4777
NM	Albuquerque, C. T. Carlberg Assocs.	505-899-2155
NY	Endwell, Reagan/Compar Albany	607-754-2171
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Rochester, Reagan/Compar, Albany	716-271-2230
NY	Syracuse, Reagan Campar, Albany	315-432-8232
NC	Cary, L. G. White & Co.	919-380-8084
NC	Winston Salem, L. G. White & Co.	919-765-1665
OH	Chesterland, Electro Sls. Assocs.	216-729-0190
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Tulsa, Kemp Engr.	918-663-4501
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Edgemont, White/Whiddett Co.	215-353-6343
PA	Pittsburgh, Electro Sls. Assocs.	412-322-9000
SC	Greenville, L. G. White & Co.	803-271-0630
TX	Addison, Kemp Instrs.	214-931-7100

TX	Houston, Kemp Instrs.	713-466-1465
TX	Marble Falls, Kemp Instrs.	512-598-6115
VA	Ashland, L. G. White & Co.	804-752-7055
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
EXP	NJ, Mahwah, Intl. Sls. Div.	201-825-0473

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FAX: 714-634-0905

AMECON, INC., 1900 S. Chris La., Anaheim, CA 92805, Tel: 714-634-2220, 800-392-2292, TWX: 510-1000-364; *Sls. Mgr.:* Frank Carleone .... **A•1178, 1182-1185, 2260-2265**

AME CORPORATION, 33 Jacksonville Rd., P.O. Box 195, Towaco, NJ 07082-0195, Tel: 201-263-1700, FAX: 201-263-8199; Empl.: 20; *Sls. Mgr.:* Edward Dimitry .... **B•1663**

Local Sales Offices & Reps

CT	Woodbridge, White Indl. Assoc.	203-387-7037
FL	Longwood, EAB,Inc.	407-339-4986
MD	Jamesburg, Decco Sls. Co.	908-521-0323
NJ	Wyckoff, Chanco	201-891-7866
TX	Dallas, Control Comps. Corp.	214-458-8877
Can	Scarborough, Ont., Leecraft Inds.	416-292-4463

Local Distributors

Can	Scarborough, Ont., Leecraft Inds.	416-439-6320

AMERACE ELECTRONIC COMPONENTS, 7474 Utilities Road, Punta Gorda, FL 33950, Tel: 813-575-8400, FAX: 813-575-8484; Empl.: 300

AMEREX, 888 Marlborough Ave., Riverside, CA 92507, Tel: 909-686-1400, FAX: 909-683-4221; *Sls. Mgr.:* Dan R. Prillwitz

AMERICAN ADVANTECH CORP., 1310 Tully Rd., Ste. 115, San Jose, CA 95122, Tel: 408-293-6786, FAX: 408-293-4697; Empl.: 72; *Sls. Mgr.:* Thomas Chen

AMERICAN AEROSPACE CONTROLS, 570 Smith St., Farmingdale, NY 11735, Tel: 516-694-5100, FAX: 516-694-6739; Empl.: 48; *Sls. Mgr.:* Gregory D'Abramo .... **B•1914-1915**

AMERICAN ALUMINUM, 230 Sheffield St., Dept. EEM, Mountainside, NJ 07092, Tel: 908-233-3500, FAX: 908-233-3241; Empl.: 125; *Sls. Mgr.:* Ronald R. King

AMERICAN ASSEMBLY INC., P.O. Box 515, 7 Industrial Dr., Florida, NY 10921, Tel: 914-651-3433, FAX: 914-651-2055; FSC No.: 74795; Empl.: 5

AMERICAN ARIUM, 14281 Chambers Rd., Tustin, CA 92680-7207, Tel: 714-731-1661, FAX: 714-731-6344; Empl.: 39; *Sls. Mgr.:* Jeff Acampora

AMERICAN CAPACITOR CORPORATION, 5367 Third St., Irwindale, CA 91706, Tel: 818-814-4444, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 59366; Empl.: 65; *Sls. Mgr.:* Joseph Latourelle; *Dist. Mgr.:* Joseph Latourelle

AMERICAN CHEMICAL ETCHING, See American Etching & Mfg.

AMERICAN CHEMICAL, INC., 2630 S. Irving Ave., Minneapolis, MN 55408-1047, Tel: 612-374-1767, FAX: 612-377-3590; *Sls. Mgr.:* Dennis Werneke; *Dist. Mgr.:* Karl Westerman

AMERICAN CONTROL PRODUCTS, Div. of Precision Timer Co., Inc., 47 Westbrook Ind'l Pk., Westbrook, CT 06498, Tel: 203-399-6253, FAX: 203-399-5619; Empl.: 35; *Sls. Mgr.:* R.D. Florin; *Dist. Mgr.:* R.D. Florin

AMERICAN CONTROL TECHNOLOGY, INC., 1447 Holmes Rd., Elgin, IL 60123-1203, Tel: 708-468-6000, FAX: 708-468-8959; *Sls. Mgr.:* Al Shrock .... **B•1665**

AMERICAN CYANAMID CO., Metal Coated Fibers Dept., South Cherry St., Wallingford, CT 06492, Tel: 203-284-4217

AMERICAN ELECTRONIC COMPONENTS, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, FAX: 219-264-4681; Empl.: 400; *Sls. Mgr.:* J. J. Wills, East/S. Kalin, West; *Dist. Mgr.:* Lonnie Haley .... **B•1711**

Local Sales Offices & Reps

AL	Birmingham, Tenn Tech, Inc.	205-879-0676
AL	Decatur, Tenn Tech, Inc.	205-350-5548
AL	Huntsville, World Distrs.	205-539-0441
AZ	Tempe, H-D Assocs., Inc.	602-784-2944
CA	Canoga Parkk, C & W Comp. Sls.	818-700-2684
CA	Sunnyvale, Pass Assocs.	408-735-9040
CT	Waterbury, Cannon Assocs., Inc.	203-597-0240
FL	Clearwater, J. J. Galleher Co.	813-461-7706
GA	Marietta, Tenn Tech, Inc.	404-971-1419
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
KS	Lenexa, Richard Greene Co.	913-492-6886
MI	Kentwood, Miltimore	616-554-9292
MI	Novi, Miltimore Sls.	313-349-0260
MI	St. Clair Shores, American Elctrns.	313-778-8440
MN	Minneapolis, Volco Co.	612-933-6631
MO	St. Louis, R. Greene Co.	314-994-0222
NE	Omaha, Volco Co.	402-330-6700
NH	Nashua, Cannon Assocs., Inc.	603-598-4766
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Phoenix, Adcon	315-695-3124
NY	Wantagh, DONY Tech. Sls.	516-826-5550
NY	Willamsville, CEF Tech. Sls.	716-633-7324
NC	Garner, Tenn Tech, Inc.	919-779-3309
OH	Cleveland, Orr Assocs.	216-871-1800,800-837-2700
PA	Erie, Orr Assocs.	814-456-2404
RI	Barrington, Cannon Assocs.	401-245-0850
TN	Brentwood, Tenn Tech, Inc.	615-373-4970
TX	Dallas, Dawson & Assocs., Inc.	214-241-3843
UT	Salt Lake City, Western Controls	801-292-5900
WA	Bothell, Temco N.W.	206-481-6150
WA	Spokane, Temco Northwest	509-534-8635
Can	Oakville, Ont., Davis Controls, Ltd.	416-829-2000

Local Distributors

AZ	Tempe, H-D Assocs., Inc.	602-784-2944
CA	Canoga Pk., Acort	818-700-2001
CA	San Carlos, Campbell & George	415-594-1994
FL	Clearwater, J.J. Galleher Co.	813-461-7706
GA	Smyrna, Tech Controls, Inc.	404-333-9883
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
KS	Lenexa, Richard Greene Co.	913-492-6886
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Grand Rapids, North Coast Comps., Inc.	616-452-0800,800-944-0325
MS	Corinth, World Distrs.	601-287-2915
MO	St.Louis, Richard Greene Co.	314-994-0222
NE	Omaha, Volco Co.	402-330-6700
NJ	Lawrenceville, Riverside Comp. Supp. Co.	609-896-1611
NY	Buffalo, Niagara Elec. Sls.	716-825-3100
NY	E. Syracuse, Niagara Elec. Sls.	315-437-1656
NY	Phoenix, Adcon	315-695-3124
NY	Rochester, Niagara Elec. Sls.	716-272-9150
NY	Wantagh, Dony Tech. Sls.	516-826-5550
NC	Charlotte, Mel Sls.	704-541-5750
OH	Cleveland, Orr Assocs.	216-871-1800,800-837-2700
PA	Erie, Orr Assocs.	814-456-2404
TX	Dallas, Dawson & Assocs.	214-241-3843
TX	Dallas, Dawson & Assocs., Inc.	214-241-3843
UT	N. Salt Lake City, Western Controls Co.	801-292-5900
WA	Bothell, Aztek	206-481-6032
Can	Oakville, Ont., Davis Controls, Ltd.	416-829-2000

AMERICAN ELECTRONIC LABS, SEE AEL, DEFENSE CORP.

AMERICAN ELECTRONICS, INC., 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 200; *Sls. Mgr.:* Bill Holland; *Dist. Mgr.:* 109

AMERICAN ETCHING & MFG., 13730 Desmond St., Pacoima,, CA 91331-2796, Tel: 818-896-1187, FAX: 818-896-0095; Empl.: 49

AMERICAN HOFMANN CORP., P.O. Box 10369, 3700 Cohen Pl., Lynchburg, VA 24506, Tel: 804-522-0300, ESYLNK: 5106000480, FAX: 804-846-1340; Empl.: 180; *Sls. Mgr.:* C. DeVuyst

AMERICAN INSULATED WIRE CORP., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, Tel: 401-726-0700, TWX: 710-384-0150, FAX: 401-723-1420; Empl.: 1300; *Sls. Mgr.:* Gabe Stephen

AMERICAN LASER SYSTEMS, INC., P.O. Box 6944, Santa Barbara, CA 93160, Tel: 805-967-0423, FAX: 805-683-4382; FSC No.: 5850; Empl.: 4

AMERICAN MAGNETICS CORPORATION, Group 4, 740 Watsoncenter Rd., Carson, CA 90745, Tel: 213-775-8651, TWX: 910-345-6258; Empl.: 300; *Sls. Mgr.:* Jane Magee, OEM Sls. Mgr.

AMERICAN MAGNETICS, P.O. Box 49, Carterville, IL 62918, Tel: 618-985-4838, FAX: 618-985-4106; Empl.: 120

AMERICAN MAGNETICS, P.O. Box 2509, Oak Ridge, TN 37831-2509, Tel: 615-482-1056, TELEX: 557-592, FAX: 615-482-5472; Empl.: 35; *Sls. Mgr.:* Scott T. Smith

AMERICAN METAL WASH, 360 Euclid Ave, Canonsburg, PA 15317, Tel: 412-746-4203, FAX: 412-746-5738; Empl.: 15; *Sls. Mgr.:* Steven M. Nourie

AMERICAN MICROSEMICONDUCTOR, INC., 133 Kings Rd., Madison, NJ 07940, Tel: 201-377-9566, FAX: 201-377-3078; Empl.: 15; *Sls. Mgr.:* W. M. Foley; *Dist. Mgr.:* D. B. Wilson

AMERICAN MICROSYSTEMS, INC., Nikko Kyodo, Ltd., 2300 Buckskin Road, Pocatello, ID 83201, Tel: 208-233-4690, FAX: 208-234-6795; Empl.: 1700; *Sls. Mgr.:* Harold Blomquist; *Dist. Mgr.:* Harold Blomquist

AMERICAN MICROWAVE TECHNOLOGY, INC., 3080 Enterprise Street, Suite A, Brea, CA 92621, Tel: 714-993-0802, FAX: 714-993-1619; Empl.: 34; *Sls. Mgr.:* Lowell A. Beezley

AMERICAN MONARCH, 2801-37th Ave., N.E., Minneapolis, MN 55421; Tel: 612-788-9161, FAX: 612-788-2057; FSC No.: 11146; Empl.: 120; *Sls. Mgr.:* Kathleen Varga

AMERICAN NEURALOGIX, INC., 411 Central Pk. Drive, Sanford, FL 32771, Tel: 407-322-5608, FAX: 407-322-5609; Empl.: 14; *Sls. Mgr.:* Richard T. English; *Dist. Mgr.:* Richard T. English

AMERICAN PRECISION INDUSTRIES

Electronic Components Group

FAX: 716-652-4814

AMERICAN PRECISION IND.,DELEVAN/SMD DIVISIONS, 270 Quaker RD., E. Aurora, NY 14052, Tel: 716-652-3600; FSC No.: 5950; Empl.: 250; *Sls. Mgr.:* Denis C. Kohlhagen .... **A•1186-1189**

Local Sales Offices & Reps

CA	West Lake Vlg., First Rep of Southern Calif.	805-373-0887
CO	Parker, TMA	303-841-3435
FL	Orlando, Comp. Design Mktg.	407-240-3903
IN	Ft. Wayne, Johnson Grp., Inc.	219-471-7100
IA	Cedar Rapids, C. Horn & Assocs.	319-393-8703
KS	Parker, S.W. Assocs.	913-898-6552
MD	Lutherville, J.A. Dougherty Sls. Co.	301-321-7890
MA	Sterling, Compatible Comps. Inc.	508-422-3327
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Morristown, T.A.I.	609-778-5353
NJ	Ridgewood, Ballou Inc.	201-444-6990
NY	Mendon, Tech-Mark	716-624-2314
NC	Charlotte, JWL	704-541-5750
OH	Troy, S-Tek	513-339-5974
TX	Irving, Kite Elctrn. Sls.	214-986-0321
Can	Dorval, Que., J.G. Weiss Co.	514-685-6644

Local Distributors

CA	Irvine, ITT Multicomponents	714-727-4001
CO	Littleton, Indelco	303-795-3431
FL	Ft. Lauderdale, Brothers Elctrns. of FL	800-342-6700
MA	Sterling, Compatible Comps. Inc.	508-422-7641
NH	Nashua, Brevan Elcttrns.	603-889-7230
NJ	E. Brunswick, Brothers Elctrns., Inc.	908-238-2200
NY	Plainview, ACI Elctrns. Corp.	516-293-6630
SC	Darlington, Aerco, Inc.	803-395-6575
TX	Ft. Worth, Patco	817-429-8596
Can	Willowdale, Ont., Electrosonic	416-494-1555

AMERICAN RADIONIC CO. INC., 32 Hargrove Grade, Palm Coast, FL 32137, Tel: 904-445-6000, FAX: 904-445-6871; Empl.: 200

American Relays, Inc.

FAX: 310-944-0590

AMERICAN RELAYS, INC., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, Tel: 310-944-0447; FSC No.: 1HY41; Empl.: 45; *Sls. Mgr.:* Richard Lenning .... **B•1407-1411**

Local Sales Offices & Reps

AL	Madison, Benchmark Technical Sales	205-464-0033
CA	Irvine, Vale Elctrn. Assocs.	714-551-4004
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	St. Petersburg, Bolton Assocs.	813-864-2294
GA	Norcross, Benchmark Technical Sales	404-446-1711
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NY	Jericho, J-Square Mktg., Inc.	516-935-3200
NC	Raleigh, Benchmark Tech. Sls., Inc.	919-850-0633
OH	Cleveland, Components, Inc.	216-243-9200
OH	Dayton, Components, Inc.	513-372-7411

Local Distributors

AZ	Phoenix, Keystone Electro Sls.	602-995-3005
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
MN	Minneapolis, The Bergquist Co.	612-835-2322
NJ	East Brunswick, Brothers Elctrns.	201-238-2200

AMERICAN RESEARCH & ENGINEERING, 1500 Executive Dr., Elgin, IL 60123, Tel: 708-888-7245, FAX: 708-888-7094; *Dist. Mgr.:* Nancy Crenshaw

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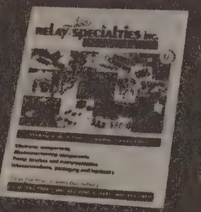

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Local Sales Offices & Reps

CA	Santa Ana, Amtek Elctrn. Co.	714-751-6181

AMERICAN SWITCH CORP., See Mors Components, Inc.

AMERICAN TECHNICAL CERAMICS CORPORATION, 1 Norden La., Huntington Sta., NY 11746-2102, Tel: 516-547-5700, FAX: 516-547-5748; FSC No.: 29990;11272-868-73; Empl.: 497; *Sls. Mgr.:* Ralph Wood, Global Sls. Mgr.

AMERICAN TIME PRODS. DIV., See Frequency Control Prods., Inc.

AMERICAN TRANS-COIL CORPORATION, 124-06 101 Ave., P.O.Box 357, Richmond Hill, NY 11419-1410, Tel: 718-441-5207, FAX: 718-441-4930; FSC No.: 18212; Empl.: 45; *Sls. Mgr.:* Walter T. Clancy

AMERICAN ULTRAVIOLET, 562 Central Avenue, Murray Hill, NJ 07974, Tel: 908-665-2211, TELEX: 13-9266, FAX: 908-665-9523; Empl.: 26; *Sls. Mgr.:* Patrick M. Higgins; *Dist. Mgr.:* Patrick M. Higgins

AMERICAN WIRE & ELECTRONICS, 3198K Airport Loop Drive, Costa Mesa, CA 92626, Tel: 714-957-5738, FAX: 714-957-1614; Empl.: 5; *Sls. Mgr.:* Greg Corzine; *Dist. Mgr.:* Ray Forbes

FAX: 714-831-8642

AMERICAN ZETTLER, 75 Columbia, Aliso Viejo, CA 92656, Tel: 714-831-5000; Empl.: 200; *Sls. Mgr.:* Fred Harmon .... **B•1412-1415**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Scottsdale, Luscombe Engrg. Co.	602-949-9333
CA	Canyon Country, Interconn	805-298-3199
CA	Newbury Park, Interconn	805-499-4024
CA	San Diego, Cetinske Sls. Co.	619-487-3335
CA	San Jose, Arnold Tech. Sls., Inc.	408-954-0400
CA	Trabuco Canyon, Interconn	714-589-4655
CO	Longmont, Luscombe Engrg. Co.	303-772-3342
CT	Madison, Focus Elctrn. Sls., Inc.	203-245-4314
IA	Cedar Rapids, J.R. Sls. Engrg. Inc.	319-393-2232
FL	Melbourne, Synergistic Technlgs., Inc.	407-242-9661
FL	Odessa, Synergistic Technlgs., Inc.	813-920-5814
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Arlington Hgts., KMA Sls. Co.	708-398-5300
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Pk., AME Sls.	913-492-3971
MD	Gaithersburg, Naudain Assocs. So. Inc.	301-258-5040
MA	Taunton, Focus Elctrn. Sls., Inc.	508-824-3840
MI	Brighton, AP Assocs., Inc.	313-229-6550
MN	Minneapolis, R.W. Marshall Co.	612-929-0457
MO	St. Charles, AME Sls.	314-928-2599
NJ	Edison, R. E. Breuer Co., Inc.	908-561-6161
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NY	Jericho, R. E. Breuer Co. Inc.	516-935-3330
NY	Rochester, Union Mktg. Grp.	716-546-7820
NC	Raleigh, Benchmark Tech. Sls. Inc.	919-850-0633
OH	Cincinnati, Makin & Assocs.	513-871-2424
OH	Dublin, Makin & Assocs.	614-793-9545
OH	Solon, Makin & Assocs.	216-248-7370
OR	Portland, Thorson Co. N.W.	503-293-9001
TX	Irving, AID Elctrns.	214-790-4761
UT	Salt Lake City, Luscombe Engrg.	801-268-3434
WA	Bellevue, Thorson Co. N.W.	206-455-9180
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Burlington, Ont., Alternate Source Comps. Ltd.	416-335-6385
Can	Port Coquitlam, B.C., Macom Agencies Ltd.	604-942-1292

Local Distributors

AL	Huntsville, Electro-Wise	205-721-0773
AZ	Tempe, Acacia Elctrns.	602-894-2874
AZ	Tempe, Cypress Elctnrs.	602-966-2256
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura, Cypress Elctrns.	818-597-9491
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Chatsworth, C.O. Supply Co.	818-998-5841
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Fremont, Acacia Elctrns.	510-623-7500
CA	Irvine, Acacia Elctrns.	714-660-0834
CA	Irvine, Kensington Elctrns.	714-588-0575
CA	Oakland, Master Distrs.	510-835-1500, FAX:510-835-0398
CA	San Diego, Acacia Elctrns.	619-597-0577
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Spectra Elctrns.	408-955-7800
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Monica, Master Distrs.	310-452-1229, FAX:310-399-8600
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Time Elctrns.	303-721-8882
CO	Wheatridge, Acacia Elctrns.	303-421-7004
CT	Milford, Fleet Elctrns., Inc.	203-877-2577
CT	Southbury, Time Elctrns.	203-271-3200
FL	Boca Raton, Zelcon, Inc.	407-451-1600
FL	Orlando, Time Elctrns.	407-841-6565
GA	Norcross, Time Elctrns.	404-368-0969
IL	Lisle, Comps., Inc.	708-852-7707
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Columbia, Time Elctrns.	301-964-3090
MD	Jessup, Treeko Sls., Inc.	301-470-3300
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Boston, Freedom Ind. Grp., Inc.	800-888-8005
MA	Peabody, Time Elctrns./New Eng.	508-532-6200
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Edina, Time Elctrns.	612-943-2433
MN	New Brighton, Chris Elctrns. Distrs.	612-631-2647
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Oakland, Relay Spec.	201-337-1000
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NJ	Wayne, Time Elctrns.	201-785-8250
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Time Elctrns.	516-273-0100
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Resco/Raleigh	919-781-5700
NC	Raleigh, Time Elctrns.	919-847-9650
OH	Columbus, Time Elctrns.	614-794-3301
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Richardson, RSC Elctrns.	214-644-3444
TX	Richardson, Time Elctrns.	214-644-4644
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	West Valley, Time Elctrns.	801-973-8494
WA	Bothel, Cypress Elctrns.	206-483-1144
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Acacia Elctrns.	206-881-5566
WI	Milwaukee, Progressive Image	414-321-4722
Can	Burnaby, Intek Elctrns.	604-294-8100
Can	Calgary, B&E Indl. Elec.	403-243-7211

LAMB ELECTRIC DIVISION, A subsidiary of Ametek Inc., 627 Lake St., Kent, OH 44240, Tel: 216-673-3451, FAX: 216-673-8994; Empl.: 1,000; *Sls. Mgr.:* Roger Smith

AMETEK, INC., Technical Motor Div., 627 Lake Street, Kent, OH 44240, Tel: 216-673-3452, FAX: 216-678-8227; Empl.: 1000; *Sls. Mgr.:* George Lemon

AMF POTTER & BRUMFIELD, See Potter & Brumfield

AMGLO KEMLITE LABORATORIES INC., 215 Gateway Rd., Bensenville, IL 60106, Tel: 708-350-9470, FAX: 708-350-9474; *Sls. Mgr.:* Paul Robichaud; *Dist. Mgr.:* Paul Robichaud

AMGLO KEMLITE LABORATORIES, INC., Halogen Lamp Div., 8787 Enterprise Blvd., Largo, FL 34643, Tel: 813-539-1000, FAX: 813-539-8535

AMHERST INTERNATIONAL CORP., 540 Commercial St., Manchester, NH 03101, Tel: 603-644-3555, 1-800-547-5600, FAX: 603-644-3550; *Sls. Mgr.:* Brock Putney; *Dist. Mgr.:* Brock Putney

AMI-DDC, 9 Wing Dr., Cedar Knolls, NJ 07927, Tel: 201-267-2000, FAX: 201-267-3267; Empl.: 110; *Sls. Mgr.:* Alan Egler

AMILON CORP., 49-12 30th Ave., Woodside, NY 11377, Tel: 718-274-1794, FAX: 718-278-5621; Empl.: 50; *Sls. Mgr.:* L. Rosenblatt

AMITRON, American Micro-Tronix, Inc., 85 Flagship Drive, North Andover, MA 01845, Tel: 508-686-1882, FAX: 508-686-0622; Empl.: 30; *Sls. Mgr.:* Raymond Simione .... **A•1688, 1720, 1865**

Local Sales Offices & Reps

AZ	Tempe, Cain Technlg.	602-966-4322
CA	Del Mar, K L Mktg.	619-755-0669
CO	Englewood, Cain Technlg.	303-220-8118
CT	Litch Field, Intrade, Inc.	203-567-5901
CT	Waterbury, Compak, Inc.	203-753-6431
FL	Palm Bay, JBM Assoc.	407-725-2823
MA	Hudson, Compak, Inc.	508-568-0331
MA	Stoneham, ECM	617-279-0900
PA	Pittsburgh, MarkeTech Intl.	412-561-0644
VA	Fairfax, Schibley Assoc.	703-591-3008

Local Distributors

CA	Santa Clara, Semi-Dice, Inc.	408-980-9777
MA	S. Easton, Semi Dice, Inc.	508-238-8344
MA	Stoneham, East Coast Microwave	617-279-0900
NY	Central Islip, Semi-Dice, Inc.	516-234-7676

AMKEY, 1 Aegean Drive, Methuen, MA 01844, Tel: 508-975-5445, FAX: 508-975-0357; Empl.: 35; *Sls. Mgr.:* Philip P. Bodoni; *Dist. Mgr.:* Philip P. Bodoni

AMOCO OIL CO., Lubricants Business Unit, 2021 Spring Rd., Ste. 500, Oak Brook, IL 60521-1857, Tel: 800-876-3221, FAX: 708-571-7174

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FAX: 717-986-7575

AMP, Box 3608, Harrisburg, PA 17105, Tel: 717-564-0100, 800-522-6752, TWX: 510-657-4110; Empl.: 25,000; *Dist. Mgr.:* Larry Backus .... **B•1202-1209, 1666-1667; C•1161-1254**

Local Sales Offices & Reps

CA	Diamond Bar, AMP	909-594-8388
PA	Harrisburg, AMP	800-522-6752

Nationwide Distributor - Allied Elctrns. please call 800-433-5700 Nationwide Distributor-DIGI-KEY Please call 800-344-4539 Nationwide Distributor-Newark Elctrns. please call 800-367-3573 Nationwide Distributor-Mouser please call 800-346-6873

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7211
AL	Huntsville, Hammond Elctrns. Inc.	205-830-4764
AL	Huntsville, Marshall	205-881-9235
AL	Huntsville, Powell Elctrns.	205-837-5300
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
AZ	Chandler, Hamilton/Avnet Elctrns.	602-961-1211
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2626
AZ	Phoenix, Marshall	602-496-0290
AZ	Phoenix, Sterling Elctrns. Corp.	602-437-5565
AZ	Scottsdale, Kent Elctrns. Corp.	602-998-0399
AZ	Tempe, Time Elctrns.	602-731-6752
AR	Little Rock, Carlton-Bates Co.	501-562-9100
AR	Little Rock, Electro Entprs.	501-661-0575
CA	Calabasas, Marshall Inds.	818-878-7000
CA	Carlsbad, Hardware Spec. Co.	619-431-8622
CA	Chatsworth, Alatec Prods.	818-727-9636
CA	Chatsworth, Kent Elctrns. Corp.	818-998-3333
CA	Costa Mesa, Cypress Elctrns., Inc.	714-549-2424
CA	Costa Mesa, Hamilton/Avnet	714-641-4100
CA	Culver City, Hamilton/Avent Elctrns.	310-217-6888
CA	El Monte, Marshall Inds.	818-307-6000
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fountain Valley, Comps. Ctr, Inc.	714-979-0437
CA	Fremont, Alatec Prods.	510-657-7701
CA	Gardena, CA Switch & Signal	310-538-9830
CA	Irvine, Marshall Inds.	714-859-5050
CA	Milpitas, Kent Elctrns. Corp.	408-262-5300
CA	Milpitas, Marshall Inds.	408-942-4600
CA	Placentia, Sage Inds., Inc.	714-630-8808
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Roseville, Hamilton/Avnet Elctrns.	916-925-2216
CA	Sacramento, IEC	916-363-6030
CA	San Diego, Cypress Elctrns, Inc.	619-535-0011
CA	San Diego, Hamilton Avnet Elctrns.	619-571-1900
CA	San Diego, Kent Elctrns. Corp.	619-453-7133
CA	San Diego, Marshall	619-627-4140
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Comps. Ctr, Inc.	408-988-3751
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	St. Petersburg, Marshall Inds.	813-573-1399
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3300
CA	Sunnyvale, Time Elctrns.	408-734-9890
CA	Torrance, Kent Elctrns.	213-320-2700
CA	Tustin, Time Elctrns.	714-669-0216
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Colorado Springs, Hamilton/Avnet Elctrns.	719-637-0055
CO	Denver, CSID, Inc.	303-292-9594
CO	Denver, Hardware Spec. Co.	303-371-8553
CO	Englewood, Hamilton Avnet Elctrns.	303-799-7800
CO	Englewood, Kent Elctrns. Corp.	303-792-9100
CO	Englewood, Time Elctrns.	303-721-8883
CO	Thornton, Marshall Inds.	303-451-8383
CT	Berlin, Kent Elctrns. Corp.	203-829-2100
CT	Danbury, Hamilton/Avnet	203-743-6077
CT	Southbury, Heilind Elctrns., Inc.	203-262-1700
CT	Southbury, Time Elctrns.	203-271-3200
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Alatec Prods.	407-834-5552
FL	Altamonte Springs, Marshall Inds.	305-767-8585
FL	Clearwater, Hamilton/Avent Elctrns.	813-530-0644
FL	Ft. Lauderdale, Hamilton/Avnet	305-733-6300
FL	Ft. Lauderdale, Hammond Elctrns., Inc.	305-973-7103
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Largo, Kent Elctrns. Corp.	813-545-0057
FL	Orlando, EMSCO	407-872-0826
FL	Orlando, Hammond Elctrns.	407-841-1010
FL	Orlando, Time Elctrns.	407-841-6566
FL	San Diego, Cypress	407-657-3300
FL	Winter Pk., Hamilton/Avnet	407-657-3300
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Duluth, Hamilton/Avent Elctrns.	404-623-5475
GA	Norcross, Atlanta Hardware Spec. Co.	404-449-3000
GA	Norcross, Hammond	404-449-1996
GA	Norcross, Marshall	404-923-5750
GA	Norcross, Time Elctrns.	404-448-4448
GA	Norcross, TTI, Inc.	404-662-0911
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Bensenville, Hamilton Avnet Elctrns.	708-860-7700
IL	Elk Grove VL, Kent Elctrns. Corp.	708-364-1300
FL	Orlando, TTI, Inc.	407-859-1000
IL	Palatine, OHM Elctrns., Inc.	708-359-5500
IL	Schaumburg, Marshall	708-490-0155
IL	Schaumburg, Sterling Elec.	708-303-9900
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Carmel, Hamilton/Avnet	317-844-9533
IN	Indianapolis, Marshall	317-297-0483
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
IA	Cedar Rapids, Kent Elctrns. Corp.	319-373-0525
KS	Lenexa, Hamilton Avnet Elctrns.	913-888-8900
KS	Lenexa, Marshall	913-492-3121
KS	Overland Park, Kent Elctrns. Corp.	913-338-4300
KY	Lexington, Hamilton/Avnet Elctrns. Strategic	606-259-1475
KY	Louisville, Peerless Elctrns.	502-637-7674
MD	Annapolis Jct., Powell	301-880-3255
MD	Columbia, Hamilton/Avnet Elctrns.	301-995-3560
MD	Columbia, Kent Elctrns. Corp.	410-720-6200
MD	Columbia, Time Elctrns.	410-964-3091
MD	Columbia, TTI, Inc.	301-995-1331
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Hunt Valley, Alatec Prods.	301-667-0063
MD	Ijamsville, Hardware Spec. Co.	301-831-1212
MD	Silver Springs, Marshall Inds.	301-622-1118
MA	Chelmsford, Kent Elctrns. Corp.	508-250-9666
MA	Marlborough, Hardware Spec. Co.	508-481-8622
MA	Methuen, Aved Elctrns.	508-688-3800
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Peabody, Hamilton/Avnet Elctrns.	508-531-7430
MA	Peabody, Time Elctrns.	508-532-9777
MA	Westborough, In Stock Prods.	508-870-5750
MA	Westborough, Powell Elec.	508-366-6100
MA	Wilmington, Heiland Elctrns.	508-657-4870
MA	Wilmington, Marshall Inds.	508-658-0810
MA	Woburn, Alatec Prods.	617-935-4530
MI	Livonia, Marshall	313-525-5850
MI	Livonia, RS Elctrns.	313-525-1155
MI	Novi, Hamilton Avnet Elctrns.	313-347-4270
MN	Edina, Time Elctrns.	612-931-2131
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minnetonka, Hamilton/Avnet	612-932-0678
MN	Minnetonka, TTI, Inc.	612-933-8555
MN	Plymouth, Marshall	612-559-2211
MN	St. Paul, Gopher Elctrns. Co., Inc.	612-490-4900
MN	St. Paul, Kent Elctrns. Corp.	612-642-2828
MO	Bridgeton, Alatec Prods.	314-298-0010
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Chesterfield, Hamilton Avnet Elctrns.	314-537-1600
MO	Earth City, Lectronix	314-344-1166
MO	Hillsboro, Kent Elctrns. Corp.	314-895-1515
MO	Manchester, Time Elctrns.	314-230-7500
MO	Maryland Hgts., RS/Olive Elctrns.	314-997-7709
NJ	Blackwood, Hardware Spec. Co.	609-228-6800
NY	Buffalo, Summit Distrs.	716-887-2800
NJ	Camden, G.R.S. Elctrns., Inc.	609-964-8560
NJ	Cherry Hill, Hamilton/Avnet	609-424-0100
NJ	Denville, Kent Elctrns. Corp.	201-625-5500
NJ	Fairfield, Marshall Elctrns.	201-882-0320
NJ	Marlton, Time Elctrns.	609-596-1286
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Old Bridge, BTC, Inc.	908-679-9300
NJ	Parsippany, Hamilton/Avent Elctrns.	201-515-5300
NJ	Wayne, Time Elctrns.	201-882-4611
NM	Albuquerque, Hamilton Avnet Elctrns.	505-828-1058
NY	Bohemia, March Elctrns., Inc.	516-563-6000
NY	East Syracuse, Time Elctrns.	315-434-9837
NY	Endicott, Marshall Inds.	607-785-2345
NY	Hauppage, Marshall Inds.	516-273-2424
NY	Hauppauge, Hamilton/Avnet	516-434-7420
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Long Island City, Hardware SPec. Co.	718-361-9393
NY	Lynbrook, Peerless Elctrns.	516-593-2121
NY	Mineola, Hardware Spec. Co.	516-741-7100
NY	Rochester, Hamilton/Avnet	716-475-9130
NY	Rochester, Marshall Inds.	716-235-7620
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NY	Syracuse, Hardware Spec. Co.	315-434-9093
NC	Cary, Powell Elctrns.	919-467-1212
NC	Charlotte, Hamilton/Avent Elctrns.	704-527-2485
NC	Greensboro, Hammond Elctrns., Inc.	919-275-6391
NC	Raleigh, Cameron & Barkley	919-828-2311
NC	Raleigh, Hamilton Avnet Elctrns.	919-878-0819
NC	Raleigh, Marshall	919-878-9882
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Cincinnati, Schuster Elctrns., Inc.	513-489-1400
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Columbus, Thompson Elctrns.	614-228-6191
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Hamilton/Avnet	513-439-6721
OH	Dayton, Marshall	513-898-4480
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Independence, Hamilton/Avent Elctrns.	216-573-1380
OH	Independence, T T I Inc.	216-328-9755
OH	Solon, Marshall Inds.	216-248-1788
OH	Solon, Repco Elctrns.	216-248-8900
OH	Twinsburg, Schuster Elctrns., Inc.	216-425-8134
OK	Oklahoma City, Electro Ent.	405-427-6591
OK	Tulsa, Carlton-Bates	918-250-1626
OK	Tulsa, Hamilton/Avnet	918-252-7297
OR	Beaverton, Hamilton/Avnet	503-526-6200
OR	Beaverton, IEC	503-641-1690
OR	Beaverton, Kent Elctrns. Corp.	503-626-8300
OR	Beaverton, Marshall	503-644-5050
OR	Beaverton, Time Elctrns.	206-820-1525
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Clifton Heights, Tri-Com, Inc.	215-259-7400
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Wayne, Peak Elctrns., Corp.	215-293-9000
SC	Greenville, EMSCO	803-233-4121
TN	Memphis, Carlton-Bates	901-365-3539
TN	Nashville, Carlton-Bates	615-885-3232
TX	Austin, Hamilton/Avnet	512-832-4306
TX	Austin, Kent Elctrns. Corp.	512-834-1900
TX	Austin, Marshall	512-837-1991
TX	Austin, Time Elctrns.	512-339-3051
TX	Carrolton, Sterling Elctrns.	713-243-1600
TX	Dallas, Hamilton/Avnet	214-308-8111
TX	Dallas, Wallace Elctrns., Inc.	214-340-0400
TX	Ft. Worth, Carlton-Bates	817-293-5558
TX	Ft. Worth, TTI Inc.	817-429-1440
TX	Grand Prairie, Alatec Prods.	214-606-1744
TX	Houston, Hamilton/Avent Elctrns.	713-861-8517
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Marshall	713-467-1666
TX	Houston, Sterling Elctrns Corp.	713-625-9800
TX	Richardson, Kent Elctrns. Corp.	214-669-2600
TX	Richardson, Marshall Inds.	214-705-0600
TX	Richardson, Time Elctrns.	214-480-5000
UT	Salt Lake City, Hamilton Avnet Elctrns.	801-266-2022
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
UT	Salt Lake City, Marshall	801-973-2288
UT	W. Valley City, IEC	801-977-9750
UT	West Valley City, Time Elctrns.	801-973-0208
VA	Richmond, Sterling Elctrns. Corp.	804-323-5510
WA	Bellevue, IEC	206-455-2727
WA	Bothell, Marshall Inds.	206-486-5747
WA	Kirkland, Time Elctrns.	206-820-1525

WA	Redmond, Hamilton Avnet Elctrns.	206-881-6697
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	Oshkosh, Electronic Inds.	414-235-8930
WI	Waukesha, Hamilton/Avnet Elctrns.	414-784-4511
WI	Waukesha, Marshall Inds.	414-797-8400
PR	Rio Piedras, Hamilton/Avnet	809-754-4356

Minority Distributors

CA	Monrovia, Erik-A- Elctrns.	800-547-1020
MA	Winchester, Webb Distbn.	800-888-6627
NJ	Moorestown, Marlac Elctrns.	800-255-1203
NC	Greensboro, Golden Elctrns.	800-234-5144
OK	Stilwell, Cherokee Nation Distrs.	800-259-7772
TX	Dallas, Elctrn. Parts Inventory Corp.	800-458-4777
TX	El Paso, Ideal Inds. Elctrn. Supp.	915-779-6647
VA	Roanoke, Mexitronics	800-342-6394

AMP-AKZO CORPORATION, 233 Wilmington W. Chester Pike, Ste. 113, Chadds Ford, PA 19317, Tel: 215-459-2800, FAX: 215-459-7777; Empl.: 1100; *Sls. Mgr.:* Dennis R. Marek

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AZ	Phoenix, Howe & Howe Sls.	602-264-7971
KS	Overland Park, Acorn Elctrns.	913-649-6402
MD	Framingham, Gallagher Assocs.	508-626-2346
MO	St. Louis, Acorn Elctrns.	314-421-1751

Local Distributors

CA	Santa Monica, Master Distrs.	310-452-1229
IL	Chicago, Newark Elctrns.	312-784-5100

AMPEX CORP., 401 Broadway, Redwood City, CA 94063-3199, Tel: 415-367-2011, TELEX: 348464, FAX: 415-367-2769; Empl.: 6000; *Sls. Mgr.:* Rollin Stanford

AMPHENOL CORPORATION, Corporate Headquarters, 358 Hall Ave., Wallingford, CT 06492, Tel: 203-265-8910, FAX: 203-265-8516; Empl.: 3200(USA)

AMPHENOL, Bendix Connector Operations, 40-60 Delaware St., Sidney, NY 13838, Tel: 607-563-5011, TELEX: 932456, FAX: 607-563-5157; FSC No.: 77820; Empl.: 1500; *Sls. Mgr.:* Chas. Morse; *Dist. Mgr.:* Lew Lafornara

AMPHENOL CANADA CORP., 20 Melford Dr., Scarborough, Ontario, Canada M1B 2X6, Tel: 416-291-4401, TELEX: 065-25210, FAX: 416-292-0647; FSC No.: 5935; Empl.: 180; *Sls. Mgr.:* Andy Toffelmire/Debbi Tippett; *Dist. Mgr.:* Tom Whitley

AMPHENOL INTERCONNECT PRODUCTS, LPL Technologies, 20 Valley St., Endicott, NY 13760, Tel: 607-754-4444, FAX: 607-786-4311; FSC No.: 13509; Empl.: 450; *Sls. Mgr.:* David Hubbell; *Dist. Mgr.:* Jerry Potochnik

AMPHENOL RF OPERATIONS, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810, Tel: 203-743-9272, 800-627-7100, FAX: 203-796-2032; FSC No.: 74868; Empl.: 600; *Sls. Mgr.:* T. R. Burton; *Dist. Mgr.:* K. V. Keefe

AMPHENOL SPECTRA-STRIP/ITD, 720 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-3200, FAX: 203-281-5872; Empl.: 119

FAX: 215-723-5688

AMPLIFIER RESEARCH, 160 School House Rd., Souderton, PA 18964-9990, Tel: 215-723-8181; FSC No.: 30639; Empl.: 75; *Sls. Mgr.:* L. Pokorny .... **D•1002-1003, 1022-1023, 1224-1225**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-830-9224
AZ	Heber, Mar Tech Assocs.	602-535-4961
CA	N. Hollywood, O'Halloran Assoc.	213-877-0173
CA	San Jose, O'Halloran Assoc.	408-243-1600
CO	Boulder, H. Bass. Assoc.	303-530-7509
FL	Melbourne, W.A. Brown Instrs., Inc.	407-723-0766
FL	Orlando, W.A. Brown Instrs., Inc.	407-648-9662
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
IL	Park Ridge, Elctrn. Instr. Assocs.	708-298-2290
IN	Indianapolis, Elctrn. Instr. Assocs.	317-252-5811
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
LA	Lockport, Airep Elctrns.	504-693-3666
MD	Severna Park, Round Bay Eng.	410-647-8007
MA	Lexington, R. J. Sickles Assoc.	617-862-5100
MN	Minnetonka, Elctrn. Instr. Assocs.	612-933-7793
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NJ	Ridgefield Pk., Scientific Dvcs.	201-440-3430
NM	Albuquerque, Hewitt & Assocs.	505-299-7746
NY	Rochester, Eastern Sys. of NY	716-292-1460
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Dublin, Micro Sls.	614-792-9117
OK	Tulsa, Airep Elctrns.	918-592-7711
PA	Philadelphia, R. Meyers Assoc.	215-224-1663
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
UT	Bountiful, Herb Bass Assoc.	801-295-7100
WA	Seattle, J. J. Assocs., Inc.	206-246-6619
Can	Ottawa, Rohde & Schwarz Canada	613-592-8000

AMPLIFONIX, INC., 2707 Black Lake Place, Philadelphia, PA 19154, Tel: 215-464-4000, FAX: 215-464-4001; FSC No.: 60979; Empl.: 75; *Sls. Mgr.:* Michael Sonstein; *Dist. Mgr.:* Michael Sonstein

AMPROBE INSTRUMENT, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563, Tel: 516-593-5600, FAX: 516-593-5682; Empl.: 200; *Sls. Mgr.:* Duncan Ladd, VP Sls.

AMPRO COMPUTERS,INC., 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-522-2100, FAX: 408-720-1305; Empl.: 51; *Sls. Mgr.:* Victor Maccharoli/Brian McConnell

AMPTEC ELECTRONICS, 12650 Sabre Springs Pky., Ste. 207, San Diego, CA 92128, Tel: 619-578-7816, FAX: 619-578-7816; Empl.: 18

AMPTEK, INC., 6 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-2242, FAX: 617-275-3470; Empl.: 17

AMPTRONIX, INC., P.O. Box 8146, Rowland Heights, CA 91748, Tel: 213-666-1564; *Sls. Mgr.:* Lou Lim; *Dist. Mgr.:* Ching Lim

AMRAD & TRANSCON MFG. CO., Div. of D.J. Assocs., Inc., 8411 South Zero St., Fort Smith, AR 72903-7097, Tel: 501-452-3987, FAX: 501-452-7752; FSC No.: 55943; Empl.: 5; *Sls. Mgr.:* M. P. Beck; *Dist. Mgr.:* M. P. Beck

A M SENSORS, INC., 26 Keewaydin Dr., Unit B, Salem, NH 03079-2839, Tel: 603-898-1543, FAX: 603-898-1638; Empl.: 10; *Sls. Mgr.:* Rocco Ciesco

AMSTAT INDUSTRIES, INC., 3012 N. Lake Terrace, Glenview, IL 60025, Tel: 708-998-6210, FAX: 708-998-6218

AMUNEAL MANUFACTORING CORP., 4737 Darrah St., Philadelphia, PA 19124, Tel: 215-535-3000, FAX: 215-743-1715; FSC No.: 23740; Empl.: 55; *Sls. Mgr.:* Larry Maltin .... **C•1683**

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn Co.	602-581-0884, FAX:602-581-3522
CA	Banning, C.E.M., Inc.	714-845-1216
CA	Fremont, Edward Blake Assocs., Inc.	510-770-9058,FAX:510-770-9698
CA	San Diego, C.E.M., Inc.	619-583-8571, FAX:619-583-2718
CA	Santa Ana, C.E.M., Inc.	714-835-2702, FAX:714-835-0851
CT	Meriden, MPS Elctrns., Inc.	203-235-1414
MA	Norwood, MPS Elctrns.	617-769-8700, FAX:617-769-7703
NY	Yonkers, Sonkin Assocs.	914-968-8282, FAX:914-968-9187
OH	Kettering, F.L. Ohmer & Assocs.	513-434-1454, FAX:513-434-2067
OR	Tigard, Rep-West, Inc.	503-639-0325, FAX:503-684-9040
TX	Austin, Eatman Engrg.	512-795-0920
TX	Austin, Eatman Engrg., Co.	512-795-0920, FAX:512-795-0960
TX	Rockwell, Eatman Engrg.	214-771-1903, FAX:214-722-3501
WA	Seattle, Rep-West	206-283-8351, FAX:206-283-8699
Intl	Israel, Ramat Hasharon, Star-Gal Engrg., Ltd.	011-972-3-5490226
Can	Toronto, Ontario, Norgay Entrprs. Ltd.	416-234-8966,FAX:416-234-8970

ANACOM GEN. CORP., 1335 S. Claudina St., Anaheim, CA 92805-6235, Tel: 714-774-8080, FAX: 714-774-7388; Empl.: 95; *Sls. Mgr.:* Sye Keene; *Dist. Mgr.:* Sye Keene

ANADEX INC., 1080 Avenida Acaso, Camarillo, CA 93012, Tel: 805-987-9660, FAX: 805-388-0133; Empl.: 15

ANADYNE POWER SUPPLY DIVISION, 14005 Stage Road, Santa Fe Springs, CA 90670-5216, Tel: 213-921-9364, FAX: 213-921-8163; Empl.: 100

ANAHEIM AUTOMATION, 910 E. Orangefair La., Anaheim, CA 92801, Tel: 714-992-6990, FAX: 714-992-0471; Empl.: 35

ANALOG & DIGITAL PERIPHERALS, INC.(ADPI), P.O. Box 499, Troy, OH 45373, Tel: 513-339-2241, FAX: 513-339-0070; FSC No.: 31-0949-745; Empl.: 28; *Sls. Mgr.:* W. Rych Haynes; *Dist. Mgr.:* Lyle Ellicott

ANALOG DEVICES, INC., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, Tel: 617-329-4700, TWX: 710-394-6577, ESYLNK: 62896514, FAX: 617-326-8703; FSC No.: 24355; Empl.: 5200; *Sls. Mgr.:* Joe Reichbach; *Dist. Mgr.:* Ed Renola

ANALOG EQUIPMENT CORPORATION, 3780-9 Burns Rd., Palm Bch. Gardens, FL 33410, Tel: 407-622-3715; FSC No.: 67584; *Sls. Mgr.:* V. Ratner

ANALOGIC CORP., 8 Centennial Dr., Peabody, MA 01960, Tel: 508-977-3000, FAX: 508-531-7356; Empl.: 1200; *Sls. Mgr.:* Martyn Culverhouse .... **D•1170**

Local Sales Offices & Reps

CA	San Diego, Analogic Corp.	619-484-7661
OH	Parma, Analogic Corp.	216-884-4420
PA	Chalfont, Analogic Corp.	215-997-1808

ANALOGIC CORP., Data Conversion Prods. Grp., 360 Audubon Rd., Wakefield, MA 01880, Tel: 508-977-3000, FAX: 617-245-1274; Empl.: 1200; *Sls. Mgr.:* D. Travers .... **D•1170**

ANALOG MODULES INC.

FAX: 407-834-3806

ANALOG MODULES, INC., 126 Baywood Avenue, Longwood, FL 32750-3426, Tel: 407-339-4355; FSC No.: 61651; Empl.: 48; *Sls. Mgr.:* W.C. Hudson, Exec. VP; *Dist. Mgr.:* Mark Roberts .... **B•1210; D•1005, 1573**

Local Sales Offices & Reps

NJ	Madison, DJ Assocs.	201-822-0002

ANALOG SYSTEMS, P.O. Box 17389, Tucson, AZ 85731-7389, Tel: 602-290-1818, FAX: 602-885-1189; Empl.: 9; *Sls. Mgr.:* Sharon Raban; *Dist. Mgr.:* Sharon Raban

ANALYTIC TECHNOLOGY CORP., 15233 N.E. 90th, Redmond, WA 98052, Tel: 206-883-2445, 800-428-2808, FAX: 206-882-2138; Empl.: 10; *Sls. Mgr.:* Jim Dooley

ANAREN MICROWAVE, INC., P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057, Tel: 315-432-8930, FAX: 315-432-9121; FSC No.: 31597; Empl.: 300

ANATECH ELECTRONICS, INC., 94 Jewell St., Garfield, NJ 07026, Tel: 201-772-4242, FAX: 201-772-4646; Empl.: 10

ANCO ELECTRONICS, INC., 9477 Archibald Avenue, Rancho Cucamonga, CA 91730, Tel: 1-800-545-ANCO, FAX: 714-989-9935

ANCOT, 115 Constitution Drive, Menlo Park, CA 94025, Tel: 415-322-5322, FAX: 415-322-0455; Empl.: 10; *Sls. Mgr.:* Chris Lynch

AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-9916, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (PURDY UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce

ANDEEN-HAGERLING, INC., 31200 Bainbridge Rd., Cleveland, OH 44139-2231, Tel: 216-349-0370, TELEX: 4931432, FAX: 216-349-0359; Empl.: 9; *Sls. Mgr.:* Eric Whitman

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FAX: 814-696-0403

ANDERSON ELECTRONICS, P. O. Box 89, Hollidaysburg, PA 16648, Tel: 814-695-4428; Empl.: 60; *Sls. Mgr.:* Mike Martin .... **A•1333**

Local Sales Offices & Reps

CA	Sunnyvale, Logan Sls	408-732-6020
GA	Lawrenceville, B. T. Funderburk, Inc.	404-963-9495
IL	South Elgin, R.K. Elctrn.	708-695-8552
KS	Westwood, E.P.I. Inc	913-432-1792
MA	Woburn, Microwave Comp. Mktg., Inc.	617-273-3106
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MO	St. Louis, E.P.I. Inc.	314-962-1411
NC	Raleigh, B. T. Funderburk, Inc.	919-846-2373
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Souderton, Intek, Inc.	215-723-0433
TX	Plano, GW Prods.	214-422-1746
WA	Seattle, Harry Levinson Co.	206-382-1300
Can	Hamilton, Ont., Cartwright Southall Assocs.	416-528-0294

ANDERSON POWER PRODUCTS, Div. of High Voltage Engineering, 145 Newton St., Boston, MA 02135, Tel: 617-787-5880, TELEX: 940453, FAX: 617-254-9217; Empl.: 110; *Sls. Mgr.:* Tom Fielding

AEC

FAX: 401-333-0287

ANDON ELCTRNS. CORP., 4 Court Dr., Lincoln, RI 02865, Tel: 401-333-0388; FSC No.: OEBT2; Empl.: 55; *Sls. Mgr.:* Jack Galinev; *Dist. Mgr.:* Peter Gallotello, Mktg. Mgr. .... **C•1256-1259**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg.	205-539-1405
AL	Huntsville, SACS	205-533-4229
CA	Los Angeles, TNT & Assocs.	714-830-6096
CA	San Jose, Integrated Tech. Sls.	408-727-3406
CO	Littleton, Con-Tek Mktg., Inc.	303-973-8490
CT	N. Bradford, Todino Engrg. Sls.	203-488-2896
FL	Boca Raton, SACS	407-391-1034
GA	Norcross, SAC	404-447-6154
IL	Arlington Heights, Greenslade Sls., Inc.	708-593-3450
MD	Baltimore, Baguol/Grimm Assocs.	410-719-0770
MN	Minneapolis, D.A. Case Assocs., Inc.	612-831-6777
NJ	Venture Quest, Inc.	201-377-4922
NY	Fairport, L-Mar Assocs., Inc.	715-425-9100
NC	Raleigh, SACS	919-859-9970
OH	Dayton, Dirckson & Assoc. Inc.	513-294-3657
OH	Richfield, Geotronix Inc.	216-659-6100
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	McMinnville, Electro-Design	503-472-0481
PA	Ft. Washington, SMC	215-628-3394
RI	Smithfield, Todino Sls.	401-232-5656
TX	Dallas, Advance Tech. Sls.	214-340-1300
Can	Concord, Ont., Votron Elctrns., Inc.	416-699-9870

Local Distributors

CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Santa Clara, Trinity Elctrns.	408-980-9011
MD	Gaithersbury, Axis Elctrns., Inc.	301-840-9640
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Syracuse, Lead Elctrns.	315-454-4544
OH	Columbus, Spectra Elctrns.	614-265-2250
TX	Tomball, Wofford Elctrns.	713-351-2255
Can	Woodbridge, Ont., Ryantronics Sls. & Importing	416-856-2992

ANDOVER, INC., 310 North Earl Avenue, Lafayette, IN 47904, Tel: 317-447-1157, FAX: 317-447-1150; Empl.: 120; *Sls. Mgr.:* Harry O. Minns

ANDREW CORP., 10500 W. 153rd St., Orland Pk., IL 60462, Tel: 800-255-1479, TELEX: 25-3897, FAX: 708-349-5943; *Sls. Mgr.:* Henry Duvalsaint

ANDREW CORPORATION, 4301 Westbánk Dr., Ste. A-100, Austin, TX 78746, Tel: 800-331-4144, 512-314-3000, FAX: 512-314-3193; Empl.: 350; *Sls. Mgr.:* John Chvatal, Dir of Sls.

ANDUFET DIGITAL CORP., 545 W. Allen Ave., San Dimas, CA 91773, Tel: 909-394-0171, FAX: 909-394-9931; Empl.: 3

ANGO ELECTRONICS CORP., 29 Ewing Ave., North Arlington, NJ 07031, Tel: 201-955-0800, FAX: 201-955-2332; *Sls. Mgr.:* John Ngo .... **C•1014**

ANGSTROHM PRECISION, INC., Dale Electronics, 18400 Precision Place, Hagerstown, MD 21742, Tel: 301-739-8722, FAX: 301-797-6852; Empl.: 500; *Sls. Mgr.:* Don Hutzell .... **A•1923**

ANGUS ELECTRONICS CO., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, TELEX: 027-419, FAX: 317-247-4749; FSC No.: 72264; Empl.: 200ò; *Sls. Mgr.:* Thomas W. Pilcher

ANNULUS TECHNICAL INDUSTRIES, INC., P.O. Box 1390, 101 Nelson St., Port Dover, Ont., CAN NOA 1NO, Tel: 519-583-3440, FAX: 519-583-3460; Empl.: 21; *Sls. Mgr.:* Don MacAdam

ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1995, FAX: 516-435-1612; Empl.: 280; *Sls. Mgr.:* Amir Chitayat, VP Sls.

ANRITSU WILTRON SALES CO., 685 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-776-8300, FAX: 408-776-1744; Empl.: 100; *Sls. Mgr.:* Bill Wiedemann

ANSONICS, INC., P.O. Box 910, Halfway, OR 97834, Tel: 503-742-7475, FAX: 503-742-2991; Empl.: 6

ANTENNA RESEARCH ASSOCIATES, 11317 Frederick Ave., Beltsville, MD 20705, Tel: 301-937-8888, FAX: 301-937-2796; FSC No.: 23360; Empl.: 30; *Sls. Mgr.:* H.W. Rapalus

ANTENNA SPECIALISTS, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139, Tel: 216-349-8400, TELEX: 4332133 (AS INTL CLV), FAX: 216-349-8407; Empl.: 1000; *Dist. Mgr.:* Patty Fritz, Natl. Distr. Sls. Mgr.

ANTEX DIVISION, 24 Tioga Way, P.O.Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel

ANTEX ELECTRONICS CORP., 16100 S. Figueroa St., Gardena, CA 90248-2617, Tel: 310-532-3092, FAX: 310-532-8509; Empl.: 53; *Sls. Mgr.:* Richard Gross; *Dist. Mgr.:* Richard Gross

ANTONA CORP., 1643 1/2 Westwood Blvd., Los Angeles, CA 90024-5603, Tel: 310-473-8995, FAX: 310-473-7112; Empl.: 3; *Sls. Mgr.:* Katherine Capanna

ANVIL CASES, Subsidiary of Zero Corporation, 15650 Salt Lake Ave., City of Industry, CA 91745, Tel: 818-968-4100; FSC No.: 59288; Empl.: 109; *Sls. Mgr.:* Whitt Adams

AOFR, INC., 800 E. Campbell, Suite 108, Richardson, TX 75081, Tel: 214-644-1394, FAX: 214-480-9278; *Sls. Mgr.:* Dwain Lawhon

AOT ELECTRONICS, INC., 4000 Mac Arthur Blvd, Newport Beach, CA 92660, Tel: 714-852-9999, FAX: 714-261-9999; Empl.: 27; *Sls. Mgr.:* Jon Stevenson

A. P. CIRCUIT, 397 Linden St., Brooklyn, NY 11237, Tel: 718-456-2717, TELEX: 428759, FAX: 718-456-2717

A.P.C.S. AMERICA, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1453; Empl.: 13; *Sls. Mgr.:* Julie A. Corby

A.P.E. CORPORATION, 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120, FAX: 516-289-4735; FSC No.: 57216; Empl.: 25; *Sls. Mgr.:* Arthur Ayala

APEX® µtéch

FAX: 602-888-3329

APEX MICROTECHNOLOGY CORP., 5980 N. Shannon Rd., Tucson, AZ 85741, Tel: 602-690-8600, TELEX: 170631; FSC No.: 60024; Empl.: 120; *Sls. Mgr.:* Greg L. Brennan .... **D•1006-1009, 2068-2069**

Local Sales Offices & Reps

AZ	Tucson, Apex Microtechnology	602-690-8602
CA	Los Altos, Kolm Mktg.	415-948-2635
CA	Manhattan Beach, Com-Star	310-318-9803
CA	Rancho Cucamonga, Com-Star	909-944-5744
CT	Lebanon, Signal Sls. Engrg.	203-889-4050
FL	Seminole, Q Rep	813-397-8431
IL	Palatine, Vine Sls., Inc.	708-934-5476
MD	Ellicott, Nelson Elctrns.	410-747-7887
MA	Woburn, Signal Sls. Engrg.	617-938-7872
MN	Bloomington, Industrial Rep.	612-854-8027
NH	Newton, Signal Sls. Eng.	603-382-3669
NJ	Allendale, Eastec Assocs.	201-934-7135
WI	Appleton, Vine Sls., Inc.	414-731-9873

Local Distributors

AZ	Tuscon, Apex	602-742-8600
Can	Kanata, J-Squared Technlgs.	613-592-9540

Can	Point-Claire, J-Squared Technlgs.	514-694-8330
Can	Rexdale, J-Squared Technlgs.	416-674-0927

A.P.M. HEXSEAL CORPORATION, 44 Honeck St., Englewood, NJ 07631, Tel: 201-569-5700, TELEX: 13-3403, FAX: 201-569-4106; FSC No.: 97539; Empl.: 29; *Sls. Mgr.:* Riva Solins; *Dist. Mgr.:* Riva Solins .... **B•1669**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
AR	Hot Springs, ASI	501-624-4608
CA	Belmont, Edward B. Hoin Assoc.	415-592-6401
CA	Chatsworth, Porter Co.	818-700-0808
CO	Englewood, Delltron Co.	303-741-2122
CT	Meriden, Gerber Sls. Corp.	203-630-3477
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Atlanta, L & D Inc.	404-395-7079
IL	Lombard, FF/Hill Gray	708-832-4101
KS	Overland Park, Spectrum Sls.	913-648-6811
MD	Silver Spring, N.K.A. Inc.	301-585-6141
MA	Burlington, Gerber Sls.	617-229-1150
MI	Troy, C.B. Jensen Co.	313-643-0506
MN	Bloomington, Mumco	612-854-4161
NJ	Hackensack, CBA/METRO	201-440-4114
NY	Syracuse, Rep Tech.	315-437-2845
NC	Raleigh, L & D Inc.	919-876-5301
OH	Powell, Val Skol Sls.	614-889-0174
PA	Paoli, Tyler Griffin	215-647-1550
WA	Edmonds, Evergreen Mktg. Grp.	206-485-8063
Can	Ontario, Deskin Inc.	416-475-1412

Local Distributors

CA	Garden Grove, Richey Impact Elec.	714-895-0060
CO	Littleton, Indelco	303-795-3431
CT	New London, Jan Elctrns.	203-442-4386
FL	Miami, Elctrn. Equip.	305-526-6000
IL	Chicago, Newark Elctrns.	312-784-5100
IN	South Bend, Pei-Genesis	219-287-2911
KS	Wichta, Midwest Fasteners	316-267-3318
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Hingham, Sager Elctrl. Sply.	617-749-6700
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MN	Minneapolis, Aero-Space Computer	612-884-4725
MO	Maryland Heights, LCOMP, Inc.	314-291-6200
NY	Lynbrook, Peerless Radio	516-593-2121
OH	Cincinnati, Hughes Peters	513-351-2000
PA	Philadelphia, Sanson & Rowland	215-329-9264
WI	Milwaukee, Indst. Elctrns.	414-276-1212

APOLLO DISPLAY TECHNOLOGIES, INC., 194-22 Morris Ave., Holtsville, NY 11742, Tel: 1-800-LCD-STOC, 516-654-1143, FAX: 516-654-1496; *Sls. Mgr.:* Richard Eicher .... **B•1019**

APOLLO MAGNETICS CORP., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348, FAX: 213-384-4067; Empl.: 420; *Sls. Mgr.:* Charles Williams

APPLIED CONTROLS CO., INC., 1275 Bloomfield Ave., Fairfield, NJ 07004, Tel: 201-227-5454, FAX: 201-882-1422; FSC No.: 4A725; Empl.: 20; *Sls. Mgr.:* W. Merel

APPLIED DATA SYSTEMS, INC., 409A East Preston St., Baltimore, MD 21202, Tel: 800-541-2003, 410-576-0335, FAX: 410-576-0338; Empl.: 6; *Sls. Mgr.:* Robert Kondner

APPLIED DESIGN COMPANY, 2010 E. Hennepin Ave., Minneapolis, MN 55413, Tel: 612-378-0094, FAX: 612-378-0733

APPLIED DISPLAY & CONTROL, 415 W. Golf Rd., Ste. 10, Arlington Heights, IL 60005, Tel: 708-228-9690, FAX: 708-228-9698 .... **B•1020**

APPLIED DISPLAY TECHNOLOGY, INC., 2150 Anchor Court, Newbury Park, CA 91320, Tel: 805-498-4984, FAX: 805-376-2011; FSC No.: OM3A8; Empl.: 15; *Sls. Mgr.:* John Becker

APPLIED ELECTRO TECHNLG., INTL., See Scientific Technologies Inc.

APPLIED ENGINEERING PRODUCTS, P.O. Box 510, New Haven, CT 06513, Tel: 203-756-1669, FAX: 203-776-2813; FSC No.: 19505; Empl.: 105; *Sls. Mgr.:* Jeff Buccitti; *Dist. Mgr.:* Jeff Buccitti

APPLIED FIBEROPTICS, INC., East Main St., Southbridge, MA 01550, Tel: 508-765-9121, 800-225-7486, FAX: 508-764-3639; Empl.: 35; *Sls. Mgr.:* Charles P. Kiritsy

APPLIED INFORMATION SYSTEMS, INC., 100 Europa Dr., Ste. 555, Chapel Hill, NC 27514, Tel: 919-942-7801, 800-334-5510, FAX: 919-493-7563; *Sls. Mgr.:* Dawn Edgerton

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, FAX: 805-967-8227; FSC No.: 11935; Empl.: 8,000; *Sls. Mgr.:* Steven E. Beal

APPLIED MICRO CIRCUITS CORP., 6195 Lusk Blvd., San Diego, CA 92121, Tel: 619-450-9333, FAX: 619-450-9885; FSC No.: 367 4112; Empl.: 250; *Sls. Mgr.:* Greg Barnhart; *Dist. Mgr.:* Greg Barnhart, V.P. Worldwide Sls.

APPLIED MICROSYSTEMS CORP., 5020 148th Ave NE, Redmond, WA 98052, Tel: 206-882-2000, TELEX: 185196, FAX: 206-883-3049; Empl.: 200; *Sls. Mgr.:* Joe Gomula

APPLIED PLASTICS TECHNOLOGY, 45 Broadcommon Rd., Bristol, RI 02809, Tel: 401-253-0200, FAX: 401-253-0474; FSC No.: 9330; Empl.: 30; *Sls. Mgr.:* John A. MacIntyre III

APC
APPLIED POWER CONVERSION

FAX: 201-385-0702

APPLIED POWER CONVERSION, Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70 .... **D•1574-1578, 2056-2057**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411,FAX:205-539-4412
AK	Contact The Factory Direct	
CA	Contact The Factory Direct	
CA	San Diego, Cirolia Elect. Sls.	619-743-3015, FAX:619-743-3804
CA	Santa Clara, W.J. Elect. Sls.	408-982-9222, FAX:408-982-9224
CO	Contact The Factory Direct	
FL	Clearwater, Tech-Rep Assoc.	813-872-9900, FAX:813-573-9370
FL	Ft. Lauderdale, Tech-Rep. Assoc.	305-791-2708, FAX:813-573-9370
GA	Lawrenceville, BCI	404-962-6826, FAX:404-962-6338
HI	Contact The Factory Direct	
ID	Contact The Factory Direct	
IL	Contact The Factory Direct	
IL	Arlington Heights, Greenslade Sls.	708-593-3450, FAX:708-593-3468
IN	Contact The Factory Direct	
IA	Contact The Factory Direct	
KS	Contact The Factory Direct	
KY	Contact The Factory Direct	
MD	Columbia, Delta III Assoc.	410-730-4700, FAX:410-730-0790
MA	Topsfield, Whitehead Assoc.	508-887-8050, FAX:508-887-5434
MI	Contact The Factory Direct	
MN	Minneapolis, Tec Team Sls.	612-854-6616, FAX:612-854-8031
MO	Contact The Factory Direct	
MT	Contact The Factory Direct	
NE	Contact The Factory Direct	
NV	Contact The Factory Direct	
NJ	Bergenfield, Technology Dynamics Inc.	201-385-0500,FAX:201-385-0702
NM	Albuquerque, IMEC	505-275-0936, FAX:505-294-1121
NY	Elmont, Crane & Egert	516-872-0800, FAX:516-872-9074
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881, FAX:315-446-3047
NC	Contact The Factory Direct	
OH	Chagrin, J.J. Bair & Co.	216-543-8617, FAX:216-543-4406
OR	Contact The Factory Direct	
PA	Contact The Factory Direct	
SC	Contact The Factory Direct	
SD	Contact The Factory Direct	
TX	Dallas, Tesco Elctrn. Sls.	214-553-1200, FAX:214-553-1299
UT	Midvale, Christec	801-566-3694, FAX:801-506-6442
WA	Contact The Factory Direct	
WV	Contact The Factory Direct	
WI	Wauwatosa, Greenslade Sls., Inc.	414-258-2727, FAX:414-258-7725
WY	Contact The Factory Direct	

APPLIED TEST SYSTEMS, INC., 348 New Castle Rd., Butler, PA 16001, Tel: 412-283-1212, TELEX: 86-6727 ATS BUTLER, FAX: 412-283-6570; Empl.: 80; *Sls. Mgr.:* Dave A. Dineff

APPROVED PURIFICATION CORP., 1088 R. Hope St., P.O. Box 4186, Stamford, CT 06907, Tel: 203-357-0141, FAX: 203-356-1697 .... **B•1916**

APROTEK, 9323 W. Evans Cr Rd., Rogue River, OR 97537, Tel: 503-582-2120, FAX: 503-582-2149; Empl.: 6; *Sls. Mgr.:* K. Conley

APSCO, INC., 5976 Heisley Road, Mentor, OH 44060, Tel: 216-352-8961, TELEX: 284580, FAX: 216-354-7306; Empl.: 200; *Sls. Mgr.:* Ian Davey-Turner

APS DYNAMICS, INC., 5731 Palmer Way, Ste. A, Carlsbad, CA 92008, Tel: 619-438-4848, TELEX: 4995113 (SHAKE), FAX: 619-438-8845; Empl.: 5

APTEK TECHNOLOGIES, INC., DBA Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442, Tel: 305-421-8450, FAX: 305-421-8044; FSC No.: 36741; Empl.: 50; *Sls. Mgr.:* Dwain Jenkins; *Dist. Mgr.:* Dwain Jenkins

A.P.W. CO., INC., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643, FAX: 201-627-6396; Empl.: 14

apx TECHNOLOGIES INC.

FAX: 516-433-1457

APX TECHNOLOGIES INC., 264 Duffy Ave., Hicksville, NY 11801, Tel: 516-433-1313; Empl.: 300; *Sls. Mgr.:* David Baum .... **A•2266-2267; D•1580-1583**

Local Sales Offices & Reps

CA	Pasadena, Electro Mech. Inst.	818-795-7193
CA	Santa Clara, Sourcetronics	408-988-8801
CT	Rocky Hill, Jones/Sudders	203-257-3582
FL	Dunedin, John White Assoc.	813-733-5319
MD	Manchester, Imagitron Sls. Co.	410-374-5600
MA	Wellesley, Brownstone Assoc.	617-239-8204
MI	Wyoming, N. Coast Comps.	616-249-8910
MN	Plymouth, Highland Elctrn.	612-557-7022
NH	Hudson, Bob Mirabella	508-877-0884
NM	Albuquerque, Syntech	505-266-7951
NY	Fulton, Jones/Sudders	315-598-6942
MO	Independence, Hitec Central	816-796-6684
NY	Lynbrook, P. Saftler Assoc.	516-593-7880
WA	Camas, Elctrn. Mktg. Grp.	206-834-6548
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
Can	Concord, Ont., Astec Comps. Ltd.	416-669-4022

AQUALARM, Marine Safety Systems, Inc., 1151 D. Bay Blvd., Chula Vista, CA 91911, Tel: 619-575-4011, FAX: 619-575-4012; FSC No.: 2V373; Empl.: 8; *Sls. Mgr.:* John L. Hooper

ARCHELON INC., 460 Forestlawn Rd., Waterloo, Ont., CAN N2K 2J6, Tel: 519-746-7925, FAX: 519-746-7925; Empl.: 3; *Sls. Mgr.:* Preston Gurd

ARCO ELECTRONICS, 9822 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8707, FAX: 818-882-6513; FSC No.: 84171; Empl.: 10; *Sls. Mgr.:* Randy Ryan

ARCOLECTRIC CORP., 9001 Canoga Ave., Canoga Park, CA 91304, Tel: 818-700-1933, FAX: 818-700-9541; *Sls. Mgr.:* Carrie Donze; *Dist. Mgr.:* Carrie Donze .... **B•1132-1133, 1670-1672**

Local Distributors

CA	Haywood, Electro Comps.	510-783-5800
FL	Lakeland, Wesgarde	813-644-7564
CA	Los Angeles, Electric Switches	800-252-4640, 800-421-8855
CA	Tustin, Western Switches	213-627-6126
CA	Van Nuys, Wesgarde Comp.	818-786-3724
CT	Hartford, Wesgarde Comp.	203-527-7705
IL	Carol Stream, Wesgarde Comp.	708-653-1460
KS	Overland Park, Wesgarde Comp.	913-262-2718
MD	W. Springfield, T. F. Cushing	413-788-7341
MI	Benton Harbor, Benton Elec. Sply.	616-925-0060
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MO	St. Louis, Wesgarde Comp.	314-567-7776
NH	Nashua, Wesgarde Comp.	603-880-1971
NJ	Denville, Lashen Elctrns.	201-627-3783
NJ	Mt. Laurel, Wesgarde Comp.	609-778-8190
NY	Woodside, Switches Unltd.	718-478-5000
OH	Westerville, Wesgarde Comp.	614-885-0319
OR	Eugene, Larsco	503-484-7491
SC	Darlington, AERCO, Inc.	803-395-6575
TX	Dallas, Wesgarde Comp.	214-357-1768

ARC SYSTEMS, INC., 2090 Joshuas Path, Hauppauge, NY 11788-4764, Tel: 516-582-8020, FAX: 516-582-8038; FSC No.: 67245; *Sls. Mgr.:* Robert Miller

AREMCO PRODUCTS, INC., Box 429, Ossining, NY 10562, Tel: 914-762-0685, FAX: 914-762-1663; Empl.: 30; *Sls. Mgr.:* Peter Schwartz

A.R.F. PRODS., P.O. Box 3128, Boulder, CO 80307-3128, Tel: 303-499-2946, FAX: 303-499-2946; FSC No.: 4G971; Empl.: 3

ARGA CONTROLS, 35 E. Glenarm St., Pasadena, CA 91105, Tel: 213-682-3314, FAX: 818-799-9407; FSC No.: 50290; Empl.: 25; *Sls. Mgr.:* Linda Galman

ARGOSSOUND, Argos Products Co., Inc., 600 S. Sycamore St., Genoa, IL 60135-1191, Tel: 800-357-5240, FAX: 815-784-5110; Empl.: 25; *Sls. Mgr.:* Dick Neville; *Dist. Mgr.:* Ron Evers

ARGO TRANSDATA CORP., 1 Heritage Pk., Clinton, CT 06413-0554, Tel: 203-669-2233, FAX: 203-669-4316; Empl.: 25

ARIEL CORPORATION, 433 River Rd., Highland Pk., NJ 08904, Tel: 908-249-2900, FAX: 908-249-2123; *Sls. Mgr.:* Bob Yarrow

ARIES ELECTRONICS, INC.

FAX: 908-996-3891

ARIES ELECTRONICS, Box 130, Frenchtown, NJ 08825, Tel: 908-996-6841; FSC No.: 51167; Empl.: 160; *Sls. Mgr.:* Frank Folmsbee .... **A•1689-1691; B•1673; C•1260-1268**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Phoenix, C.T. Carlsberg Assocs.	602-468-0750
CA	San Mateo, Larsen Assoc.	415-358-9559
CA	Westlake Vlg., Elkins & Assoc.	818-597-1075
CO	Denver, West Inc.	303-477-8180
FL	Melbourne, The R-Rep Co.	407-722-1900
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
WI	Hartland, Selective Sls.	414-367-1133
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
MD	W. Friendship, Consolidated Techlgs., Co.	301-442-5827
MA	Harvard, Enterprise Tech.	508-772-6003
MI	Novi, Innovative Sls. & Mktg.	313-344-8860
MN	Bloomington, Horizon Technlgs.	612-884-6515
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Ho-Ho-Kus, DJ Fisher Co.	201-652-0080
NM	Albuquerque, C.T. Carlberg Assocs.	505-899-2155
NY	Rochester, Harmon & Sullivan Assoc. Inc.	716-647-6037
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Willoughby Hills, Versatron	216-944-0082
OR	Hillsboro, Doran Sls. Assocs.	503-640-4500
PA	Harrisburg, All-Tech Mktg.	717-540-1204
PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Burleson, Bounty Elctrns.	817-447-9775
WA	Redmond, Doran Sls. Assocs.	206-885-1885

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Gardena, Cal, Switch & Signal	213-770-2330
CO	Englewood, Indelco	303-694-9444
FL	Ft. Lauderdale, KSM	305-971-5900
FL	Palm Bay, CDI	407-724-9910
IL	Northbrook, Classic	312-272-9650
IN	Indianapolis, Meunier	317-635-3511
MD	Baltimore, Resco	410-529-0500
MD	Beltsville, Resco Washington	301-937-9100
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Southfield, Michigan Lectrols	313-353-1350
MN	Minneapolis, Bergquist Elect.	612-835-2322
NM	Albuquerque, Harrison	505-343-1011
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Cary, Powell Elctrns.	919-467-1212
OH	Willoughby, Gateway Megatech	216-953-0333
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Dallas, Wofford	214-320-0294
TX	Richardson, Altair Co.	214-231-5155
UT	Salt Lake City, Kimball	801-328-2075
WI	Milwaukee, Progressive	414-321-4722
Can	Toronto, SEMAD	416-475-8500

ARI INDUSTRIES, INC., 381 ARi Court, Addison, IL 60101, Tel: 708-953-9100, 800-237-6725, FAX: 708-953-0590; FSC No.: 04849; Empl.: 56; *Sls. Mgr.:* D. J. MacKenzie; *Dist. Mgr.:* D. J. MacKenzie

ARISTO COMPUTERS INC., 6700 SW 105th Avenue, Ste. 307, Beaverton, OR 97005, Tel: 503-626-6333, 800-327-4786, FAX: 503-626-6492; *Sls. Mgr.:* Linda Fish, Ntl. Sls. Coord.

ARISTO COMPUTERS INC., 6700 SW 105th Avenue, Ste. 307, Beaverton, OR 97005, Tel: 503-626-6333, 800-327-4786, FAX: 503-626-6492; *Sls. Mgr.:* Linda Fish (Natl. Sls. Coord.)

ARISTO GRID LAMP PRODS., 35 Lumber Road, Roslyn, NY 11576, Tel: 516-484-6141, FAX: 516-484-6992; Empl.: 21

ARKAY ENGRAVERS, INC., 10-3 Drew Court, Ronkonkoma, NY 11779, Tel: 516-467-7795, FAX: 516-467-8310; FSC No.: 6Z099; Empl.: 9; *Sls. Mgr.:* Kenneth Kaplan

ARK-LES CORP, P.O.BOX 14466, Raleigh, NC 27620, Tel: 919-231-2000, FAX: 919-231-9825; Empl.: 350

ARMBAR INDUSTRIES INCORPORATED

FAX: 908-679-3222

ARMBAR INDUSTRIES, INC., 139 White Oak Lane, Old Bridge, NJ 08857, Tel: 908-679-3377; FSC No.: 2R610; Empl.: 11; *Sls. Mgr.:* Stephen Gregg .... **A•1015**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Prods.	205-880-1156
CA	Pleasanton, C.F.M.C.	510-417-0450
MD	Rockville, C.E. Tech. Elctrns.	301-983-2140
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
PA	Saegertown, Multi-Phase	814-763-3640

ARMEL ELECTRONICS, 1601 75th St., N. Bergen, NJ 07047, Tel: 201-869-4201, FAX: 201-869-4304; FSC No.: 91663; Empl.: 55; *Sls. Mgr.:* V. A. Pasqualino

ARNOLD ENGINEERING COMPANY, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152, Tel: 815-568-2000, FAX: 815-568-2228; Empl.: 650; *Sls. Mgr.:* E. F. Migely, V.P. Mktg./Sls.

ARNOLD MAGNETICS

FAX: 805-484-4113

ARNOLD MAGNETICS, 4000 Via Pescador, Camarillo, CA 93012, Tel: 805-484-4221; FSC No.: 04879; Empl.: 100; *Sls. Mgr.:* Glen Underwood .... **D•1585-1591**

Local Sales Offices & Reps

AL	Huntsville, Arnold Magnetics Corp.	800-421-8181
AZ	Phoenix, Arnold Magnetics Corp.	800-421-8181
CA	Los Angeles, Arnold Magnetics Corp.	805-484-4221
CA	San Jose, Arnold Magnetics Corp.	800-421-8181
CO	Denver, Arnold Magnetics Corp.	800-421-8181
FL	Melbourne, Arnold Magnetics Corp.	800-421-8181
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TX	Houston, Arnold Magnetics Corp.	800-421-8181
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AZ	Mesa, Sys. Sls. of Arizona, Inc.	602-464-9989
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CA	Garden Grove, Elsco	714-891-4621
CA	San Jose, Aromat Corp.	408-433-0466
CA	Santa Clara, Fahrner-Miller	408-727-9800
CO	Englewood, Omega Ltd.	303-762-1921
CT	Plainville, Northeast Reps.	203-866-6030
FL	Maitland, EIR, Inc.	407-660-9600
FL	Orlando, Aromat Corp.	407-855-1075
GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Elk Grove Village, Aromat Corp.	708-593-8535
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Manchester, Imagitron Sls.	410-374-5600
MA	Hingham, Northeast Reps.	617-749-8700
MI	Detroit, R. P. Urban & Assocs.	313-535-2355
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, Rush & West Assocs.	314-965-3322
NH	Mt. Vernon, Northeast Reps.	603-880-8199
NJ	New Providence, Aromat Corp.	908-464-3550
NJ	W. Caldwell, Mariniello Tech. Sls. Co.	201-228-4418
NM	Albuquerque, SSA Inc. of New Mexico	505-889-2901
NY	Rochester, Ontec	716-464-8636
NC	Raleigh, Beacon Elctrns. Assoc.	919-787-0330
OH	Dublin, J. R. Thornberry Co.	614-792-5171
OH	Solon, J. R. Thornberry Co.	216-248-4995
PA	Allison Park, Bear Mktg.	412-492-1150
TX	Austin, Component Technlg.	512-250-2450
TX	Dallas, Component Technlg.	214-783-8831
TX	Houston, Component Technlg.	713-961-1262
TX	Richardson, Aromat Corp.	214-235-0415
WA	Redmond, Sls. & Engrg.	206-883-4999
WA	Vancouver, Sls. & Engrg.	206-573-4161
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
Can	Mississauga, Ont., Aromat Canada, Inc.	416-624-3777
Can	Mississauga, Ont., Tech-Trek Ltd.	416-238-0366
Can	Nepean, Ont., Tech-Trek, Ltd.	613-225-5161
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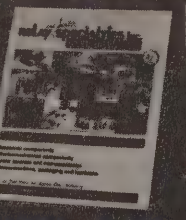

Local Distributors

AL	Huntsville, Pioneer Technlgs.	205-837-9300
AL	Huntsville, RS Elctrns.	800-859-5859
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tempe, Bell Inds.	602-966-7800
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Angoura Hills, Bell Inds.	818-706-1608
CA	Chatsworth, Mil-Comm Dist.	213-998-3111
CA	Cypress, Bell Inds.	714-895-7801
CA	Fremont, Acacia/Deanco	415-623-7500
CA	Gardena, California Switch & Signal	310-538-9830
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Los Angeles, Master Distrs.	310-399-8600
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Oakland, Master Dists.	510-835-1500
CA	San Diego, Acacia/Deanco	619-565-4365
CA	San Diego, Bell Inds.	619-268-1277
CA	San Jose, Pioneer Technlgs.	408-954-9100
CA	San Jose, Sierra West	408-435-7477
CA	Santa Monica, Brill Elctrns.	310-452-8002
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Bell Inds.	303-691-9010
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Indelco	303-694-9444
CO	Lakewood, Acacia/Deanco	303-232-2882
CO	Wheat Ridge, Acacia/Deanco	303-421-7004
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager	203-265-4600
CT	Yalesville, Glynn Elctrns.	203-265-2498
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Altamonte Springs, Pioneer Technlgs.	407-834-9090
FL	Clearwater, Pioneer Technlgs.	813-536-0445
FL	Deerfield Bch., Pioneer Technlgs.	305-428-8877
FL	Orlando, Sager	407-240-3114
GA	Concord, Dixie Elctrns.	800-277-5916
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Pioneer Technlgs.	404-448-1711
GA	Norcross, RS Elctrns.	404-242-0520
GA	Norcross, Sager Elctrcl.	404-446-0085
IL	Bensenville, Goold Elctrncs.	708-860-7171
IL	Elk Grove Vl., Bell Inds.	708-640-1910
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Control Design Supp.	317-788-4614
IN	Indianapolis, Newark Elctrns.	317-259-0085
IN	Indianapolis, RS Elctrns.	317-253-9065
MD	Gaithersburg, Pioneer Technlgs.	301-921-0660
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MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Pk., Newark Elctrns.	313-967-0600
MN	Fridley, Voyager Elctrns.	612-571-7766
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MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	St. Paul, Gopher Elctrns.	612-490-4900
MO	Maryland Heights, L Comp	314-426-3150
MO	Maryland Heights, Olive Elctrns.	314-997-7709
MO	Maryland Hgts., L-Comp	314-291-6200
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NJ	Mountainside, Mars Elctrns.	201-233-0044
NJ	Oakland, Relay Specialties	201-337-1000
NM	Albuquerque, Bell Inds.	505-292-2700
NC	Durham, Pioneer Technlgs.	919-544-5400
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NY	Rochester, Simcona Elctrns.	716-328-3230
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NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Charlotte, Pioneer Technlgs.	704-527-8188
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OH	Dayton, Bell Inds.	513-435-8660
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OH	Kettering, Elctrns. Mktg. Corp. (EMC)	513-439-4711
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OK	Oklahoma City, Newark Elctrns.	405-495-5000
OK	Tulsa, Newark Elctrns.	918-832-7004
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Lake Oswego, Bell Inds.	503-635-6500
OR	Portland, P&R Inds.	503-292-8682
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TX	Irving, Newark Elctrns.	214-256-6585
TX	Richardson, Bell Inds.	214-690-0466
TX	San Antonio, Newark Elctrns.	512-349-2641
TX	Stafford, Southwest Elctrns.	713-240-4000
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AZ	Tucson, Compass Mktg. & Sls., Inc. ...	602-293-1220
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CO	Wheatridge, Waugaman Assocs.	303-423-1020
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IL	Itasca, Janus, Inc.	708-250-9650
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IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs. ...	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs. ..	319-393-8703
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MI	Southfield, R. O. Whitesell & Assocs. ..	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MO	St. Louis, John G. Macke Co.	314-432-2830
NH	Salem, Sls. Engrg. Co.	603-893-5521
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-888-0800
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Scotch Plains, Mil Comp.	908-322-7898
NJ	Marlton, BGR Assocs.	609-983-1020
OH	Cincinnati, R. O. Whitesell & Assocs. ..	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs. ..	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Elctrn. Sources	503-627-0838
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TN	Knoxville, R. O. Whitesell & Assocs.	615-694-9476
TN	Nashville, R.O. Whitesell & Assoc.	615-352-4760
TX	Austin, Design Mktg. & Assocs.	512-263-9151
TX	Dallas, Design Mktg. & Assocs.	214-480-8151
TX	Houston, Design Mktg. & Assocs.	713-550-3318
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WA	Bellevue, Elctrn. Sources	206-451-3500

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AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tucson, Hall-Mark	602-742-0515
CA	Agoura Hills, Bell Inds.	818-879-9494
CA	Chatsworth, Hall-Mark	818-713-4500
CA	Chatsworth, Passive Comps.	818-700-8838
CA	Chula Vista, Inter Elctrns.	619-476-0577 (US)
CA	Cypress, Bell	805-499-6821
CA	Irvine, Hall-Mark	714-727-6000
CA	Rocklin, Bell Inds.	916-652-0414
CA	Rocklin, Hall-Mark	916-624-9781
CA	San Diego, Bell	619-268-1277
CA	San Diego, Hall-Mark	619-268-1201
CA	San Jose, Hall-Mark	408-432-4000
CA	San Jose, Passive Comps.	408-441-1441
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Fe Spg., Bell JIT/JDE	213-921-3611
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Bell Inds.	303-424-1985
CO	Englewood, Hall-Mark	303-790-1662
CT	Cheshire, Hall-Mark	203-271-2844
CT	Wallingford, Bell Inds.	203-269-6801
FL	Altamonte Spgs., Bell Inds.	407-339-0078
FL	Casselberry, Hall-Mark	407-830-5855
FL	Ft. Lauderdale, Bell Inds.	305-421-1997
FL	Largo, Hall-Mark	813-541-7440
FL	Melbourne, New Yorker Elect.	407-727-0955
FL	Pompano, Hall-Mark	305-971-9280
FL	Pompano Bch., Peerless	305-973-4141
FL	Tampa, Bell Inds.	813-541-4434
GA	Duluth, Hall-Mark	404-623-4400
GA	Norcross, Bell Inds.	404-662-0923
IL	Elk Grove Vlg., Bell Inds.	708-640-1910
IL	Urbana, Bell	217-328-1077
IL	Wood Dale, Hall-Mark	312-860-3800
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Bell	317-875-8200
IN	Indianapolis, Bell Inds. JIT	317-876-3740
IN	Indianapolis, Hall-Mark	317-872-8875
IN	Indianapolis, PEI/Genesis	317-879-0700
IN	South Bend, PEI/Genesis	219-287-2911
KS	Lenexa, Hall-Mark	913-888-4747
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MD	Columbia, Peerless Radio Corp.	301-997-1717
MD	Jessup, Bell Inds.	301-953-2566
MA	Andover, Bell Inds.	508-474-8880
MA	Billerica, Hall-Mark	617-935-9777
MA	Middleboro, Glynn Elctrns.	800-225-8684
MA	Middleboro, Glynn Elctrns.	800-427-4262
MI	Livonia, Hall-Mark	313-462-1205
MN	Bloomington, Hall-Mark	612-941-2600
MO	Earth City, Hall-Mark	314-291-5350
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Moorestown, Hall-Mark	609-235-1900
NJ	Parsippany, Hall-Mark	201-515-3000
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Fairport, Hall-Mark	716-425-3300
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Mamaroneck, New York Elctrn.	914-698-7600
NY	Penn Yann, Advacom Technlgs.	315-536-2221
NY	Ronkonkoma, Hall-Mark	516-737-0600
NC	Charlotte, EMC	704-394-6195
NC	Raleigh, Hall-Mark	919-872-0712
OH	Centerville, EMC	513-439-4711
OH	Cleveland, EMC	216-442-3441
OH	Columbus, EMC	614-299-4161
OH	Columbus, Hall-Mark	614-888-3313
OH	Dayton, Advacom Tech.	513-274-5900
OH	Dayton, Bell Inds.	513-434-8231
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Hall-Mark	216-349-4632
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OH	Worthington, Hall-Mark	800-767-0392
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OR	Lake Oswego, Bell Inds.	503-635-6500
PA	Bristol, Bell Inds.	215-788-5000
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PA	Philadelphia, Hall-Mark	215-355-7300
PA	Philadelphia, PEI-Genesis	215-673-0400
PA	Trevose, Bell Inds.	215-953-2800
TN	Jackson, Carlton-Bates	901-664-2714
TN	Nashville, Carlton-Bates	615-885-3232
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Hall-Mark	214-553-4300
TX	Dallas, Hall-Mark (Corp.)	214-343-5000
TX	Houston, Hall-Mark	713-781-6100
TX	Richardson, Bell Inds.	214-690-0466
UT	Salt Lake City, Bell Inds.	801-255-9611
VT	Charlotte, Kelner Elctrns.	800-323-0460
WA	Redmond, Priebe Elctrns.	206-881-2363
WA	Seattle, Bell Inds.	206-867-5410
WA	Seattle, Hall-Mark	206-547-0415
WI	New Berlin, Hall-Mark	414-797-7844
WI	Waukesha, Bell	414-547-8879

Ascent POWER TECHNOLOGY INC.

FAX: 905-660-9567

ASCENT POWER TECHNOLOGY, 146 Adesso Dr., Concord, Ont., Canada L4K3C3, Tel: 905-660-9819; Empl.: 125; *Sls. Mgr.:* Howard Gang .... **D•1592-1594**

Local Sales Offices & Reps

CA	Santa Clara, Computer Modules	408-496-1881
IA	Cedar Rapids, Rep Assocs. Corp.	319-373-0152
KY	Prospect, Keibler & Assocs.	502-228-7283
MD	Towson, Arbotek Assocs. Inc.	410-825-0775
MA	Burlington, New England Tech. Sls.	617-229-6387
NJ	Mahwah, North East Comps.	201-825-0233
NJ	Tintan Falls, McAdam Assocs.	908-870-8685
NY	E. Rochester, Empire Tech. Assoc.	716-381-8500
NY	Skaneateles, Empire Tech. Assoc.	315-685-5703
Can	Ontario, B.C., Current Mktg. Inc.	416-426-3413

ASC SYSTEMS, Box 566, St. Clair Shores, MI 48080, Tel: 313-882-1133; Empl.: 15; *Sls. Mgr.:* R. Martin; *Dist. Mgr.:* D. Leader

ASELCO, INC., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877, Tel: 301-863-1937, FAX: 301-840-1382; Empl.: 7; *Sls. Mgr.:* Yoon Kim

ASHLAND ELEC. PRODS., INC., 10 Industrial Way, POB 1380, Rochester, NH 03867, Tel: 603-335-1100, FAX: 603-335-1120; FSC No.: 04810; Empl.: 30; *Sls. Mgr.:* T.G. Dolan, Jr.; *Dist. Mgr.:* Roxanne Ramsey

ASI INSTRUMENTS, INC., 8570 Katy Freeway, Suite 116, Houston, TX 77024, Tel: 800-245-7056, FAX: 713-461-7348; Empl.: 15; *Sls. Mgr.:* Bill Walker

A.S.I. MICROSYSTEMS, INC., (Formerly Andrich Systems, Inc.), 1531 Smithtown Ave., Bohemia, NY 11716, Tel: 516-589-5656, FAX: 516-589-6094; *Sls. Mgr.:* Robert G. Andrews

ASLAN COMPUTER CORPORATION, 10922 Klingerman Ave., Bldg.4, S. El Monte, CA 91733, Tel: 818-575-5271, FAX: 818-575-0394; Empl.: 20; *Sls. Mgr.:* Chris Witham

ASPECT ELECTRONICS INC., 12740 Earhart Ave., Auburn, CA 95602, Tel: 916-887-1008, FAX: 916-887-1108; Empl.: 42; *Sls. Mgr.:* Donald Roelands

ASPEN IMAGING, International, Inc., 555 Aspen Ridge Dr., Lafayette, CO 80026-9300, Tel: 303-666-5750, 1-800-955-5555, TELEX: 45-0055; FSC No.: 84-0724829; Empl.: 380; *Sls. Mgr.:* Elizabeth Ema

ASPEN SEMICONDUCTOR CORP., 4001 North First Street, San Jose, CA 95134, Tel: 408-456-1800

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ASSEMBLED ELECTRONIC ENCLOSURES, 666-668 Tower Rd., Mundelein, IL 60060, Tel: 708-566-2030, FAX: 708-566-4712

ASSEMBLY SPECIALISTS, 14 Alpha Rd., Chelmsford, MA 01824, Tel: 508-250-5900, FAX: 508-250-5902; Empl.: 15

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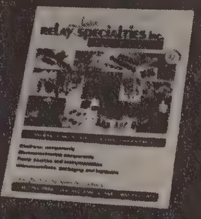

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CA	Chatsworth, Techlgs. West	818-700-6426
CA	Pleasanton, MMI	510-846-0377
CO	Morrison, Energy Equip. Sls.	303-697-0662
IN	Nobelsville, Loren Green Assocs. South	317-776-9473
NH	Nashua, Intersell	603-880-6500
TX	Richardson, J. Wisdom & Assocs., Inc.	214-470-9093
VA	Fairfax, Sci. Assocs., Inc.	703-385-0600

ASSOCIATED SPRING, BARNES GRP., 10 Main St., Bristol, CT 06010, Tel: 203-583-1331, FAX: 203-584-0727; Empl.: 1920; *Sls. Mgr.:* D.G. Ammerman

ASSURANCE TECHNOLOGIES, INC., 495 Wegner Dr., West Chicago, IL 60185, Tel: 708-231-4800, FAX: 708-231-8844; Empl.: 25; *Dist. Mgr.:* Brian K. Bagan

ASTEC HIGH VOLTAGE, C/O 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-8407, FAX: 508-879-8669; *Sls. Mgr.:* Jim Stedman **D•1596-1597**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Scottsdale, Power-Up Elctrns.	602-955-1105
CA	Dana Point, Electro Venture	714-496-5225
FL	Palm Bch. Gdns., Graham Assocs., Inc.	407-622-4049
IL	Arlington Heights, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Olathe, Tech. Sls. Assocs	913-829-2800
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Plymouth, EQS Sys.	313-455-7920
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Tech. Sls. Assocs.	314-521-2044
NH	Intersell	603-880-6500
NY	Wantagh, Bytec	516-781-7400
NC	Winston-Salem, Murcota	919-722-9445
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9570
WI	Brookfield, McMahon Sls., Inc.	414-782-3335

Local Distributors

MA	Ashland, Intl. Power Sources	508-881-7434
OH	Chesterland, EQS Sys.	216-729-2222

ASTEC

FAX: 619-439-4243

ASTEC STANDARD POWER, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880; Empl.: 600; *Sls. Mgr.:* Tom Szabo, Dir. of Sls.; *Dist. Mgr.:* Robert Claborne **D•1598-1603, 2071-2073**

Local Sales Offices & Reps

AZ	Tempe, Techni-Source Corp.	602-497-0711, FAX:602-497-1077
CA	Englewood, Omega Ltd.	303-762-1921, FAX:303-762-1928
CA	Los Gatos, Luscombe Engrg.	408-370-2020, FAX:408-374-8663
CO	Colorado Springs, Omega Ltd.	719-598-6845, FAX:719-528-5729
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120, FAX:305-977-4752
FL	St. Petersburg, QXI	813-894-4556, FAX:813-894-3989
IL	Itasca, LTD Technlgs., Inc.	708-773-2900, FAX:708-773-0358
IA	Cedar Rapids, Delltron Co., Inc.	319-393-0075, FAX:319-393-0058
MD	Pasadena, Electronic Engrg. & Sls.	410-255-9686, FAX:410-255-9688
MA	Needham, Com-Sls., Inc.	617-444-8071, FAX:617-449-8047
MN	Edina, Ohms Technlg., Inc.	612-932-2920, FAX:612-932-2918
MO	Florissant, Delltron Co. Inc.	314-839-0033, FAX:314-839-4290
MO	Kansas City, Delltron Co., Inc.	816-436-6445, FAX:816-436-9982
NJ	Moorestown, T.A.I. Corp.	609-778-5353, FAX:609-778-7828
NM	Albuquerque, Techni-Source Corp.	505-268-4232, FAX:505-268-0451
NY	Clarence Ctr., Leonard D. Allen	716-634-5403, FAX:716-634-5404
NY	Melville, Parallax	516-351-1000, FAX:516-351-1606
NY	Pittsford, Leonard D. Allen	716-377-3530
NY	Syracuse, Leonard D. Allen	315-437-8387, FAX:315-437-3710
NC	Raleigh, R.W. Mitscher Co., Inc.	919-848-0941, FAX:919-848-9156
OH	Englewood, Carter, McCormic & Peirce	513-836-0951,FAX:513-836-2358
OR	Portland, ES/Chase Co., Inc.	503-292-8840, FAX:503-292-8827
TX	Austin, Milco Mktg., Inc.	512-343-1275, FAX:512-343-0980
TX	Missouri City, Milco Mktg., Inc	713-261-7843, FAX:713-469-5156
TX	Plano, Milco Mktg., Inc.	214-578-8827, FAX:214-578-7026
WA	Kirkland, ES/Chase Co., Inc.	206-823-9535, FAX:206-821-7257
WI	Milwaukee, LTD Technlgs., Inc.	414-774-1000, FAX:414-774-0593
Can	Brampton,Ont., Cantec Reps.	416-791-5922, FAX:416-791-7940
Can	Ottawa, Ont., Cantec Reps.	613-725-3704, FAX:613-725-0490
Can	St. Eustache, Que., Cantec Reps.	514-623-5496, FAX:514-623-5482

Local Distributors

AL	Birmingham, Newark	205-979-7003
AL	Huntsville, Future	205-830-2322
AL	Huntsville, Newark	205-837-9091
AL	Huntsville, Reptron	205-722-9500
AL	Mobile, Newark	205-471-6500
AL	Montgomery, Newark	205-270-8074
AK	Newark	800-321-8984
AZ	Phoenix, Future	602-968-7140
AZ	Phoenix, Newark	602-742-9905
AZ	Tempe, RicheyCypress	602-966-8856
AR	Little Rock, Newark	501-225-8130
CA	Camarillo, Milgray	805-484-4055
CA	Chatsworth, Future	818-772-6240
CA	Citrus Hgts., Newark	916-721-1633
CA	Corona, Compumech	714-278-4761
CA	Dublin, Newark	415-572-8300
CA	Garden Grove, RicheyCypress	714-895-0060
CA	Garden Grove, RicheyCypress	714-898-8288
CA	Irvine, Future	714-250-4141
CA	Irvine, Milgray	714-753-1282
CA	Los Angeles, Newark	213-664-5252
CA	Los Angeles, Newark	818-242-1900
CA	Milpitas, Compumech	408-945-9100
CA	Orange, Newark	714-634-8224
CA	San Diego, Future	619-625-2800
CA	San Diego, Newark	619-453-8211
CA	San Diego, RicheyCypress	619-271-4511
CA	San Jose, Future	408-434-1122
CA	San Jose, Milgray	408-456-0900
CA	San Jose, Newark	408-559-6900
CA	San Jose, RicheyCypress	408-956-8010
CA	Sun Valley, RicheyCypress	818-768-0403
CA	Thousand Oaks, Compumech	805-492-6299
CA	Ventura, Newark	805-644-2265
CO	Colorado Springs, Newark	719-576-2644
CO	Denver, Newark	303-757-3351
CO	Englewood, RicheyCypress	303-792-5829
CO	Lakewood, Future	303-232-2008
CT	Bethel, Future	203-743-9594
CT	Bloomfield, Newark	203-243-1731
CT	E. Hartford, Newark	203-289-1416
CT	Meriden, Newark	203-630-2239
CT	Milford, Milgray	203-878-5538
CT	Newton, Target	203-426-4403
CT	Seymore, Target	203-888-1480
FL	Altamonte Springs, Future	407-767-8414
FL	Boca Raton, Newark	407-241-0605
FL	Bradenton, Newark	813-755-7910
FL	Clearwater, Newark	813-443-0661
FL	Ft. Lauderdale, Reptron	305-735-1112
FL	Ft. Meyers, Newark	813-275-6310
FL	Jacksonville, Newark	904-399-5041
FL	Lake Mary, Milgray	407-321-2555
FL	Largo, Future	813-530-1222
FL	Melbourne, Newark	407-727-7308
FL	Miami, Newark	305-593-2686
FL	Orlando, Newark	407-896-8350
FL	Plantation, Newark	305-424-1566
FL	Tampa, Newark	813-287-1578
FL	Tampa, Reptron	813-854-2000
FL	Tampa, Reptron	813-854-2351
FL	Tampa, Reptron	813-855-4650
GA	Atlanta, Newark	404-448-8500
GA	Atlanta, Newark	404-761-9902
GA	Atlanta, Newark	404-951-2363
GA	Macon, Newark	912-743-2446
GA	Norcross, Future	404-441-7676
GA	Norcross, Milgray	404-446-9777
GA	Norcross, Newark	404-448-1300
GA	Norcross, Reptron	404-446-1300
HI	Aiea, Newark	806-487-8951
ID	Boise, Newark	208-342-4311
IL	Addison, Newark	708-495-7740
IL	Arlington Hgts., Newark	708-392-9009
IL	Aurora, Newark	708-820-2411
IL	Chicago, Hallmark	708-860-3800
IL	Chicago, Newark	312-792-8233
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Decatur, Newark	217-875-4411
IL	Glenview, Compumech	708-998-8264
IL	Hoffman Estates, Future	708-882-1255
IL	Libertyville, Newark	708-362-2248
IL	Palatine, Milgray	708-202-1900
IL	Palos Hills, Newark	708-430-0690
IL	Peoria, Newark	309-693-3771
IL	Rockford, Newark	815-229-0225
IL	Schaumburg, Newark	708-310-8980
IL	Schaumburg, Newark	708-843-0700
IL	Schaumburg, Reptron	708-882-1700
IL	Springfield, Newark	217-787-9972
IN	Evansville, Newark	812-423-2552
IN	Ft. Wayne, Newark	219-484-0766
IN	Indianapolis, Custom Svc. Elec.	317-879-9119
IN	Indianapolis, Newark	317-884-0047
IN	Merriville, Newark	219-738-2787
IA	Bettendor, Newark	319-359-3711
IA	Cedar Rapids, Newark	319-393-3800
IA	Des Moines, Newark	515-278-0670
KS	Overland Park, Newark	913-677-0727
KS	Overland Pk., Milgray	913-236-8800
KS	Wichita, Newark	316-267-8755
KY	Lexington, Newark	605-266-6446
KY	Louisville, Newark	502-423-0280
LA	Metairie, Newark	504-838-9771
MD	Beltsville, Newark	301-604-1700
MD	College Pk., Newark	301-982-9711
MD	Columbia, Future	410-290-0600
MD	Columbia, Milgray	410-995-6169
MD	Columbia, Newark	301-964-4482
MD	Hanover, Newark	410-712-6922
MD	Timonium, Newark	410-560-2886
MD	Wheaton, Newark	301-949-9665
MA	Bolton, Future	508-779-3000
MA	Braintree, Target	617-848-9330
MA	Gardner, Computech	508-630-2909
MA	Methuen, Newark	508-683-0913
MA	Methuen, Newark	508-688-1837
MA	W. Springfield, Newark	413-785-5851
MA	Walpole, Newark	508-660-1071
MA	Walpole, RicheyCypress	508-668-8200
MA	Waltham, Newark	617-894-8050
MA	Westwood, Target	617-329-2700
MA	Wilmington, Milgray	508-657-5900
MA	Woburn, Newark	617-932-9040
MA	Woburn, Newark	617-935-8350
MA	Worcester, Newark	508-757-4515
MI	Detroit, Newark	313-967-0600
MI	Farmington Hills, Newark	313-737-5150
MI	Flint, Royalite	313-238-4641
MI	Gaylord, Reptron/K-Byte	517-732-6244
MI	Grand Rapids, Future	616-249-3200
MI	Grand Rapids, Newark	616-455-9190
MI	Livonia, Future	313-261-5270
MI	Livonia, Reptron	313-525-2700
MI	Oak Park, Newark	313-967-0600
MI	Saginaw, Newark	517-799-0480
MI	Traverse City, Newark	616-929-2313
MI	Troy, Newark	313-680-9110
MN	Burnsville, Newark	612-890-0584
MN	Crystal Bay, Newark	612-535-4280
MN	Duluth, Newark	218-727-4776
MN	Eden Prairie, Future	612-944-2200
MN	Eden Prairie, Richeycypress	612-934-2104
MN	Minneapolis, Newark	612-331-6350
MN	Minnetonka, Reptron	612-938-0000
MN	St. Paul, Newark	612-631-2683
MN	Vadnais Hgts., Reptron	612-481-0756
MS	Jackson, Newark	601-956-3834

MS	Tupelo, Newark	601-840-0305
MO	Crestwood, Newark	314-821-7466
MO	Independence, Newark	816-478-0561
MO	Springfield, Newark	417-886-0092
MO	St. Louis, Future	314-469-6805
MO	St. Louis, Newark	314-296-2505
MT	Helena, Newark	406-443-6192
NE	Omaha, Newark	402-592-2423
NV	Las Vegas, Newark	702-597-0330
NV	Reno, Newark	702-322-6090
NH	Derry, Target	603-434-8440
NH	Nashua, Newark	603-888-5790
NH	Salem, Diamond	603-894-4420
NH	Salem, Sager	603-894-4420
NJ	Bordentown, Newark	609-298-4450
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NJ	E. Brunswick, Newark	908-937-6600
NJ	Fairfield, Newark	201-882-0300
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NJ	Marlton, Milgray	609-983-5010
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NY	Farmingdale, Milgray	516-420-9800
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Fishkill, Newark	914-896-4190
NY	Hauppauge, Future	516-234-4000
NY	Latham, Newark	518-783-0083
NY	Long Island, Sager Elctrns.	516-348-1300
NY	Pittsford, Milgray	716-381-9700
NY	Pittsford, Newark	716-381-4244
NY	Rochester, Future	716-272-1120
NY	Syracuse, Future	315-451-2371
NY	Syracuse, Newark	315-437-6611
NC	Charlotte, Newark	704-535-5650
NC	Concord, Future	704-455-9030
NC	Greensboro, Newark	919-292-7240
NC	Greensboro, Newark	919-294-2142
NC	High Point, Newark	919-884-8881
NC	Raleigh, Future	919-790-7111
NC	Raleigh, Milgray	919-790-8094
NC	Raleigh, Newark	919-781-7677
NC	Raleigh, Reptron	919-870-5189
NC	Wilmington, Newark	919-791-9393
OH	Akron, Newark	216-374-9987
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cincinnati, Hughes Peters	800-899-8228
OH	Cincinnati, Newark	513-771-9700
OH	Cincinnati, Newark	513-772-8181
OH	Cleveland, Milgray	216-447-1520
OH	Cleveland, Newark	216-391-9330
OH	Columbus, Hughes Peters	614-294-5351
OH	Columbus, Newark	614-431-0809
OH	Columbus, Newark	614-481-8141
OH	Dayton, Newark	513-294-8980
OH	Mayfield Hgts., Future	216-449-6996
OH	Parma Hgts., Newark	216-886-0505
OH	Solon, Reptron	216-349-1415
OH	Toledo, Newark	419-866-0404
OH	Valley View, Newark	216-447-8860
OH	Warrensville, Newark	216-587-1700
OH	Worthington, Reptron	614-436-6675
OH	Youngstown, Newark	216-793-6134
OH	Zanesville, Newark	614-454-6704
OK	Oklahoma City, Newark	405-495-5000
OK	Tulsa, Newark	918-252-5070
OR	Beaverton, Future	503-645-9454
OR	Portland, Newark	503-257-0741
PA	Allentown, Newark	609-434-7171
PA	Freeport, Newark	412-295-4400
PA	King of Prussia, Newark	215-265-0933
PA	Malvern, Newark	215-296-5522
PA	Philadelphia, Newark	215-245-7300
PA	Pittsburgh, Newark	412-367-2790
PA	Pittsburgh, Newark	412-788-4790
PA	Pittsburgh, Newark	412-823-5150
SC	Columbia, Newark	803-798-0198
SC	Greenville, Newark	803-288-9610
SC	N. Charleston, Newark	803-764-3091
TN	Brentwood, Newark	615-371-1341
TN	Chattanooga, Newark	615-899-0056
TN	Jackson, Newark	901-664-6076
TN	Knoxville, Newark	615-588-6493
TN	Memphis, Newark	901-365-8060
TX	Austin, Future	512-502-0991
TX	Austin, Newark	512-338-0287
TX	Dallas, Hall-Mark Elctrns.	214-553-4300
TX	Dallas, Milgray	214-248-1603
TX	El Paso, Newark	915-778-5322
TX	Ft. Worth, Newark	817-589-1295
TX	Houston, Future	713-556-8696
TX	Houston, Newark	713-270-4800
TX	Irving, RicheyCypress	214-255-0065
TX	Richardson, Future	214-437-2437
TX	Stafford, Milgray	713-240-5360
UT	Murray, Milgray	801-261-2999
UT	Salt Lake City, Future	801-972-8489
UT	Salt Lake City, Newark	801-261-5660
VT	Burlington, Newark	802-282-5671
VT	Burlington, Newark	802-860-1856
VA	Arlington, Newark	703-522-7552
VA	Chantilly, Newark	703-471-7447
VA	Richmond, Newark	802-282-5671
VA	Roanoke, Newark	703-345-7001
VA	Virginia Bch., Newark	804-499-0719
WA	Bellvue, Newark	206-641-9800
WA	Bothell, Future	206-489-3400
WA	Seattle, RicheyCypress	206-575-1910
WA	Spokane, Newark	509-327-1935
WV	Dunbar, Newark	304-768-6872
WI	Brookfield, Newark	414-783-6566
WI	Green Bay, Newark	414-494-1400
WI	Madison, Newark	608-221-4738
WI	Milwaukee, Newark	414-453-9100
WI	Waukesha, Future	414-786-1884
Can	Calgary, Alb., Future	403-250-5550
Can	Edmonton, Alb., Future	403-438-2858
Can	Laval, Que., Newark	514-681-6476
Can	London, Ont., Newark	519-685-4280
Can	Markham, Ont., Carsten	416-477-7705
Can	Mississauga, Ont., Future	416-612-9200
Can	Mississauga, Ont., Milgray	416-678-0958
Can	Mississauga, Ont., Newark	416-670-2888
Can	Mississauga, Ont., Newark	416-670-7799
Can	Montreal, Que., Newark	514-738-4488
Can	Nepean, Ont., Carsten	613-564-0622
Can	Ottawa, Ont., Future	613-820-8313
Can	Pointe Claire, Que., Future	514-426-5900
Can	Pointe Claire, Que., Future	514-694-7710
Can	Quebec, que., Future	418-877-6666
Can	St. Laurent, Que., Carsten	514-334-8321
Can	Vancouver, BC, Future	604-294-1166
Can	Westminster, BC, Newark	604-520-5721
Can	Winnipeg, Man., Future	204-786-7711

ASTER, a Porta Systems Company, 86 South Street, Hopkinton, MA 01748, Tel: 508-435-0101; *Sls. Mgr.:* Lou Maiolo

ASTRO DYNAMICS, INC., 2 Gill St., Woburn, MA 01801, Tel: 617-935-4944, FAX: 617-935-4982; Empl.: 50; *Sls. Mgr.:* Leo Donahue

ASTRO-GEO-MARINE, INC., 2186 Knoll Dr. B, Ventura, CA 93003, Tel: 805-654-8300, FAX: 805-654-8314; FSC No.: 51473; Empl.: 12

ASTRO INSTRUMENT CORP., 450 Goolsby Blvd., Deerfield, FL 33442-3019, Tel: 305-698-6000, FAX: 305-698-6011; FSC No.: 51761; *Sls. Mgr.:* Peter J. Sinatra, Jr.

ASTRO INTERNATIONAL CORP., 100 Park Ave., League City, TX 77573, Tel: 713-332-2484, FAX: 713-554-6795; Empl.: 50; *Sls. Mgr.:* Curt Nicholls

ASTROMEC, INC., 2950 Arrowhead Dr., Carson City, NV 89706, Tel: 702-883-9226, FAX: 702-883-9228; Empl.: 40; *Sls. Mgr.:* Ken Irvin

Ai

FAX: 401-822-2430

ASTRO-MED, INC., 600 East Greenwich Avenue, W. Warwick, RI 02893, Tel: 401-828-4000, TWX: 710-382-6409; FSC No.: 6625; Empl.: 225; *Sls. Mgr.:* Everett V. Pizzuti .... **D•1410-1412**

ASTROSYSTEMS, INC., 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600, FAX: 516-328-1658; *Sls. Mgr.:* Howard Lazarus; *Dist. Mgr.:* Roy Hartmann, Sls. Mgr. .... **D•2244-2249**

ASTRO TOOL CORP., 21615 Southwest Tualatin Valley Hwy., Beaverton, OR 97006, Tel: 503-642-9853, FAX: 503-591-7766

A-SYSTEMS INC., 1500 Avon St. Extd., Charlottesville, VA 22902, Tel: 804-295-7200, FAX: 804-295-7201; Empl.: 45; *Sls. Mgr.:* F. M. Artrip

AT&T Capital Corporation

FAX: 214-456-4002

AT&T CAPITAL CORPORATION, 1830 West Airfield Dr., DFW Airport, TX 75261-9260, Tel: 800-874-7123; Empl.: 220 .... **D•1228-1233**

AT&T Microelectronics

FAX: 215-778-4106

AT&T MICROELECTRONICS, 555 Union Blvd., 500404000, Allentown, PA 18103, Tel: 1-800-372-2447, In Can.:1-800-553-2448 .... **A•1334-1335, 2268-2271; D•1604-1607**

Local Sales Offices & Reps

AZ	Phoenix, AT&T Microelectronics	602-844-6529
CA	Cypress, AT&T Microelectronics	714-220-6223
CA	Santa Clara, AT&T Microelectronics	408-980-3700
CO	Denver, AT&T Microelectronics	303-290-3708
GA	Norcross, AT&T Microelectronics	404-446-4700
IL	Itasca, AT&T Microelectronics	708-290-3335
MA	Framingham, AT&T Microelectronics	508-626-2161
MN	Bloomington, AT&T Microelectronics	612-885-4300
NY	Poughkeepsie, AT&T Microelectronics	914-485-7744
NC	Raleigh, AT&T Microelectronics	919-881-8023
OR	Portland, AT&T Microelectronics	503-244-3883
PA	Allentown, AT&T Microelectronics	215-770-3343
TX	Irving, AT&T Microelectronics	214-869-2040

Local Distributors

AL	Huntsville, Arrow/Schweber	205-837-6955
AZ	Tempe, Anthem	602-966-6600
AZ	Tempe, Arrow/Schweber	602-431-0030
CA	Calabasas, Arrow/Schweber	818-880-9686
CA	Chatsworth, Anthem	818-775-1333
CA	Irvine, Anthem	714-768-4444
CA	Rocklin, Anthem	916-624-9744
CA	San Diego, Anthem	619-453-9005
CA	San Diego, Arrow/Schweber	619-565-4800
CA	San Jose, Anthem	408-452-2219
CA	San Jose, Arrow/Schweber	408-441-9700
CA	San Jose, Capstone	408-453-9804
CA	San Jose, Merit	408-434-0800
CA	Tustin, Arrow/Schweber	714-587-0404
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone	303-375-1300
CO	Englewood, Anthem	303-790-4500
CO	Englewood, Arrow/Schweber	303-799-0258
CT	Wallingford, Arrow/Schweber	203-265-7741
CT	Waterbury, Anthem	203-575-1575
FL	Deerfield Beach, Arrow/Schweber	305-429-8200
FL	Lake Mary, Arrow/Schweber	407-333-9300
GA	Duluth, Arrow/Schweber	404-497-1300
IL	Itasca, Arrow/Schweber	708-250-0500
IL	Itasca, Capstone	708-250-0300
IL	Schaumburg, Anthem	708-884-0200
IN	Indianapolis, Arrow/Schweber	317-299-2071
IA	Cedar Rapids, Arrow/Schweber	319-395-7230
KS	Lenexa, Arrow/Schweber	913-541-9542
MD	Columbia, Anthem	301-995-6640
MD	Columbia, Arrow/Schweber	301-596-7800
MA	Wilmington, Anthem	508-657-5170
MA	Wilmington, Arrow/Schweber	508-658-0900
MA	Wilmington, Capstone	508-657-5874
MI	Livonia, Arrow/Schweber	313-462-2290
MN	Eden Prairie, Anthem	612-944-5454
MN	Eden Prairie, Arrow/Schweber	612-941-5280
NJ	Holmdel, Arrow/Schweber	908-949-4700
NJ	Marlton, Arrow/Schweber	609-596-8000
NJ	Marlton, Capstone	609-596-7500
NJ	Pine Brook, Anthem	201-227-7960
NJ	Pine Brook, Arrow/Schweber	201-227-7889
NY	Commack, Anthem	516-493-6600
NY	Hauppauge, Arrow/Schweber	516-231-1000
NY	Melville, Arrow/Schweber	516-391-1300
NY	Rochester, Arrow/Schweber	716-427-0300
NC	Raleigh, Arrow/Schweber	919-876-3132
NC	Raleigh, Capstone	919-954-0600
OH	Centerville, Arrow/Schweber	513-435-5563
OH	Solon, Arrow/Schweber	216-248-3990
OK	Tulsa, Arrow/Schweber	918-252-7537
OR	Beaverton, Anthem	503-643-1114

OR	Beaverton, Arrow/Schweber	503-629-8090
PA	Horsham, Anthem	215-443-5150
PA	Pittsburgh, Arrow/Schweber	412-963-6807
TX	Austin, Arrow/Schweber	512-835-4180
TX	Carrollton, Arrow/Schweber	214-380-6464
TX	Carrollton, Capstone	214-380-9049
TX	Houston, Arrow/Schweber	713-530-4700
TX	Richardson, Anthem	214-238-7100
UT	Salt Lake City, Anthem	801-973-8555
UT	Salt Lake City, Arrow/Schweber	801-973-6913
WA	Bellevue, Almac	206-643-9992
WI	Brookfield, Arrow/Schweber	414-792-0150
Can	Dorval, Que., Arrow/Schweber	514-421-7411
Can	Mississauga, Ont., Capstone	416-670-2010
Can	Nepean, Ont., Arrow/Schweber	416-670-7769

AT&T NETWORK SYSTEMS,NETWORK CABLE SYS. DIV., 111 Madison Ave., Morristown, NJ 07962, Tel: 1-800-344-0223, Ext. 1027

ATC-FROST MAGNETICS INC., 1130-Eighth Line, Oakville,Ont., Canada L6H 2R4, Tel: 416-844-6681, FAX: 416-844-6895; Empl.: 180; *Sls. Mgr.:* C.M. Webb

ATC POWER SYSTEMS, INC., 45 Depot St., Merrimack, NH 03054, Tel: 603-429-0391, FAX: 603-429-0795; FSC No.: 61814; Empl.: 40; *Sls. Mgr.:* Robert L. Grant, Jr. Sls. Mgr.

ATEC, INC., 8219 Kempwood Dr., Houston, TX 77055, Tel: 713-468-7971, FAX: 713-468-6585; FSC No.: 09552; Empl.: 70; *Sls. Mgr.:* R.L. Rainwater

ATE SUPER TECHS, 4031 NE 17 Terr., Pompano Beach, FL 33064, Tel: 800-780-6343, 305-941-6343, 305-973-0996, FAX: 305-941-9413; *Sls. Mgr.:* Desmond James

ATHENA CONTROLS, INC., 5145 Campus Dr., Whitemarsh Ind. Campus, Plymouth Meeting, PA 19462, Tel: 215-828-2490, FAX: 215-828-7084; Empl.: 70; *Sls. Mgr.:* Douglas Crowell

ATI (AHAM TOR INC.), 999 Company, P.O. Box 9019, Temecula, CA 92390-0739, Tel: 714-676-4151, FAX: 714-676-3031

ATI TECHNOLOGIES INC., 3761 Victoria Park Ave., Scarborough, Ont., Canada M1W 3S2, Tel: 416-756-0718, FAX: 416-756-0720; Empl.: 430; *Sls. Mgr.:* Jon Turner, VP-OEM Sls.

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ATKINS TECHNICAL INC., 3401 S.W. 40th Blvd., Gainesville, FL 32608, Tel: 904-378-5555, FAX: 904-335-6736; Empl.: 45; *Sls. Mgr.:* Robert M. Atkins; *Dist. Mgr.:* Kenneth A. Robinson

ATLANTA SIGNAL PROCESSORS, INC., 770 Spring Street N.W., Atlanta, GA 30308, Tel: 404-892-7265, FAX: 404-892-2512; Empl.: 20; *Sls. Mgr.:* William E. Jouris

ATLANTIC MAGNETICS, INC., 1441 S.W. 30th Ave., Pompano Beach, FL 33069, Tel: 305-979-7920, FAX: 305-978-3788; Empl.: 37; *Sls. Mgr.:* Edward Cammarata; *Dist. Mgr.:* Scott Thompson

ATLANTIC OPTICAL MOULDING, Ellis St., P.O. Box 309, Webster, MA 01570, Tel: 508-943-1746; Empl.: 6

ATLANTIC SCIENTIFIC CORPORATION, 4300 Fortune Pl., Ste. A, W. Melbourne, FL 32904, Tel: 1-800-544-4737, FAX: 407-727-0736; Empl.: 50; *Sls. Mgr.:* Bill Purcell, V.P.

ATLAS ENERGY SYSTEMS, INC., 713 W. Duarte Rd., Bldg. G299, Arcadia, CA 91007, Tel: 818-575-0755, FAX: 818-575-0665; Empl.: 30; *Sls. Mgr.:* James LoGudice; *Dist. Mgr.:* James LoGudice

ATLAS ENGINEERING CORP., 10 Cheney St., Dorchester, MA 02121, Tel: 617-445-7100, FAX: 617-445-4942; FSC No.: 07001; Empl.: 75; *Sls. Mgr.:* Levi Fears

ATLAS/SOUNDOLIER, COMMERCIAL SOUND DIV., Atapco Security & Communications Group, 1859 Intertech Dr., Fenton, MO 63026, Tel: 314-349-3110, FAX: 314-349-1251; *Sls. Mgr.:* Bud Waters, Natl. Sls. Mgr.

ATLAS/SOUNDOLIER, INDUSTRIAL CABINET DIV., Atapco Security & Communications Grp., 1859 Intertech Dr., Fenton, MO 63026, Tel: 314-349-3110, FAX: 314-349-1251; *Sls. Mgr.:* Gary Shamel, Indl. Cabinet Div./Sls. Mgr.

ATLEE INC., 10 Bayfield Dr., North Andover, MA 01845, Tel: 508-681-1003, TELEX: 928252, FAX: 508-686-2934; FSC No.: 99378; Empl.: 20; *Sls. Mgr.:* Tom Fiocco; *Dist. Mgr.:* Tom Fiocco .... **C•1015, 1671**

Local Sales Offices & Reps

MA	Sharon, Cummings Assocs.	617-784-5600
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Arlington, Rem-Air Corp.	214-234-1069

Local Distributors

CA	Anaheim, Bisco Inds.	714-635-0380
CA	San Jose, Bisco Inds.	408-946-8980
IL	Franklin Pk., Bisco Inds.	312-451-1230
MA	Marlboro, Hardware Specialties	617-481-8622
MA	N. Andover, Atlee, Direct	508-681-1003
MA	Winchester, Webb	617-729-5800
MA	Woburn, Bisco Inds.	617-938-8590
MN	Minneapolis, Aerospace Computer	612-884-4725
NJ	Paramus, N.Y. Fastener	201-265-8770
NY	Long Island City, Hardware Specialty	212-361-9393
NY	Plainview, G & B Fasteners	516-694-0990

ATMEL CORPORATION, 2125 O'Nel Drive, San Jose, CA 95131, Tel: 408-441-0311, FAX: 408-436-4200; Empl.: 875; *Dist. Mgr.:* Dave Walton

ATOMERGIC CHEMETALS CORP., 222 Sherwood Ave., Farmingdale, NY 11735-1718, Tel: 516-694-9000, TWX: 6852289, FAX: 516-694-9177; Empl.: 30; *Sls. Mgr.:* A. Pensiero

ATV RESEARCH, INC., 1301 Broadway, Dakota City, NE 68731, Tel: 402-987-3771; *Sls. Mgr.:* Mel Shadbolt

THE AUBURN MANUFACTURING COMPANY, 29 Stack Street/P.O. Box 251, Middletown, CT 06457-0251, Tel: 203-346-6677, FAX: 203-346-1334; Empl.: 45; *Sls. Mgr.:* Gary L. Mittelman, VP

AUDIO PRECISION, INC., PO Box 2209, Beaverton, OR 97075-3070, Tel: 503-627-0832, TELEX: 283957 AUDIO UR, FAX: 503-641-8906; Empl.: 33; *Sls. Mgr.:* Thomas Mintner

AUDIOSEARS, South St., Stamford, NY 12167, Tel: 607-652-7305, 800-533-7863, FAX: 607-652-3653; FSC No.: 97101; Empl.: 120; *Sls. Mgr.:* Fred Rosscoe

AUDIOTRONICS CORP., 7428 Bellaire Ave., N. Hollywood, CA 91605, Tel: 818-765-2645, TELEX: 69-1241; Empl.: 14; *Sls. Mgr.:* Gordon Anderson

AUDRE, INC., 10915 Technology Place, San Diego, CA 92127, Tel: 619-451-2260, FAX: 619-451-0267; Empl.: 50

AUGAT ALCOSWITCH, Augat Inc., 452 John Dietsch Blvd., Attleboro Falls, MA 02763, Tel: 508-699-9800, FAX: 508-699-6717; FSC No.: 95146; Empl.: 150; *Sls. Mgr.:* Gillis Mellen

AUGAT, INC., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703, Tel: 508-222-2202, TWX: 710-391-0644, FAX: 508-222-0693; *Sls. Mgr.:* Gillis Mellen; *Dist. Mgr.:* Dick Thorpe

AUGAT/RDI, 525 Randy Rd., Carol Stream, IL 60188, Tel: 708-682-4100, FAX: 708-682-4562; FSC No.: 53337; Empl.: 85; *Sls. Mgr.:* Jim Steranko, Prod. Mgr.; *Dist. Mgr.:* Jim Steranko, Prod. Mgr.

FAX: 612-493-1911

AULT, INCORPORATED, 7300 Boone Ave. N, Minneapolis, MN 55428, Tel: 612-493-1900; Empl.: 300; *Sls. Mgr.:* Greg Harris .... **D•1608-1609**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Santa Clara, Magna Sls.	408-727-8753
CT	Wallingford, Marathon Sls., LTD	203-663-2734
FL	Deerfield Bch., Sls. Engrg. Concepts Inc.	305-426-4601
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, MSI	708-285-1000
IA	Des Moines, Spectrum Sls.	913-648-6811
MA	Framingham, Marathon Sls., LTD	508-875-3566
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, Cahill, Schmitz & Cahill	612-646-7217
MO	St. Louis, Beams Co.	314-434-8448
NJ	Fairfield, T.A.M.	201-575-4130
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Jas. J. Backer Co.	503-627-0775
PA	Philadelphia, All-Tech Mktg.	717-540-1204
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

CA	Huntington Bch., House of Batteries	800-432-3385
Can	Markham, Deskin Sls.	416-475-1412
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Van Nuys, Natl. Electro Sls. Corp.	800-423-2664
MA	Wilmington, North Star Elctrns.	508-657-5155
NJ	Clifton, Vantage Comps.	201-777-4100
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Columbus, Promark/EMC	614-299-4161
TX	Fort Worth, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Std. Supp. Co.	801-453-3371
WA	Seattle, Radar Elec.	206-282-2511

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100, FAX: 201-242-5796; Empl.: 60; *Sls. Mgr.:* Michael Aleksinas

AUSTRIA MIKRO SYSTEME INTERNATIONAL, Schloss Premstaetten, Unterpremstaetten, Austria A-8141, Tel: (03136) 500, TELEX: 312547 AMS A, FAX: (03136)52501,53650; Empl.: 600; *Sls. Mgr.:* Mr. Wilfried Beie

AUSTRON, INC., See FTS Austron

AUTEC POWER SYSTEMS

FAX: 805-522-8777

AUTEC POWER SYSTEMS, 69 Moreland Rd., Simi Valley, CA 93065, Tel: 805-522-0888; Empl.: 100; *Sls. Mgr.:* Bill Glynn; *Dist. Mgr.:* Jeanne Hirsch .... **D•1610-1615**

Local Sales Offices & Reps

CA	Bonsall, Power Specialists	619-726-4799
CA	Los Alamitos, Power Specialists	310-594-9418
CA	Mountain View, Straube Assocs., Inc.	415-969-6060
CA	Simi Valley, Power Specialists	805-581-4785

OH	Dayton, The Lyons Corp.	513-278-0714
OH	Richfield, The Lyons Corp.	216-659-9224
OH	Westerville, The Lyons Corp.	614-895-1447
OR	Beaverton, Blair-Hirsh Co.	503-641-1875
WA	Lynnwood, Blair-Hirsh Co.	206-774-8151
Can	Kanata, Ont., CMT Renmark, Inc.	613-591-9555
Can	Mississauga, Ont., CMT Renmark, Inc.	416-612-0900
Can	Pointe Claire, Que., CMT Renmark, Inc.	514-694-6088

Local Distributors

CA	Corona, Compumech Elctrns.	714-278-4761
CA	Milpitas, Compumech Elctrns.	408-945-9100
CA	Thousand Oaks, Compumech Elctrns.	805-495-6299
IL	Glennview, Compumech Elctrns.	708-998-8264
MA	Gardner, Compumech Elctrns.	508-630-2909

AUTOMATED PRODUCTION CONCEPTS, 63 Hillside Terrace, Wayne, NJ 07470, Tel: 201-831-8300, FAX: 201-633-7755; Empl.: 4

AUTOMATIC COIL CORP., 3545 N.W. 71st Street, Miami, FL 33147, Tel: 305-696-6660, FAX: 305-696-0626; FSC No.: 03765; Empl.: 245; *Sls. Mgr.:* Joseph Keith, VP, Sls. Mgr.

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, TELEX: 136422, FAX: 1-201-966-2628; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC TIMING AND CONTROLS, Sycon Corp., 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-8827; Empl.: 300; *Sls. Mgr.:* J.M. Tornetta

AUTOMATION COMPONENT TECHNOLOGY, 41305 Albrae At., Fremont, CA 94538, Tel: 510-226-0900, 510-490-3587 (Sales), FAX: 510-226-0769; Empl.: 28; *Sls. Mgr.:* George Holman, Sls. Mgr.

AUTOMATION DISPLAYS INC., 3533 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595, FAX: 715-834-9596; Empl.: 21

AUTOMATION ELCTRNS., R.J.A. Inds., Inc., 9640 Topanga Cyn Pl., Chatsworth, CA 91311, Tel: 818-998-5124, FAX: 818-998-6654; Empl.: 25; *Sls. Mgr.:* Robert J. Aiani

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, TELEX: 775-959, FAX: 713-869-7332

AUTOMATIX INC., 755 Middlesex Turnpike, Billerica, MA 01821, Tel: 506-667-7900, FAX: 508-663-5482; Empl.: 65; *Sls. Mgr.:* Peter Mayek, Dir. of Sls.

AUTOMOTION, INC., 683 Airport Blvd., Ann Arbor, MI 48108, Tel: 313-662-7771, FAX: 313-662-3707; Empl.: 25; *Sls. Mgr.:* David E. Drenning .... **B•1240**

Local Sales Offices & Reps

CA	Valencia, Blair Randle & Assoc.	805-259-3326
CA	Watsonville, Techrep North	408-761-2244
CT	Newtown, Sturdy Corp.	203-426-4403
CT	Seymour, Sturdy Corp.	203-888-1480
IL	St. Charles, Arrowhead Automation	708-584-0058
MA	Braintree, Sturdy Corp.	617-848-9330
MA	Westwood, Sturdy Corp.	617-326-8300
MN	Little Canada, Assured Sls.	612-482-1309
NH	Derry, Sturdy Corp.	603-434-8440
NY	Sidney, Charles Co.	607-563-8064
OR	Portland, D.A. Sullivan Co.	503-292-2448

AUTOROLL MACHINE CORPORATION, 11 River St., Middleton, MA 01949, Tel: 508-777-2160, TELEX: 940250, FAX: 508-777-9453; Empl.: 120

AUTOSPLICE, INC., 10121 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-535-0077, FAX: 619-535-0130; Empl.: 197; *Sls. Mgr.:* Ken Krone

AUTOSWAGE PRODUCTS, 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, FAX: 203-929-6187; *Sls. Mgr.:* Arthur DiFabbio

AUTRONICS CORP., 325 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5470, FAX: 818-446-0014; FSC No.: 03972; Empl.: 100; *Sls. Mgr.:* Annabelle Cloud, Contracts Mgr.; *Dist. Mgr.:* Gary Noyes

AVA ELECTRONICS CORPORATION, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026, Tel: 215-284-2500, FAX: 215-259-8379; Empl.: 100

AVA INSTRUMENTATION, INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, FAX: 408-336-5049; FSC No.: 61933; Empl.: 4; *Sls. Mgr.:* Allan Hughes

AVANTEK, INC, A Subsidiary of Hewlett-Packard, 3175 Bowers Ave., Santa Clara, CA 95054, Tel: 408-727-0700, FAX: 408-970-6070; Empl.: 7600

AVANTI CIRCUITS, INC., 17650 N. 25th Ave., Phoenix, AZ 85023, Tel: 1-800-234-1556, FAX: 1-602-375-1909; Empl.: 65; *Sls. Mgr.:* Steve Tappan

AVASEM CORPORATION, 1271 Parkmoor Ave., San Jose, CA 95126, Tel: 408-297-1201, FAX: 408-925-9460; Empl.: 42; *Sls. Mgr.:* Richard Konrad

AVELEM, La Billardiere, Gargilesse, France 36190, Tel: 33-54478672, FAX: 33-54477799; Empl.: 12

AVEL TRANSFORMERS INC., 47 South End Plaza, New Milford, CT 06776, Tel: 203-355-4711, FAX: 203-354-8597; Empl.: 225; *Sls. Mgr.:* Melanie B. Roman .... **A•2272-2275; D•1616**

AVENS SIGNAL EQUIPMENT, 85-08 Queens Blvd., Elmhurst, NY 11373, Tel: 718-335-1886, FAX: 718-429-5785; Empl.: 15; *Sls. Mgr.:* Peter Eng .... **A•1620-1622**

AVERY DENNISON, 1 Clarks Hill, Framingham, MA 01701, Tel: 508-879-0511, FAX: 508-879-5009; Empl.: 8000; *Sls. Mgr.:* George Curtis

AVEX ELECTRONICS, 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515, 800-345-1295, FAX: 215-638-9108; FSC No.: 58414; *Sls. Mgr.:* Dona Logan; *Dist. Mgr.:* Michael S. Batley VP/GM .... **D•1424-1425**

Local Sales Offices & Reps

CO	Denver, Tessco	303-778-1119
IL	Cary, Bob Burns Assoc.	708-516-3322
IN	Carmel, New Era	317-844-4530
NM	Albuquerque, Genl. Mktg.	505-892-3426
PA	Philadelphia, Allpower Tech.	215-289-6025
TX	Rowlett, Campion Sls.	800-877-7623

AVIBANK MANUFACTURING, INC., 210 S. Victory Blvd, P.O. Box 391, Burbank, CA 91503-0391, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 485; *Sls. Mgr.:* D. Ladin

FAX: 908-382-4996

AVIONIC INSTRUMENTS, REA International Inc., 1414 Randolph Ave., Avenel, NJ 07001, Tel: 908-388-3500; FSC No.: 10933 (FSCM); Empl.: 150; *Sls. Mgr.:* Bryce Wiedeman; *Dist. Mgr.:* Mike Barnaba .... **D•2232-2239**

Local Distributors

NJ	Avenel, REA Intl. Ltd.	908-382-7100

AVO BIDDLE INSTRUMENTS, 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, TELEX: 685 1045 JGBCO, FAX: 215-643-2670; Empl.: 285

AVO INTERNATIONAL, TBG, 4651 S. Westmoreland, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Hermann Michaeli

AVTECH

FAX: 613-226-2802

AVTECH ELECTROSYSTEMS LTD., P.O. Box 5120, Stn. F, Ottawa, Ontario, Canada K2C 3H4, Tel: 613-226-5772; Empl.: 8 .... **D•1234**

Local Sales Offices & Reps

MA	Westford, ICS Assocs, Inc.	508-692-3545
NM	Albuquerque, Tech. Mktg. Specialists	505-291-1363
NY	Ogdensburg, Avtech Electrosystems Ltd.	315-472-5270
Can	Ottawa, Ont., Avtech Electrosystems Ltd.	613-226-5772

AVTEL/UNITRON, 10925 Miller Rd., Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511, FAX: 214-341-2099; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* Fred Cullum .... **D•2241-2243**

Local Sales Offices & Reps

CA	Sunland, JVC Assocs. (Jim Crevier)	818-352-7348
NC	Charlotte, Bruster Lawing & Assocs.	803-831-1205
VA	Midlothian, Bruster Lawing & Assocs.	804-794-3879

AVX

A Kyocera Group Company

FAX: 803-626-2442

AVX CORPORATION, A Kyocera Group Company, 801 17th Ave. South, Myrtle Beach, SC 29577, Tel: 803-448-9411, TWX: 810-661-2252; *Dist. Mgr.:* Mike Craven .... **A•1024-1028, 1336-1337, 1866-1867**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Interstate Mktg.	602-263-8044/8241
CA	Mountain View, Peninsula Tech Sls.	415-965-3636
CA	San Diego, Interstate Mktg.	619-693-3220
CA	San Jose, Quadrep Inc.	408-432-3300
CA	Woodland Hills, Interstate Mktg. Assocs.	818-883-7606
CO	Englewood, Thorson Rocky Mt. Inc.	303-773-6300
CT	Wallingford, J.E. Boeing	203-265-1318
FL	Belleair Bch., Beacon Elctrns.	813-593-2267
FL	Casselbury, Dyne-A-Mark	407-831-2822
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6508
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
IL	Itasca, Janus, Inc.	708-250-9650
IN	Ft. Wayne, F.J. Campisano Co.	219-486-6443
IN	Indianapolis, Frank J. Campisano	317-577-0319
IN	Kokomo, M. Gottlieb Assocs.	317-455-0444
IA	Cedar Rapids, R.F. Welch	319-362-6824
KS	Overland Park, Beneke & McCaul	816-765-2998
MA	Chelmsford, J.E. Boeing Co.	508-256-5800
MI	Flint, M. Gottlieb Assocs.	313-732-3922
MI	Southfield, M. Gottlieb Assocs.	313-358-4151
MN	Minneapolis, Comstrand Inc.	612-574-9480
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NY	Ithica, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
NC	Greensboro, Beacon Elctrns.	919-674-0348
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Beaverton, Western Tech Sls.	503-644-8860
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OH	Columbus, Frank J. Campisano	614-538-1176
OH	Mentor, Frank J. Campisano	216-975-9300
OK	Tulsa, Ammon & Rizos	918-749-6116
PA	Coraopolis, F.J. Campisano Co.	412-264-5151
PA	Leechburg, Frank J. Campisano	412-845-2577
SC	Greenville, Beacon Elctrns.	803-297-7830
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	El Paso, Ammon & Rizos	915-534-7533
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
UT	Salt Lake City, Thorson Rocky Mt. Inc.	801-942-1683

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
BIDDLE INSTRUMENTS
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

WA	Bellevue, Western Tech Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Delafield, Janus, Inc.	414-646-5420
PR	Rio Piedras, J.E. Boeing	809-753-9805
Can	Calgary, Alb., Tech-Trek	403-241-1719
Can	Kanata, Ont., Tech-Trek	613-599-8787
Can	Mississauga, Ont., Tech-Trek	416-238-0366
Can	Richmond, BC, Tech-Trek	604-276-8735
Can	St. Laurent, Que., Tech-Trek	514-337-7540

Local Distributors

AL	Huntsville, Future Elctrns. Corp.	205-830-2322
AL	Huntsville, Hallmark Elctrns.	205-830-2565
AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Future Elctrns. Corp.	602-968-7140
AZ	Phoenix, Hallmark Elctrns.	602-437-1200
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Phoenix, Wyle Elctrns.	602-437-2088
AZ	Scottsdale, Kent Elctrns.	602-998-0399
AZ	Scottsdale, Spirit Elctrns.	602-998-1533
AZ	Tucson, Hallmark Elctrns.	602-742-0515
CA	Calabasas, Kent Elctrns.	818-876-1800
CA	Calabasas, Marshall Inds.	818-878-7000
CA	Calabasas, Wyle Elctrns.	818-880-9000
CA	Camarillo, Milgray Elctrns.	800-635-7812
CA	Chatsworth, Future Elctrns. Corp.	818-772-6240
CA	Chatsworth, Hallmark Elctrns.	818-773-4500
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Capstone Elctrns.	714-587-0638
CA	Irvine, Future Elctrns. Corp.	714-250-4141
CA	Irvine, Hallmark Elctrns.	714-727-6000
CA	Irvine, Integrated Elctrns. Corp.	714-753-0127
CA	Irvine, Marshall Inds.	714-458-5301
CA	Irvine, Milgray Elctrns.	800-468-9277
CA	Irvine, Wyle Elctrns.	714-863-9953
CA	Milpitas, California Capacitor	408-262-6000
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	Milpitas, Marshall Inds.	408-942-4600
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Rancho Cordova, Wyle Elctrns.	916-638-5282
CA	Rocklin, Hallmark Elctrns.	916-624-9781
CA	Sacramento, Integrated Elctrns. Corp.	916-363-6030
CA	San Diego, Future Elctrns. Corp.	619-625-2800
CA	San Diego, Hallmark Elctrns.	619-268-1201
CA	San Diego, Kent Elctrns.	619-453-7133
CA	San Diego, Marshall Inds.	619-627-4140
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Wyle Elctrns.	619-565-9171
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Future Elctrns. Corp.	408-434-1122
CA	San Jose, Hallmark Elctrns.	408-432-4000
CA	San Jose, Jaco Elctrns.	408-432-9290
CA	San Jose, Milgray Elctrns.	408-456-0900
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Clara, Wyle Elctrns.	408-727-2500
CA	Torrance, Kent Elctrns.	310-320-2700
CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Tustin, Projections Unltd.	714-544-2700
CA	Yorba Linda, Corona	714-283-8185
CO	Aurora, Capstone Elctrns.	303-375-2613
CO	Denver, Integrated Elctrns. Corp.	303-292-6121
CO	Denver, Integrated Elctrns. Corp.	303-292-9594
CO	Englewood, Hallmark Elctrns.	303-790-1662
CO	Englewood, Kent Elctrns.	303-792-9100
CO	Thornton, Marshall Inds.	303-451-8383
CO	Thornton, Wyle Elctrns.	303-457-9953
CT	Berlin, Kent Elctrns.	203-829-2100
CT	Bethel, Future Elctrns. Corp.	203-743-9594
CT	Chesire, Hallmark Elctrns.	203-272-1704
CT	Milford, Milgray Elctrns.	800-922-6911
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, GRS Elctrns.	203-265-2077
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Future Elctrns. Corp.	407-767-8414
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Ft. Lauderdale, Hallmark Elctrns.	305-484-4740
FL	Ft. Lauderdale, Marshall Inds.	407-767-8585
FL	Lake Mary, Milgray Elctrns.	800-367-0780
FL	Largo, Future Elctrns. Corp.	813-530-1222
FL	Largo, Hallmark Elctrns.	813-544-4394
FL	Largo, Kent Elctrns.	813-545-0057
FL	Melbourne, Dove Elctrns.	407-242-6916
FL	Melbourne, GRS Elctrns.	407-768-6966
FL	St. Petersburg, Marshall Inds.	813-573-1399
GA	Duluth, Hallmark Elctrns.	404-476-8206
GA	Norcross, Future Elctrns. Corp.	404-441-7676
GA	Norcross, Marshall Inds.	404-923-5750
GA	Norcross, Milgray Elctrns.	800-241-5523
IL	Elk Grove Vlg., Kent Elctrns.	708-364-1300
IL	Gurnee, NEP Elctrns.	708-662-0185
IL	Hoffman Estates, Future Elctrns. Corp.	708-882-1255
IL	Hoffman Estates, Integrated Elctrns. Corp.	708-843-2040
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Lisle, Components, Inc.	708-852-7707
IL	Palatine, Milgray Elctrns.	800-322-6271
IL	Schaumburg, Marshall Inds.	708-490-0155
IL	Wood Dale, Hallmark Elctrns.	703-860-0239
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, Hallmark Elctrns.	317-876-7165
IN	Indianapolis, Marshall Inds.	317-297-0483
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
KS	Lenexa, Hallmark Elctrns.	913-888-0523
KS	Lenexa, Marshall Inds.	913-291-4650
KS	Overland Park, Milgray Elctrns.	800-255-6576
MD	Baltimore, Resco Baltimore	301-931-8200
MD	Beltsville, Resco Baltimore	301-937-9100
MD	Columbia, Future Elctrns. Corp.	410-290-0600
MD	Columbia, GRS Elctrns.	410-995-6744
MD	Columbia, Hallmark Elctrns.	410-381-2036
MD	Columbia, Jaco Elctrns.	410-995-6620
MD	Columbia, Kent Elctrns.	410-720-6200
MD	Columbia, Milgray Elctrns.	800-638-6658
MD	Gaithersburg, M.S. Elctrns.	301-921-0200
MD	Silver Spring, Marshall Inds.	301-622-1118
MA	Billerica, Hallmark Elctrns.	508-667-0902
MA	Bolton, Future Elctrns. Corp.	508-779-3000
MA	Burlington, Wyle Elctrns.	617-272-7300
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Springfield, C&D Elctrns.	413-781-1776
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, Marshall Inds.	508-658-0810
MA	Wilmington, Milgray Elctrns.	800-648-3595
MI	Farmington hills, Key Elctrns.	313-489-5455
MI	Livonia, Future Elctrns. Corp.	313-261-5270
MI	Livonia, Marshall Inds.	313-525-5850
MI	Plymouth, Hallmark Elctrns.	313-416-5811
MN	Bloomington, Hallmark Elctrns.	612-881-9461
MN	Eden Prairie, Future Elctrns. Corp.	612-944-2200
MN	Plymouth, Marshall Inds.	612-559-2211
MN	St. Paul, Kent Elctrns.	612-642-2828
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Earth City, Hallmark Elctrns.	913-888-0523
MO	St. Louis, Future Elctrns. Corp.	314-469-6805
NH	Manchester, Cronin Elctrns.	603-624-0105
NJ	Camden, GRS Elctrns.	609-964-8560
NJ	Denville, Kent Elctrns.	201-625-5500
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Fairfield, Tri-Start Elctrns.	201-227-3500
NJ	Marlton, Capstone Elctrns.	609-596-7500
NJ	Marlton, Future Elctrns. Corp.	609-596-4080
NJ	Marlton, Milgray Elctrns.	800-257-7111
NJ	Moorestown, Hallmark Elctrns.	609-235-1900
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Future Elctrns. Corp.	201-299-0400
NJ	Parsippany, Hallmark Elctrns.	201-515-4475
NJ	Parsippany, Milgray Elctrns.	800-622-0291
NJ	Teterboro, EAC Corp.	201-288-4477
NM	Albuquerque, Hallmark Elctrns.	505-344-2454
NY	E. Rochester, Rome Elctrns.	716-248-0160
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Endicott, Marshall Inds.	607-785-2345
NY	Fairport, Hallmark Elctrns.	716-425-7195
NY	Farmingdale, Milgray Elctrns.	800-622-0291
NY	Fayetteville, Tri-Start Elctrns.	315-637-1312
NY	Hauppauge, Future Elctrns. Corp.	516-234-4000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Hauppauge, Marshall Inds.	516-273-2695
NY	Hauppauge, Vargas Elctrns.	516-273-1111
NY	Penn Yan, Advacom, Inc.	315-536-2221
NY	Pittsford, Milgray Elctrns.	716-381-9700
NY	Rochester, Future Elctrns. Corp.	716-272-1120
NY	Rochester, Marshall Inds.	716-235-7620
NY	Rome, Rome Elctrns.	800-366-7663
NY	Ronkonkoma, Hallmark Elctrns.	516-737-0838
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NY	Williamsville, Rome Elctrns.	800-366-0118
NC	Concord, Future Elctrns. Corp.	704-455-9030
NC	Pleasant Garden, Tri-Start Elctrns.	919-674-5515
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Future Elctrns. Corp.	919-790-7111
NC	Raleigh, Hallmark Elctrns.	919-878-8729
NC	Raleigh, Jaco Elctrns.	919-876-7767
NC	Raleigh, Marshall Inds.	919-878-9882
NC	Raleigh, Milgray Elctrns.	800-562-3118
OH	Cleveland, Milgray Elctrns.	800-321-0008
OH	Dayton, Advacom, Inc.	513-274-5900
OH	Dayton, Marshall Inds.	513-898-4480
OH	Mayfield Heights, Future Elctrns. Corp.	216-449-6996
OH	Middleburg, Advacom, Inc.	216-826-3300
OH	Solon, Hallmark Elctrns.	216-248-4803
OH	Solon, Marshall Inds.	216-248-1788
OH	Worthington, Hallmark Elctrns.	614-888-0767
OK	Tulsa, Hallmark Elctrns.	918-254-6207
OR	Beaverton, integrated Elctrns. Corp.	503-641-1690
OR	Beaverton, Almac/Cap Elctrns.	503-629-8090
OR	Beaverton, Future Elctrns. Corp.	503-645-9454
OR	Beaverton, Kent Elctrns.	503-626-8300
OR	Beaverton, Marshall Inds.	503-644-5050
OR	Beaverton, Wyle Elctrns.	503-643-7900
PA	Export, Advacom, Inc.	412-325-7551
PA	McKean, Advacom, Inc.	814-476-7774
PA	Warrington, Tri-Start Elctrns.	215-343-8384
TX	Austin, Hallmark Elctrns.	512-258-3777
TX	Austin, Jaco Elctrns.	512-835-0220
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Marshall Inds.	512-837-1991
TX	Austin, Wyle Elctrns.	512-345-8853
TX	Carrollton, Capstone Elctrns.	800-388-CAPS
TX	Dallas, Hallmark Elctrns.	214-553-4295
TX	Dallas, Milgray Elctrns.	800-637-7227
TX	Houston, Future Elctrns. Corp.	713-556-8696
TX	Houston, Hallmark Elctrns.	713-781-6100
TX	Houston, Jaco Elctrns.	713-780-7770
TX	Houston, Marshall Inds.	713-467-1666
TX	Houston, Wyle Elctrns.	713-879-9953
TX	Richardson, Future Elctrns. Corp.	214-437-2437
TX	Richardson, Jaco Elctrns.	214-234-5565
TX	Richardson, Kent Elctrns.	214-669-2600
TX	Richardson, Marshall Inds.	214-705-0600
TX	Richardson, Wyle Elctrns.	214-235-9953
TX	Stafford, Milgray Elctrns.	800-952-1849
UT	Murray, Milgray Elctrns.	800-537-9739
UT	Salt Lake City, Future Elctrns. Corp.	801-972-8489
UT	Salt Lake City, Hallmark Elctrns.	801-269-0416
UT	Salt Lake City, Marshall Inds.	801-973-2288
UT	W. Valley City, Integrated Elctrns. Corp.	801-977-9750
UT	W. Valley City, Wyle Elctrns.	801-974-9953
VA	Vienna, Dove Elctrns.	703-893-1821
WA	Bellevue, Almac/Cap Elctrns.	206-643-9992
WA	Bellevue, Integrated Elctrns. Corp.	206-455-2727
WA	Bothell, Future Elctrns. Corp.	206-489-3400
WA	Bothell, Marshall Inds.	206-486-5747
WA	Everett, Hallmark Elctrns.	206-290-5324
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Redmond, Wyle Elctrns.	206-881-1150
WI	New Berlin, Hallmark Elctrns.	414-797-9259
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	Waukesha, Future Elctrns. Corp.	414-786-1884
WI	Waukesha, GRS Elctrns.	414-544-3193
WI	Waukesha, Marshall Inds.	414-797-8400
PR	Canovanas, Milgray Elctrns.	809-876-8200
Can	Brampton, Ont., Marshall Inds.	416-458-8046
Can	Calgary, Alb., Future Elctrns. Inc.	403-250-5550
Can	Edmonton, Alb., Future Elctrns. Corp.	403-438-2858
Can	Mississauga, Ont., Capstone Elctrns.	416-670-2010
Can	Mississauga, Ont., Future Elctrns. Corp.	416-612-9200
Can	Mississauga, Ont., Milgray Elctrns.	416-678-0958
Can	Ottawa, Ont., Future Elctrns. Inc.	613-820-8313
Can	Pointe Claire, Que., Future Elctrns. Corp.	514-694-7710
Can	Pointe Claire, Que., Marshall Inds.	514-694-8142
Can	Pointe Claire, Que., Milgray Elctrns.	514-426-5836
Can	Quebec, Que., Future Elctrns. Inc.	418-877-6666
Can	Vancouver, BC, Future Elctrns. Inc.	604-294-1166
Can	Winnipeg, Man., Future Elctrns. Inc.	204-786-7711
KS	Overland Park, Kent Elctrns.	913-338-4300
MD	Baltimore, Micro-Comp	301-644-5700
CA	Westlake Vlg., Jaco/Distel	805-495-9998
VA	Lynchburg, Micro-Comp	804-239-2626

AVX FILTERS CORP., 11144 Penrose St, Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 160; *Sls. Mgr.:* Terry Cantine, Prod. Mktg. Mgr.

AXEL ELECTRONICS, INC., Subsidiary of FPBSM Industries Inc., 19060 Dominquez Hills Dr., Rancho Dominquez, CA 90220, Tel: 718-291-3900, FAX: 718-526-0248; FSC No.: 13058; Empl.: 160; *Sls. Mgr.:* H. Mordkoff

NORMAN N. AXELROD ASSOCS.:ELECTRO-OPTICAL, LASER, & MACHINE VISION DIV., 445 East 86th Street, New York, NY 10028, Tel: 212-228-0900

AXIAL MAGNETICS, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, Tel: 805-527-0900, FAX: 805-527-4968; *Sls. Mgr.:* K. G. Kroll

AXIOHM, INC., 1775 Hwy. 8, Ste. 107, New Brighton, MN 55112, Tel: 612-638-9856, FAX: 612-638-0758; Empl.: 130; *Sls. Mgr.:* Kieth Jentoff .... **D•1078-1081**

AYA-INSTRUMENTS, INC., 5001 Baum Blvd., Pittsburgh, PA 15213, Tel: 412-622-5500, FAX: 412-681-3773; *Sls. Mgr.:* A. Anouchi

AYDIN CORP., 700 Dresher Rd, Horsham, PA 19044, Tel: 215-657-7510, TELEX: 685-1211, FAX: 215-657-3830; Empl.: 1400; *Sls. Mgr.:* John Politis

AYDIN CORPORATION (WEST), 30 Great Oaks Boulevard, San Jose, CA 95119-1371, Tel: 408-629-1100, TWX: 910-373-1238, FAX: 408-224-4625; FSC No.: ZV23-1686808; *Sls. Mgr.:* George Whitehill; *Dist. Mgr.:* Clarence Ruckriegel

AYDIN VECTOR DIV., Aydin Corp., Box 328, Newtown, PA 18940-0328, Tel: 215-968-4271, FAX: 215-968-3214; FSC No.: 13923; Empl.: 300

AZCO CORP., 385 Falmouth Ave., Elmwood Park, NJ 07407, Tel: 201-791-1428, FAX: 201-791-8420; Empl.: 15

AZ-COM, 12 Rose Lane, Ste. 104, Orinda, CA 94563-2206, Tel: 510-254-5400, FAX: 510-254-5400; FSC No.: 68-0283683; Empl.: 5; *Sls. Mgr.:* A. Hadas ..... **D•1235**

AZIMUTH ELECTRONICS, INC., 2605 So. El Camino Real, San Clemente, CA 92672, Tel: 714-492-6481, FAX: 714-492-0744; *Sls. Mgr.:* Kenneth C. Johnsen

A/Z-TECH, INC. R&D LAB, Indiana Institute of Technlg., 1600 East Washington Blvd., Fort Wayne, IN 46803, Tel: 219-422-5561, FAX: 219-422-7696; Empl.: 25

aztec INDUSTRIES

FAX: 602-844-9625

AZTEC INDUSTRIES, INC., 333 S. Nina Drive, Mesa, AZ 85210, Tel: 602-833-3131, 800-729-3132; Empl.: 40; *Sls. Mgr.:* Dan Harper .... **B•1821**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540, FAX:205-830-1542
FL	Dearfield Beach, Cartwright & Bean, Inc.	305-429-3400,FAX:305-429-3402
FL	Orlando, Cartwright & Bean, Inc.	407-889-9100, FAX:407-889-2168
GA	Atlanta, Cartwright & Bean, Inc.	404-368-0160, FAX:404-368-0125
KS	Shawnee Mission, Marc E. Nelson Assoc.	913-268-9099
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170, FAX:601-981-1171
NE	Omaha, Label Concepts	402-496-3997, FAX:402-496-3855
NE	Omaha, Label Concepts	402-592-5080, FAX:402-592-5088
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303, FAX:704-536-0313
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130, FAX:919-876-4132
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, Kay Todd Assocs.	214-458-8833, FAX:214-458-8837

BABCOCK, INC., 1717 West Collins Ave., Orange, CA 92667, Tel: 714-633-3700, FAX: 714-538-9740; FSC No.: 56623; Empl.: 165; *Sls. Mgr.:* Bosie White; *Dist. Mgr.:* Bosie White .... **B•1021**

Local Distributors

CA	Santa Ana, Norstan Elctrns.	714-667-7826

BABCOCK
DISPLAY PRODUCTS, INC.

FAX: 714-490-1368

BABCOCK DISPLAY PRODUCTS, INC., A Subsidiary of Babcock, Inc., 1051 S. East St, Anaheim, CA 92805, Tel: 714-491-5100; Empl.: 150 .... **B•1021**

Local Sales Offices & Reps

AZ	Tempe, ETS	602-921-7122
CA	Cupertino, Costar Inc.	408-446-9339
CO	Denver, AKI Entprs.	303-756-0700
CT	Wallingford, Alpha Omega Sls. Corp.	203-949-0388
FL	N. Palm Beach, Universal Mktg. & Sls.	407-842-1440
GA	Norcross, Elctrns. Sls. Inc. (ESI)	404-448-6554
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IA	Des Moines, The Beams Co.	515-255-1148
KS	Lenexa, The Beams Co.	913-541-9197
MD	Baltimore, Eastern Comps. Sls.	410-788-7050
MA	North Reading, Alpha Omega Sls. Corp.	508-664-1118
MI	Farmington Hills, Rathsburg Assoc., Inc.	313-489-1500
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Glen Rock, WD Sls., Inc.	201-447-8821
NM	Rio Rancho, Elctrn. Tech. Sls. Inc. (ETS)	602-921-7122
NY	Eastchester, WD Sls., Inc.	914-779-8738
NY	N. Syracuse, Entec Grp., Inc.	315-458-7936
NC	Cary, Elctrn. Sls. Inc. (ESI)	919-467-8486
OH	Columbus, Rathsburg Assoc., Inc.	614-457-2242
OR	Hillsboro, Temco Northwest	503-465-4030
PA	Norristown, Eastern Comps. Sls.	215-270-9530
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
WA	Bothell, Temco Northwest	206-481-6150
Can	Mississauga, Ont., bbd Elctrns.	416-821-7800

BACHI, INC., 1201 Ardmore, Itasca, IL 60143, Tel: 708-773-5600, FAX: 708-773-5621; Empl.: 95

BACON INDUSTRIES, INC., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518, FAX: 617-926-2022; FSC No.: 99098; Empl.: 25; *Sls. Mgr.:* R. S. Cass

BAKER CO., INC., Drawer E - Sanford Airport, Sanford, ME 04073, Tel: 1-800-992-2537; Empl.: 150

BAKNOR INDUSTRIES INC., 2209 Dunwin Drive, Mississauga, Ont., Canada L5L 1X1, Tel: 416-828-2400, FAX: 416-828-5500; Empl.: 25; *Sls. Mgr.:* M. E. Sawicki

BALDOR ELECTRIC COMPANY, P.O. Box 2400, Fort Smith, AR 72902, Tel: 501-646-4711, FAX: 501-648-5792; Empl.: 2900; *Sls. Mgr.:* John McFarland V.P. Sls.

BALLANTINE LABORATORIES, 9 Saddle Rd., Cedar Knolls, NJ 07927, Tel: 201-984-1900, FAX: 201-984-1479; FSC No.: 50423; Empl.: 30

BALLARD TECHNOLOGY, 1216 NW 75th Street, Seattle, WA 98117, Tel: 206-782-8704, 1-800-829-1553, FAX: 206-782-8174; Empl.: 7; *Sls. Mgr.:* Kevin S. Christian

BALLCO ATLANTA, Conceptual Enterprises Intl. Ltd., P.O. Box 1078, Snellville, GA 30278-1078, Tel: 404-979-5900, FAX: 404-979-5900; Empl.: 49; *Sls. Mgr.:* W. Kann

BALL CORP., EFRATOM DIVISION, 3 Parker, Irvine, CA 92718-1605, Tel: 714-770-5000, TELEX: 68-5635, FAX: 714-770-2463; Empl.: 225 .... **A•1339**

Local Sales Offices & Reps

CA	Dana Point, Geil Mktg.	714-489-7644
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CO	Parker, W. Howard Assoc.	303-841-5755
FL	Melbourne, Bass Assocs.	407-259-1866
GA	Norcross, Beacon Microwave	404-449-8464
IN	Fort Wayne, TX Sls. Indiana	219-489-4447
MD	Baltimore, Stemler Assoc., Inc.	410-944-8262
MA	Natick, Wayland Engrg. Sls.	617-655-6080
NM	Albuquerque, Mayco, Inc.	505-299-4002
NY	Huntington, CDB Entprs.	516-692-5200
TX	Dallas, Beacon Microwave	214-437-1505
CA	Huntington Bch., Scientific Dvcs.- West	714-840-3501
VA	Lynchburg, Incandescent Tech.	804-846-7391
WA	Bellevue, Syntek	206-462-7700

BALL CORPORATION, Industrial Systems Division, 3400 Gilchrist Rd., Mogadore, OH 44260, Tel: 216-784-4456, TELEX: 98-6327-PVI-AKR, FAX: 216-784-9854; Empl.: 130; *Sls. Mgr.:* George Gugliotta

BALL SCREWS & ACTUATORS CO., 3616 Snell Ave., San Jose, CA 95136-1305, Tel: 408-629-1132, FAX: 408-629-2620; Empl.: 63; *Sls. Mgr.:* Steve Trumbauer

BALSTON, 260 Neck Rd., Box 8223, Haverhill, MA 01835-0723, Tel: 508-374-7400, FAX: 508-374-7070; Empl.: 200; *Sls. Mgr.:* Scott Feenan

BAMBECK SYSTEMS INC., 1921 E. Carnegie Ave., Santa Ana, CA 92705, Tel: 714-250-3100, 800 334-3101, FAX: 714-757-1610; Empl.: 25; *Sls. Mgr.:* Robert Bambeck

B & B MOTOR & CONTROL CORP., B & B Long Island City, 1967 State Hwy 27 Ste. 32, Edison, NJ 08817, Tel: 908-819-7070, 908-572-0500, FAX: 908-819-7010; Empl.: 90; *Sls. Mgr.:* Thomas Miceli

BAND-IT - IDEX, INC., 4799 Dahlia Street, Denver, CO 80216, Tel: 303-320-4555, TELEX: 45-0009, FAX: 303-333-6549; *Sls. Mgr.:* Terry L. Joles; *Dist. Mgr.:* Ron Isherwood

B & K PRECISION, Maxtec International Corp, 6470 W. Cortland, Chicago, IL 60635, Tel: 312-889-1448, FAX: 312-794-9740; FSC No.: 08098, 18110, 48560, 30678; Empl.: 200; *Sls. Mgr.:* Richard Polak

BANNER ENGINEERING CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, FAX: 612-544-3631; *Sls. Mgr.:* Floyd Schneider

BARADINE PRODUCTS LTD., P.O. Box 86757, North Vancouver, B.C., Canada V7L 4L3, Tel: 604-988-9853, FAX: 604-988-9899; Empl.: 3; *Sls. Mgr.:* Garry J. Anderson; *Dist. Mgr.:* Garry J. Anderson

BARANTI GROUP INC., 2650 John St., Unit 22, Markham, Ont., Can L3R 2W6, Tel: 416-479-0148, FAX: 416-479-0149; *Sls. Mgr.:* Barry Papoff

BARBER COLMAN COMPANY
a Siebe company

FAX: 815-877-8844

BARBER-COLMAN CO., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132-2940, Tel: 815-637-3000, TELEX: 4330175 BC11; Empl.: 300; *Sls. Mgr.:* David Boxall .... **B•1241**

Local Sales Offices & Reps

AZ	Tucson, Kachina Controls	602-886-4984
AK	Anchorage, Control Contractors	907-561-3044
CA	Anaheim, Instrument Lab.	714-236-7900
CA	San Jose, Instr. Lab.	408-434-0160
CA	Santa Clara, Johnson Assocs.	408-984-4626
CO	Denver, Tessco	303-778-1119
FL	Clearwater, J. J. Galleher Co.	813-461-7706
GA	Norcross, McGoff Pyrotech, Inc.	404-840-9811
GA	Roswell, Cascade Controls	404-664-9000
HI	Rockford, Barber-Colman	815-637-3000
IL	Arlington Hgts., Carlin Automation	708-981-0800
IL	Rock Island, Carlin Automation	309-788-1275
IN	Noblesville, Triangle Sls.	317-773-5480
KS	Goddard, Parker & Foster	316-794-2686
LA	Baton Rouge, Hahn/Enstocko, Inc.	504-926-9310
MI	Allendale, Applied Instr. Co.	616-895-9600
MI	Farmington, Applied Instrs.	313-476-9060
MN	Minneapolis, Temp-Tec	612-784-3306
MO	St. Louis, Temtron	314-968-5242
NV	Las Vegas, Kachina Controls	702-791-5666
NJ	Hackensack, AP Tech. Sls.	201-487-6222
NM	Albuquerque, Kachina Controls	505-260-1741
NY	Victor, Sanwal Technlgs.	716-924-1950
NC	Matthews, Carotek, Inc.	704-847-4406
OH	Cincinnati, Heat Equip. & Technlgs.	513-591-3000
PA	Frazer, Weiss Instrs. Inc.	215-647-4650
PA	Pittsburgh, Weiss Instr., Inc.	412-344-1500
RI	Providence, N.E.T.S.	401-454-2777
TN	Memphis, Industrial Process Controls	901-795-4200
TX	Fort Worth, ASKCO Instr. Corp.	817-568-0003
TX	Houston, ASKCO Instr. Co.	713-645-9898
WA	Redmond, Sales & Engrg. Assocs.	206-883-4999
WA	Vancouver, Sls. & Engrg. Assocs.	206-573-5161
WI	Appleton, Pyro-Matic	414-739-4247
WI	Wauwatosa, Pyro-Matic	414-453-1171

BARBER COLMAN CO. (A SIEBE CO.), Motor Division, P.O. Box 7040, Rockford, IL 61125-7040, Tel: 815-397-7400, FAX: 815-398-3885; Empl.: 350; *Sls. Mgr.:* Jeff Wagner; *Dist. Mgr.:* John Locarno .... **B•1241**

Local Sales Offices & Reps

AR	Van Buren, Hightower Ind. Sls.	501-471-8116
CA	Corona Del Mar, Motion Control of So.CA.	714-675-0211
CA	Mission Viejo, PJS Assocs.	714-472-0856
CA	San Jose, O'Donnell Assoc. North	408-456-2856
CO	Denver, Motion Technlg.	303-757-3003
IL	Hinsdale, Patton Sls. Co.	708-325-2170
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
MI	Grand Rapids, Russell Sls.	616-956-9111
MN	Minneapolis, Josco Melius, Inc.	612-861-3343
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NH	Salem, Sales Engrg.	603-893-5521
NJ	W. Caldwell, Grimm-Siegel Assoc.	201-575-9300
PA	Huntingdon Valley, Ed Leiby & Assocs.	215-659-8938
PA	Pittsford, Franklin Sls.	716-248-8251

WI	Brookfield, Heartland Tech. Mktg.	414-792-0920
Can	Vancouver, B.C., Madison Indl. Equip., Ltd.	604-872-8155

Local Distributors

CA	Anaheim, Minarik Elec. Co.	714-994-2251
AZ	Phoenix, Minarik Elec. Co.	602-233-3000
CA	Fresno, Minarik Elec. Co.	209-255-8087
CA	Glendale, Minarik Elec. Co.	818-507-6500
CA	Ontario, Minarik Elec. Co.	714-391-0064
CA	San Diego, Minarik Elec.	619-560-6632
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
MI	Troy, B & B Motor & Control Corp.	313-583-7450
FL	Winter Springs, B & B Motor & Control Corp.	407-696-4511
CO	Commerce City, Minarik Elec. Co.	303-289-5800
NJ	Edison, B & B Motor & Control Corp.	201-572-0500
IL	Elk Grove Vlg., Genl. Controls	708-595-2152
NY	Long Island City, B & B Motor & Control Corp.	718-784-1313
IL	Schaumburg, Minarik Elec. Co.	708-885-9337
IN	Indianapolis, B & B Motor & Control Corp.	317-248-0396
MD	Silver Spring, B & B Motor & Control Corp.	301-685-5834
MA	Somerville, Electro-Sls. Co., Inc.	617-666-0500
MN	Eagan, N.W. Power Prods. Inc.	612-452-6467
NJ	Edison, B & B Motor & Control Corp.	908-572-0500
NY	Rochester, B & B Motor & Control Corp.	716-424-7040
NC	Greensboro, B & B Motor & Control Corp.	919-379-8966
OR	Portland, Minarik Elec. Co.	503-253-3402
OH	Cincinnati, Cincinnati Belting & Transmission Co.	513-621-9050
OH	Dayton, Cincinnati Belting & Transmission Co.	513-223-0653
TX	Houston, Minarik Elec. Co.	713-748-0808
TX	Irving, Minarik Elec. Co.	214-402-8188
TX	San Antonio, Minarik Elec. Co.	512-822-7097
SC	Taylors, B & B Motor & Control Corp.	803-268-5702
WA	Redmond, Minarik Elec. Co.	206-885-0832

BARCO CHROMATICS, 2558 Mountain Ind. Blvd, Tucker, GA 30084, Tel: 404-493-7000, FAX: 404-493-1314; FSC No.: FSCM 59992; Empl.: 103; *Sls. Mgr.:* James Spencer

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[209] 441-1725

(800) CAL-SWCH

BARKSDALE CONTROLS DIV., Imo Industries Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058, Tel: 213-589-6181; Empl.: 234; *Sls. Mgr.:* J. Douglas Holland

BARNES ENGINEERING, West Coast Sls. & Mktg., 3601 W. Macarthur Blvd., 904, Santa Ana, CA 92704, Tel: 714-533-7530, FAX: 714-533-4755; FSC No.: 53823, SIC 3400; Empl.: 47; *Sls. Mgr.:* Gordon Mackenzie

BARNES ENGINEERING DIV., EDO Corporation, 88 Long Hill Cross Rds., Shelton, CT 06484, Tel: 203-926-1777, TELEX: 6819115, FAX: 203-926-9285; Empl.: 250; *Sls. Mgr.:* M. L. Marusic

BARNES ENGINEERING COMPANY, 2715 Delta Pl., Colorado Springs, CO 80910, Tel: 719-390-6500, FAX: 719-390-6700; Empl.: 57

BARR ASSOCIATES, INC., 2 Lyberty Way, Westford, MA 01886, Tel: 508-692-7513, FAX: 508-692-7443; FSC No.: 65807; Empl.: 95

BARRINGTON PLASTICS, 3838 Church Road, Mt. Laurel, NJ 08054, Tel: 609-235-5151, FAX: 609-778-9032; Empl.: 120; *Sls. Mgr.:* Gary Brown

BARSOM INC., See IR Scientific

BARTH ELECTRONICS, INC., 1300 Wyoming St., Boulder City, NV 89005, Tel: 702-293-1576, FAX: 702-293-7024; Empl.: 9; *Sls. Mgr.:* Sue Smith

BARTLETT INSTRUMENT CO., 14th & Ave. 'M', P.O. Box 445, Ft. Madison, IA 52627, Tel: 319-372-8366; Empl.: 10; *Sls. Mgr.:* David P. Bartlett

BAS BLEU INDL. CO., LTD., Rm. 815, No.110, Han-Kow ST., Sec.1, Taipei, Taiwan 10008, Tel: (02)331-6519, TELEX: 23015 HJIC, FAX: 886-2-381-6812; Empl.: 20; *Sls. Mgr.:* Athena W.R. Lo, VP

BASIC ELECTRONICS, INC., 11762 Western Ave. "Q", Stanton, CA 90680, Tel: 714-530-2400; Empl.: 50; *Sls. Mgr.:* Tom Jones; *Dist. Mgr.:* Tom Jones

BASIC MEASURING INSTRUMENTS, 335 Lakeside Dr., Foster City, CA 94404, Tel: 415-570-5355, TWX: 910-374-3059, FAX: 415-574-2176; Empl.: 90; *Sls. Mgr.:* Craig Waterman

BASICON, INC., 14273 NW Science Park Drive, Portland, OR 97229, Tel: 503-626-1012, FAX: 503-643-4686

BASISTA/NIEC, 3401 Brecksville Rd 110, Richfield, OH 44286, Tel: 216-659-9287, FAX: 216-659-3580; Empl.: (NIEC-Japan) 1200 230M Sales

Basler Electric
Electronic Product Group

FAX: 618-654-2351

BASLER ELEC., Electronic Product Group, Rte. 143, Highland, IL 62249, Tel: 618-654-2341, 800-645-2074; Empl.: 1401; *Sls. Mgr.:* Dennis Faires .... **D•1617**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg. Co.	205-880-0592
AZ	Tempe, Trembly Assoc., Inc.	602-431-9417
CA	Newport Beach, S.P.A. Inc.	714-863-1193
CA	Santa Clara, Sourcetronics, Inc.	408-988-8801
CA	Torrance, Printed Circuit Board Specialists	213-320-3022
CO	Golden, Trembly Assocs., Inc.	303-421-8900
FL	Clearwater, Sunland Assoc.	813-536-2955
FL	Lauderhill, Sunland Assoc.	305-748-1303
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Norcross, Electro Mech Sls. Engrg. Co.	404-447-6478
IL	Chicago, G. McI. Cole Co.	708-827-6040
IA	Cedar Rapids, Thomas L. Dowell & Assoc., Inc.	313-393-7920
KS	Overland Park, Thomas L. Dowell & Assocs., Inc.	913-722-4242
MD	Baltimore, C.W. Bass & Assocs.	410-744-4611
MA	Braintree, R. F. Duffy Assocs.	617-848-3550
MA	Monson, R. F. Duffy Assocs.	413-267-9884
MA	Whitinsville, Power Factor & Assocs.	508-234-6415
MN	Apple Valley, Arkco Sls.	612-432-6593
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Louis, Thomas L. Dowell & Assoc., Inc.	314-849-4234
NJ	Scotch Plains, Mil-Com Sls. Assocs.	908-322-7898
NM	Albuquerque, Trembly Assoc., Inc.	505-266-8616
NY	Smithtown, T & K Sls.	516-724-3456
NC	Raleigh, Electro Mech. Sls. Engrg. Co.	919-790-9300
OH	Hillsboro, J. P. Woods & Assocs.	513-393-9582
OH	Maineville, J. P. Woods & Assocs.	513-677-2120
PA	Pittsburgh, Gormley Farrington	412-795-8010
TX	Dallas, Weisler & Assoc., Inc.	214-437-2386
TX	Houston, Weisler & Assoc., Inc.	713-467-1847
UT	N. Salt Lake City, Trembly Assocs.	801-295-4703
VA	Ashland, Glasscock & Assoc.	804-798-2125
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WA	Vancouver, Elctrn. Mktg. Grp.	206-944-0761
PR	Rio Piedras, Klamco Elctrns.	809-748-5214

BASLER ELECTRICS, Magnetics Product Grp., Rt 143, Box 269, Highland, IL 62249, Tel: 618-654-2341, FAX: 618-654-2351; Empl.: 1500; *Sls. Mgr.:* Don Ginther .... **D•1617**

FAX: 617-361-1835

BATTERY ENGINEERING, INC., 1636 Hyde Park Ave., Hyde Park, MA 02136, Tel: 617-361-7555; FSC No.: 60289; Empl.: 50; *Sls. Mgr.:* R. Fay .... **D•1426**

BATTERY SPECIALTIES

FAX: 714-755-0889

BATTERY SPECIALTIES, 3530 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-755-0888, 1-800-352-3706 (Toll free in CA); Empl.: 30; *Sls. Mgr.:* Guy K. Hudson; *Dist. Mgr.:* Guy K. Hudson .... **D•1427-1429**

BAXTER-INDUSTRIAL DIVISION, 27200 N. Tourney Rd., Valencia, CA 91355, Tel: 805-253-7466, FAX: 805-253-7634; Empl.: 50; *Sls. Mgr.:* Jeff Blair

BAY COMPONENTS, INC., 418 3rd St., Annapolis, MD 21403, Tel: 410-268-0122, FAX: 410-268-7909; Empl.: 1; *Sls. Mgr.:* Barbara Bunting

BAYLEY INSTRUMENT COMPANY, Box 357, Kenwood, CA 95452, Tel: 707-833-6014

BAYSTAT, 3575 Haven Ave., Menlo Park, CA 94025, Tel: 415-364-3205, FAX: 415-363-8079; Empl.: 100; *Sls. Mgr.:* James V. Travis

BAY TECHNICAL ASSOCIATES, INC., 200 N. 2nd St., Bay St. Louis, MS 39520, Tel: 800-523-2702, 601-467-8231, FAX: 601-467-4551; FSC No.: 64-0588860; Empl.: 100; *Sls. Mgr.:* Jackie La Fontaine

B C SYSTEMS, INC., 200 Terminal Road, Setauket, NY 11733, Tel: 516-751-9370, FAX: 516-751-9378; Empl.: 50; *Sls. Mgr.:* Joseph Small

BEAD INDUSTRIES, 110 Mountain Grove St., P.O. Box K, Dept. 100, Bridgeport, CT 06605-0571, Tel: 203-334-4124, FAX: 203-367-9957; Empl.: 175; *Sls. Mgr.:* Keith Lebo

BEA ELECTRO-OPTICS, INC., 640 Pearson, Ste. 200, Des Plaines, IL 60016, Tel: 708-298-1420, FAX: 708-298-1423; *Sls. Mgr.:* George E. Magerl; *Dist. Mgr.:* Vic Halkyn

BEARING INSPECTION, 10041 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 310-944-6251, FAX: 310-946-9670; Empl.: 43

Beau Products
DIVISION OF VERNITRON CORPORATION

FAX: 603-524-1627

BEAU INTERCONNECT SYSTEMS, Vernitron Corp., Box 10, Laconia, NH 03247, Tel: 603-524-5102; FSC No.: 13150; Empl.: 150; *Sls. Mgr.:* Wayne Eshelman; *Dist. Mgr.:* Larry Murphy .... **C•1269-1273**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg.	205-880-0592
AZ	Phoenix, Shefler-Kahn	602-581-0884
CA	Garden Grove, Elsco Elect. Inc.	714-891-4621
GA	Norcross, Electro-Mech Sls. Engrg.	404-447-6478
IL	Lisle, W-G Controls	708-963-5954
IN	Carmel, Green-Wissler Sls., Inc.	317-843-5785
IA	Cedar Rapids, KKB and Co.	319-373-1730
MN	Bloomington, PSI	612-944-8545
MO	St. Louis, KKB & Co.	314-647-2400
NH	Amherst, D.A.Crowley & Assoc.	603-673-7050
NJ	Lawrenceville, DVS Co.	609-896-1112
NJ	W. Caldwell, Grimm Siegel & Assoc.	201-575-9300
NY	Syracuse, Pi'tronics, Inc.	315-455-7346
NC	Raleigh, Electro-Mech Sls. Engrg.	919-790-9300
OH	Beechwood, Electronic Salesmasters Inc.	216-831-9555
OR	Beaverton, Pacific Mktg. Specialist,	503-641-9373
TX	Irving, Comtech Sls. Inc.	214-751-1181
WA	Redmond, Pacific Mktg. Specialists,	206-882-3144
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121
Can	West Vancouver, BC, Leister Blake Entprs. Ltd.	604-926-6127

BEAU TECH, 98 Elm Street, Portland, ME 04101, Tel: 207-775-6139, TELEX: 950-027 Attn Beau, FAX: 207-775-7710; Empl.: 6; *Sls. Mgr.:* Barbara Pike, Credit Mgr.; *Dist. Mgr.:* Barbara Pike

BEAVER LABS, P. O. Box 202, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

BEC INC./CERTIFIED CALIBRATION LABS, 945 Horsham Rd., Horsham, PA 19044, Tel: 800-523-3808, FAX: 215-675-0966,800-523-3808; Empl.: 8; *Sls. Mgr.:* David Hines

BECKMAN INDUSTRIAL CORP., Affiliate of Emerson Electric Co., 4200 Bonita Pl., Fullerton, CA 92635, Tel: 714-447-2300, TELEX: 7607569, FAX: 714-447-2400; Empl.: 1900; *Sls. Mgr.:* Ron Sullivan, Sls. & Mktg. V.P. **A•1868, 2056-2057**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls., Inc.	205-533-1735
AZ	Scottsdale, Thom Luke Sls.	602-451-5400
CA	Escondido, Clint Bradley Sls.	619-743-0138
CA	Newport Beach, Jones & McGeoy Sls.	714-724-8080
CA	Santa Clara, Criterion Sls.	408-988-6300
CO	Littleton, Simpson Assocs.	303-794-8381
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120
FL	St. Petersburgh, QXI, Inc.	813-894-4556
GA	Norcross, Elctrn. Sls., Inc.	404-448-6554
ID	Boise, Emerging Technlg. Sls., Inc.	208-378-4680
IL	Elk Grove Village, Carlson Elctrn. Sls. Co.	708-956-8240
IN	Indianapolis, Precision Elec. Comp.	317-842-3740
IA	Cedar Rapids, Carlson Elctrns.	319-378-1450
KS	Overland Park, Electri-Rep, Inc.	913-649-2168
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Farmingham, Gallagher Assoc.	508-626-2346
MI	Brighton, A.P. Assoc.	313-229-6550
MN	Minneapolis, Comstrand, Inc.	612-574-9480
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Fairfield, Tech. Applications & Mktg., Inc.	201-575-4130
NY	Manlius, LamTec Sls. Corp.	315-682-4780
NC	Cary, Electronic Sls., Inc.	919-467-8486
OH	Centerville, Omega Sls., Inc.	513-434-5507
OH	Cleveland, Omega Sls., Inc.	216-360-9400
OR	Portland, Venture Elctrns., Inc.	503-624-0617
PA	Trevose, Omega Sls.	215-244-4000
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
UT	Midvale, Simpson Assoc.	801-566-3691
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790
Can	Kanata, Ont., Electro Source, Inc.	613-592-3214
Can	Pointe Claire, Que., Electro Source, Inc.	514-630-7486
Can	Rexdale, Ont., Electro Source, Inc.	416-675-4490
Can	Richmond, B.C., Blakewood Elctrn. Sys., Inc.	604-444-3344

BECK SYSTEMS INC., Beck Technology, 2354 Ave. C North, Saskatoon, SK, CAN S7L 5X5, Tel: 306-975-1080, FAX: 306-975-3993; Empl.: 7; *Sls. Mgr.:* Shane Simpson

BEEDE ELECTRICAL INSTRUMENT CO., INC., 175 South Main St., Penacook, NH 03303, Tel: 603-753-6362, FAX: 603-753-6201; FSC No.: 06555; Empl.: 350; *Sls. Mgr.:* Jeffrey L. Schindler; *Dist. Mgr.:* Diane Aldrich **D•1339**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, F L W, Inc.	714-751-7512
CA	Fremont, FLW, Inc.	510-651-6511
CA	Oxnard, FLW, Inc.	805-984-0167
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Des Plaines, Saffro & Assocs.	708-299-7680
IN	Carmel, Frank Kahsar Sls.	317-844-9353
MD	Mt. Airy, Strayton Assocs., Inc.	301-831-7007
MA	Canton, N.E.S. Elctrn. Rep. Co.	617-828-4835
MI	Muskegon, Frank Kahsar Sls.	616-798-4451
MI	Sterling Hghts., Frank Kahsar Sls.	313-795-3530
MO	Independence, Gribble Sls. Engrg. Co.	816-796-4333
NJ	Kenilworth, Shortess-Rawson & Assocs.	908-276-2525
NY	Buffalo, NRM Mktg.	716-634-4300
NY	Skaneateles, NRM Mktg. Grp.	315-685-8991
NY	Spencerport, NRM Mktg. Grp.	716-352-9166
NC	Raleigh, 20th Century Mktg.	919-790-9383
OH	Cincinnati, Frank Kahsar Sls.	513-598-1484
OH	Columbus, Frank Kahsar Sls.	614-252-4009
OH	Elyria, Frank Kahsar Sls.	216-365-5219
OH	Palma, Frank Kahsar Sls.	216-845-0103
PA	Kulpsville, The James Dell Co.	215-584-4925
PA	Pittsburg, Frank Kahsar Sls.	412-734-8797
TX	Dallas, Southwest Elctrn. Industries	214-690-9881
TX	Vidor, Southwest Elec. Ind.	409-786-1028
Can	Brampton, Ont., Mod-Tronics, Ltd.	416-457-6322

Local Distributors

CA	El Cajon, Meter Craft	619-258-8990
CA	Hayward, Dynametron	510-786-9459
CA	Los Angeles, EIL	213-685-7020
CA	Sunnyvale, EIL	408-744-0271
CO	Aurora, R & R Instrmn.	303-364-8325
CO	Denver, EIL	303-534-4160
CO	Denver, Process Meas.	303-937-7226
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Edgewater, Southern Instrs.	904-427-3963
FL	Hialeah, Kimball Elec.	305-822-5792
FL	Palm Bay, EIL	407-725-8300
IL	Bridge View, EIL	708-430-2292
IL	Countryside, Inotek/Pacific Indicator	708-352-3500
IL	Franklin Pk., Alca, Inc.	708-451-6644
KS	Overland Pk., Brooks Elctrns.	913-648-3131
KY	Louisville, E.I.L. Instrs.	502-454-3420
MD	Hunt Valley, E.I.L. Instrs.	410-584-7400
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Waltham, Calibron	617-894-6440
MI	Ferndale, Ram Meter, Inc.	313-398-6767
NJ	Pennsauken, EIL	609-488-0474
NJ	Pompton Lakes, Instrument Masters	201-839-2876
NY	Clarence, EIL	716-634-8500
NY	Mastic Beach, Alternate Solution	516-399-7701
NC	Charlotte, E.I.L. Instrs.	704-376-2237
OH	Cleveland, Weschler Instr.	216-238-2550
OH	Dayton, EIL	513-435-2134
OH	Madison, Madison Elec.	216-428-6464
OH	Middlefield, Bentronix	216-632-0606
PA	Pittsburgh, E.I.L. Instrs.	412-823-2255
TN	Knoxville, Brownell Elec.	615-966-3441
TX	Beaumont, Straughn Elec.	409-838-4563
TX	Dallas, Dallas Meter Tek	214-349-6044
TX	Dallas, E.I.L. Instrs.	214-357-0297
TX	Houston, American Analog	713-941-7265
TX	Houston, E.I.L. Instrs.	713-271-3100
VA	Norfolk, EIL	804-855-9553
VA	Richmond, Meter Metrics	804-275-1431
WA	Redmond, E.I.L. Instrs.	206-882-3222
WI	Milwaukee, E-M Instrs.	414-272-7799
Can	Ontario, Modtronics	416-457-6322
Can	Quebec, Brunelle	819-563-9096
Can	Toronto, EIL	416-624-6660

BEHLMAN

An Astrosystems Company

FAX: 516-328-1658

BEHLMAN ELECTRONICS INC., 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600 **D•2244-2249**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs., Inc.	602-431-9417
CA	Chatsworth (Southern), Technlgs. West	818-700-6426
CA	San Francisco (Northern), RDX Corp.	510-568-5606
CA	Ventura, Behlman Elctrns.	805-642-0660
CO	Golden, Trembly Assocs., Inc.	303-279-3019
IL	Wheeling, Ed Joyner & Co.	708-520-1200
KS	Overland Park, Markline Technlgs.	913-681-8880
MD	Hampstead, Tech. Instr. Sls.	301-239-4452
MI	St. Claire Shores, Agren-Asher Co.	313-773-2220
MN	Eden Prairie, Professional Mktg.	612-934-5939
MO	Lake St. Louis, Markline Technlgs.	314-625-6222
NH	Nashua, Intersell	603-880-6500
NM	Albuquerque, Trembly Assocs., Inc.	505-266-8616
NY	Lake Success, Behlman Elctrns.	516-328-1600
OK	Tulsa, Acudata Inc.	918-743-1875
PA	Lansdale (Eastern), Tech. Inst. Sls.	215-361-7850
PA	Pittsburgh (Western), Instrmn. Sys.	412-823-7005
TX	Houston, Acudata Inc.	713-580-2451
UT	N. Salt Lake City, Trembly Assocs., Inc.	801-295-4703
WA	Seattle, Datacom Assocs.	206-285-2525

BEHLMAN ELECTRONICS, INC., Astrosystems, 2021 Sperry Ave.,No. 18, Ventura, CA 93003, Tel: 805-642-0660, FAX: 805-642-0790; FSC No.: 53636 **D•2244-2249**

Local Sales Offices & Reps

AL	Huntsville, Reynolds Assocs.	205-539-1485
AZ	Tempe, Trembly Assocs. Inc.	602-431-9417
CA	Chatsworth, Technlgs. West	818-700-6426
CA	San Francisco, RDX Corp.	510-568-5606
CA	Ventura, Behlman	805-642-0660
CO	Golden, Trembly Assocs. Inc.	303-279-3019
FL	Melbourne, Reynolds & Assocs.	407-259-7000
GA	Duluth, Reynolds Assocs.	404-476-4992
IL	Wheeling, Ed Joyner & Co.	708-520-1200
KS	Overland Park, Markline Technlgs.	913-681-8880
MD	Hampstead, Tech. Inst. Sls.	301-239-4452
MN	Eden Prairie, Professional Mktg. Svcs. Inc.	612-934-5939
NH	Nashua, Intersell	603-880-6500
NM	Albuquerque, Trembly Assocs. Inc.	505-266-8616
NY	Fayettsville, Martin P. Andrews	315-637-5291
OK	Tulsa, Acudata Inc.	918-743-1875
PA	Lansdale, Tech. Inst. Sls.	215-361-7850
PA	Pittsburgh, Instrmn. Sys. Inc.	412-823-7005
TX	Houston, Acudata Inc.	713-580-2451
TX	Plano, Acudata, Inc.	214-424-3567
UT	N. Salt Lake City, Trembly Assocs. Inc.	801-295-4703
WA	Seattle, Datacom Assocs.	206-285-2525
Can	Mississauga, Ont., Altus Technologies	416-670-0783

BEI

FAX: 619-931-1212

BEI MOTION SYSTEMS COMPANY, Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500; Empl.: 25 **B•1917**

Local Sales Offices & Reps

CA	Garden Grove, BEI Motion Sys. Co.	714-534-5830
CA	San Rafael, BEI Motion Sys. Co.	415-492-2840
CO	Westminster, BEI Motion Sys. Co.	303-426-1566
GA	Snellville, BEI Motions Sys. Co.	404-978-6301
IL	Rockford, BEI Motion Sys. Co.	815-968-9528
MA	Norwell, BEI Motion Sys. Co.	617-878-9820
MI	Plymouth, BEI Motion Sys. Co.	313-451-0359
NJ	Morristown, BEI Motion Sys. Co.	201-984-5600
OH	Cincinnati, BEI Motion Sys. Co.	513-232-4545
PA	Lancaster, BEI Motion Sys. Co.	717-299-6243
TX	Cleburne, BEI Motion Sys. Co.	817-556-2211
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Willowdale, Willer Engrg., Ltd.	416-499-4421

BEI MOTION SYSTEMS COMPANY, Chatsworth Encoder Div., 9223 Deering Avenue, Chatsworth, CA 91311, Tel: 818-341-6161, FAX: 818-882-4553; Empl.: 120; *Sls. Mgr.:* Robert Kemp **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off.,Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, FAX: 619-471-2675; Empl.: 30; *Sls. Mgr.:* Hank Robinson, Sls. Mgr. **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off. Carlsbad, CA for sales off. info.

BEI MOTION SYSTEMS COMPANY, DIGITAL PRODS. DIV., See BEI Motion Systems Company,Prec. Sys. & Space Div.

BEI MOTION SYSTEMS COMPANY, Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, FAX: 805-968-3154; Empl.: 60; *Sls. Mgr.:* Glenn Avolio **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, ITEK ENCODER DIV., See BEI Motion Systems Company, Prec. Sys. & Space Div.

BEI MOTION SYSTEMS COMPANY, Kimco Magnetics Div., 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, FAX: 619-744-8815; Empl.: 60; *Sls. Mgr.:* Mike Lopez .... **B•1917**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Precision Systems & Space Division, 178 A Street, Needham Hgts., MA 02194, Tel: 617-455-1414, FAX: 617-455-6514; *Sls. Mgr.:* Marvin Kansky .... **B•1917**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Precision Systems & Space Division, P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, FAX: 501-851-5476; Empl.: 80; *Sls. Mgr.:* Marvin Kansky, Sls. Mgr. ... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BELDEN WIRE AND CABLE COOPER INDS., See Cooper Industries/ Belden Div.

bel BEL FUSE INC.

FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* Dennis Ackerman
.... **A•1512, 1515-1523, 1692, 2276-2293; B•1340, 1344-1349; D•2074-2075**

Local Sales Offices & Reps

AL	Huntsville, INTEREP	205-881-1096
AZ	Phoenix, U.S. Sls.	602-451-1155
CA	Los Angeles, C & N Assocs.	805-254-5844
CA	San Jose, Meridian Tech Sls.	408-262-5474
CO	Boulder, Talisman Assoc.	303-444-7300
FL	Sanford, D Assocs.	407-321-9594
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, LTD Tech.	708-773-2900
IN	Indianapolis, Insul Reps	317-469-1994
MN	St. Paul, Rockmore Sls.	612-941-1390
MO	Bridgeton, Dy-Tronix	314-291-4777
NJ	East Brunswick, Winch Sls.	908-613-1515
NM	Albuquerque, Syntech	602-264-7971
NY	Rochester, Tri-Tech	716-385-6500
NC	Raleigh, Beacon Elctns.	919-787-0330
OH	Columbus, A. Baier Co.	614-764-1144
PA	Hatboro, AQS Electro	215-674-3562
TN	Knoxville, Insul-Reps	615-691-7586
TX	Dallas, Oeler & Menelaides	214-361-8876
UT	Salt Lake City, Western Mktg.	801-268-9768
WI	Milwaukee, LTD Tech.	414-774-1006
Can	Toronto, Cantronics	416-297-8668
GA	Atlanta, Beacon Elect.	404-256-9640
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994

BRILL ELECTRONICS
(510) 834-5888
810 E. 10th. St., Oakland, CA 94608
COOPER INDUSTRIES BELDEN
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

KS	Leawood, Dy-Tronix	913-339-6333
MN	St. Paul, Rockmore Sls.	612-941-1390
NY	Rochester, Tri-Tech Elec.	716-385-6500
NJ	New Brunswick, Winch Sls. Assocs.	201-613-1515
NC	Raleigh, Beacon Elect.	919-787-0330
OH	Cleveland, Arthur Baier Co.	216-461-6161
PA	Hatboro, AQS	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

FL	Longwood, D-Assocs., Inc.	407-830-8976
IL	Chicago, LTD	708-773-2900
GA	Atlanta, Beacon Elect.	404-256-9640
KS	Leawood, Dy-Tronix	913-339-6333
MN	S. St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
NJ	E. Brunswick, Winch Sls. Assoc.	201-613-1515
MO	St. Louis, Dy-Tronix	314-291-4777
OH	Cleveland, Arthur Baier Co.	216-461-6161
NY	E. Rochester, Tri-Tech Elec.	716-385-6500
PA	Hatsboro, AQS	215-674-3562
NC	Raleigh, Beacon Elect.	919-787-0330
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
TN	Knoxville, Insul. Reps.	615-691-7586
PR	Hato Rey, M. Anderson Co., Inc.	809-751-2020
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Local Distributors

CT	Wallingford, Sager	203-265-4600
FL	Boca Raton, D & R	407-977-8751
FL	Orlando, Sager	407-240-3114
MD	Columbia, Sager	301-995-4900
MA	Hingham, Sager	617-749-6700
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, Sager	919-850-9550
PA	Bristol, Aim Elctrns.	215-785-3500
PA	Philadelphia, Sager	215-464-4336
AL	Huntsville, CDI	205-883-7501
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Hayward, Kea Elctrns.	415-887-2900
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Force Elctrns.	408-943-1324
CT	Wallingford, Sager	203-265-4600
FL	Ft. Lauderdale, CDI	305-971-4950
FL	Orlando, Sager	407-240-3114
GA	Norcrosss, CDI	404-441-3320
MD	Columbia, Sager	301-995-4900
MA	Hingham, Sager	617-749-6700
MA	Marlboro, Hardware Specialty	617-481-8622
MN	New Brighton, Chris Elctrns.	612-631-2647
NH	Hudson, Bell Inds.	603-882-1133
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Bohemia, Key Comps.	516-567-7500
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, CDI	919-787-7311
NC	Raleigh, Sager	919-850-9550
OR	Beaverton, Comp. Resources	503-641-8488
PA	Cornwall Hgts., Reliance Merchandising	215-638-8200
PA	Philadelphia, Sager	215-464-4336
VA	Falls Church, CDI	703-241-8227

BEL HYBRIDS & MAGNETICS, Bel Fuse Inc., 5362 W. 78TH St., Indianapolis, IN 46268, Tel: 317-876-0044, FAX: 317-876-0092; Empl.: 23; *Sls. Mgr.:* Warren Mitch .... **A•1692**

Local Sales Offices & Reps

AL	Huntsville, Interep	205-881-1096
CA	Milpitas, Meridian	408-262-5474
FL	Longwood, D-Assocs.	407-830-8976
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Indianapolis, Insul-Reps, Inc.	317-251-1994
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix Inc.	316-838-0884
MN	Eden Praire, Rockmore	612-941-1390
MO	Raytown, Dy-Tronix	913-229-6333
MO	St. Louis, Dy-Tronix	314-291-4777
NY	Hauppauge, CCI	516-273-5050
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Cleveland, Arthur H. Baier, Inc.	216-461-6161
PA	Hatboro, AQS Electro	215-674-3562
TN	Knoxville, Insul-Reps	615-691-7586
TX	Austin, Oeler & Menelaides, Inc.	512-453-0275
VA	Charlottesville, DVS	804-973-0303
WI	Milwaukee, LTD Technlgs.	414-774-1000

BELL, FLOYD, INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-294-4000, FAX: 614-291-0823; FSC No.: 56493; *Sls. Mgr.:* Tom Shain .... **D•1026-1027**

Local Sales Offices & Reps

IL	Mt. Prospect, Robert Adams Sls. Co.	312-297-8733
MD	Columbia, Tyler Griffin Co.	301-995-1215
PA	Paoli, Tyler Griffin Co.	215-647-1550

F.W. BELL

FAX: 407-677-5765

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 407-678-6900; FSC No.: 18479; Empl.: 70; *Sls. Mgr.:* Stephen L. Dakel; *Dist. Mgr.:* Stephen L. Dakel
.... **B•1918; D•1152-1153, 1236-1237**

Local Sales Offices & Reps

AL	Birmingham, Southrep	205-304-8225
AZ	Tempe, Trembly Assoc.	602-431-9417
CA	Arcadia, Southwest Instr.	818-574-0049
CA	Milpitas, Maxim Electronic Sls.	408-946-6001
CO	Denver, Trembly Assoc.	303-279-3019
FL	Winter Springs, T Squared Mktg.	407-699-9992
GA	Newnan, South Rep	404-304-8225
IL	Palatine, Golbeck Milota Assoc.	708-705-0602
MD	Hampstead, Technical Instr. Sls.	301-239-4452
MA	Ashland, Sullivan Tech. Sls.	508-881-2215
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NM	Albuquerque, Trembly Assoc.	505-266-8616
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Beachwood, Electronic Salesmaster	216-831-9555
OR	Beaverton, NW Test & Measurement	503-645-9000
PA	Lansdale, Technical Instr. Sls.	215-361-7850
WA	Bellevue, NW Test & Measurement	206-881-8857
WI	Madison, Golbeck Milota Assoc.	608-222-7037
Can	Dorval, Que., Weiss Co.	514-685-6644

Local Distributors

AZ	Tempe, Trembly Assoc.	602-431-9417
ID	Boise, Radar Elec. Co. Inc.	208-336-2227
CA	Irwindale, Shafer Eng.	818-960-5402
CA	Milpitas, Maxim Electronic Sls.	408-946-6001
CA	Norco, Empire Instr.	714-279-6364
CA	Pomona, Inspection Tech.	714-626-2600
CA	San Marcos, Mitchell Instr.	619-744-2690
FL	Orlando, Brownell Electro	407-843-6776
OR	Portland, Radar Elec. Co.	503-232-3404
GA	Atlanta, P & R Instrs.	404-391-9117
GA	Forest Park, Brownell Electro	404-362-9009
GA	Marietta, Peach State Instr.	404-424-0447
IL	Crystal Lake, Right Distributors	815-459-0645
KY	Louisville, United Utility Supp.	502-451-2430
MD	Baltimore, Davis Instr.	410-358-3900
MD	Hunt Valley, E.I.L. Instrs.	410-584-7400
MA	N. Andover, Contact East	508-682-9844
MA	Sharon, Adcour	617-784-8123
MO	St. Louis, Indsl. Srv. Lab.	314-423-3141
NY	Rochester, Transcat	800-828-1470
NY	Whitestone, Power Electro Supply	718-767-1447
OH	Cleveland, Meter Master	216-351-1234
OH	Dayton, Electro Sls. Assoc.	513-426-5551
TX	Dallas, Seaton Elctrns.	214-980-9860
PA	McKeesport, Barno Radio Co.	412-751-5966
PA	Reading, Barbey Elctrns.	215-376-7451
SC	Charleston, Cameron Barkley Co.	803-745-2837
TN	Chattanooga, Edwin Bohr	615-877-8207
TN	Chattanooga, Edwin Bohr Elctrns.	615-877-8207
TX	Mesquite, Inspection Prods.	214-686-4275
VA	Richmond, Fidus	804-275-2302
WA	Seattle, Radar Elec. Co.	206-282-2511
Can	Mississauga, Ont., BCS Elctrns. Ltd.	416-602-8550
Can	Montreal, Que., Pro Jean	514-273-8331

J.W.MILLER

FAX: 310-515-1962

BELL INDS., J. W. Miller Div., 306 E. Alondra Blvd. P.O. Box 2859, Gardena, CA 90247-1059, Tel: 310-515-1720; FSC No.: 76493; Empl.: 30; *Sls. Mgr.:* Jeff Johnson
.... **A•1190-1195**

Local Sales Offices & Reps

AZ	Mesa, Fetty/Schoenduve, Inc.	602-844-8289
CA	J.W. Miller	310-515-1720
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Denver, West, Inc.	303-477-8180
FL	Winter Park, HHP Assocs., Inc.	407-740-0320
GA	Buckhead, MFRS. Sls. & Mktg. Svcs.	404-342-3503
IL	Skokie, Specialized Mktg.	708-674-1111
IN	Carmel, Current Elctrn. Mktg., Inc.	317-844-1770
MD	Sykesville, DJC Elctrn. Sls., Inc.	410-795-7020
MA	Burlington, Conti-Younger Assocs., Inc.	617-273-1582

MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
MS	Hattiesburg, Mfgs. Sls. & Mktg. Svcs.	601-264-4755
MO	St. Louis, Lowell/Kangas Assocs.	314-821-4050
NJ	Englewood, Epstein & Siebel Assoc.	201-569-7600
NY	Marcellus, J.G. Welch Sales	315-673-1009
NY	Rochester, J.G. Welch Sales	716-244-1100
NY	Yonkers, Roburn Agencies, Inc.	914-968-1016
NC	Raleigh, South Tech Sls.	919-571-1313
OH	St. Mary's, Thomas Shelby & Co., Inc.	419-394-3377
OR	Portland, Caruso-Camelleri Assoc.	503-246-5439
TN	Memphis, MFRS. Sls. & Mktg. Svcs.	901-767-0801
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
WA	Bellevue, Caruso-Camelleri Assoc.	206-455-8811
EXP	N.Y., Yonkers, Roburn Agencies, Inc.	914-968-1016
Can	Calgary, Alberta, Cana Rep Grp., Inc.	403-255-0294
Can	Montreal, Que., Cana-Rep. Grp., Inc.	514-276-4477
Can	Surrey, B.C., Cana Rep Grp., Inc.	604-599-1232

Local Distributors

CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
IL	Chicago, Newark Elctrns.	708-784-5100
IN	Indianapolis, Custom Svc. Elctrn.	
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
NJ	E. Brunswick, Brothers Elctrns.	908-238-2200
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Willowdale, Ont., Electro Sonic, Inc.	416-494-1666

BELLOFRAM CORPORATION, State Route 2, Box 305, Newell, WV 26050, Tel: 304-387-1200, 1-800-733-2356, FAX: 304-387-1212; Empl.: 300; *Sls. Mgr.:* David Lewis; *Dist. Mgr.:* David Lewis

BELMONT INSTRUMENT CORP., Pinehurst Pk, 8 Cook St, Billerica, MA 01821, Tel: 508-663-0212, FAX: 508-663-0214

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 908-272-8591, TELEX: 229854, FAX: 908-272-3825; Empl.: 125; *Sls. Mgr.:* Joseph Abramczyk

BEMCO, 2255 Union Place, Simi Valley, CA 93065, Tel: 805-583-4970, FAX: 805-583-5033; Empl.: 43; *Sls. Mgr.:* Glenn Elliott

BENCHMARQ MICROELECTRONICS, INC., 2611 Westgrove 109, Carrollton, TX 75006, Tel: 214-407-0011, FAX: 214-407-9845; Empl.: 120; *Sls. Mgr.:* Jim Vernon

BENDIX CONNECTOR OPERATIONS, See Amphenol, Bendix Connector Ops.

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENJAMIN INTERNATIONAL, INC., 3677 23rd Ave. South, Lake Worth, FL 33461, Tel: 407-533-0064, FAX: 407-547-2844

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 800-227-5514, 702-782-3611, TELEX: 354437, FAX: 702-782-9253; FSC No.: 1561105

BERG
ELECTRONICS

FAX: 302-892-1274,5

BERG ELECTRONICS, 150 Corporate Center Dr., Ste. 201, Camp Hill, PA 17011, Tel: 800-237-2374; *Dist. Mgr.:* Phil Raudensky, Dir. Natl. Distbn.

Local Sales Offices & Reps

PA	Camp Hill, Berg Elctrns.	800-237-2374

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Aerospace Computer SW	602-582-2779
AZ	Phoenix, Bell Ind.	602-966-7800
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Deanco/Acacia Div.	602-894-2874
AZ	Tempe, TTI	602-431-1191
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fremont, Deanco/Acacia Div.	510-623-7500
CA	Hawthorne, Bell Inds.	213-757-8381
CA	Irvine, Deanco/Acacia Div.	714-660-0834
CA	Los Angeles, TTI	818-891-8885
CA	LosAngeles, Bell Ind.	310-826-2355
CA	Orange County, Bell Inds.	714-895-7801
CA	Orange County, Capstone Elctrns.	714-730-0349
CA	Orange County, TTI	714-641-9393
CA	Sacramento, Bell Ind.	916-652-0414
CA	San Carlos, LoDan West	415-592-4600
CA	San Diego, Bell Ind.	619-268-1277
CA	San Diego, Deanco/Acacia Div.	619-597-0577
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, TTI	619-748-2025
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, TTI	408-946-5577
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Santa Fe Springs, Bell/Cable & Components	213-921-3611
CA	Sante Fe Springs, Bell/Corp. Warehouse	213-921-3611
CA	Sante Fe Springs, Bell/Just-In-Time	213-921-3611
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Ventura, Bell Inds.	818-879-9494
CO	Denver, Bell Inds.	303-424-1985
CO	Denver, Capstone Elctrns.	303-375-1300
CO	Denver, TTI	303-429-6806
CO	Lakewood, Deanco/Acacia Div.	303-375-1300
CT	Danbury, Bell Inds.	203-269-6801
CT	Wallingford, Sager Elctrns.	203-265-4600
CT	Wallingford, TTI	203-284-7474
CT	Yalesville, Deanco/Schaal Div.	203-265-4600
DC	Washington, Resco/Washington	301-937-9100
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Largo, LoDan Elctrns.	813-538-2600
FL	Orlando, Bell Inds.	407-339-0078
FL	Orlando, Deanco Inc.	407-671-5100
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Orlando, TTI	407-859-1000
GA	Atlanta, Bell Inds.	404-446-7167
GA	Atlanta, Deanco Inc.	404-429-0126
GA	Norcross, Hammond Elctrns.	800-241-5437
GA	Norcross, TTI	404-662-0911
IL	Addison, Belford Elctrns. Inc.	708-691-1100
IL	Chicago, Bell Inds.	708-640-1910
IL	Chicago, Capstone Elctrns.	708-250-0300
IL	Chicago, LoDan Elctrns.	708-398-5311
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, TTI	708-884-6500
IL	Chicago, Waldom Elec.	312-585-1212
IL	Wheaton, Deanco/Mega Div.	708-665-6214
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Bell/Just-In-Time	317-876-3740
IN	Indianapolis, Meunier Elctrn. Supply	317-635-3511
MD	Baltimore, Bell Inds.	410-290-5100
MD	Baltimore, Resco/Baltimore	410-931-8200
MD	Columbia, Sager Elctrns.	301-995-4900
MD	Columbia, TTI	410-995-1331
MD	Gaithersburg, Deanco, Inc.	301-948-5444
MA	Boston, Bell Inds.	508-474-8880
MA	Boston, Capstone Elctrns.	800-388-2277
MA	Burlington, Deanco/Schaal Div.	617-272-7940
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Tewksbury, TTI	508-851-2000
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	Minnetonka, TTI	612-933-8555
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Fairfield, Deanco Inc.	201-575-7960
NJ	Mt. Laurel, TTI	609-234-6400
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Ithaca, Deanco, Inc.	607-257-4444
NY	Ronkonkoma, Conco Elctrns.	516-467-8200
NY	Ronkonkoma, TTI	516-737-2000
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Deanco, Inc.	919-851-2065
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, TTI	513-898-8330
OH	Independence, TTI	216-328-9755
OK	Tulsa, Norvell Elctrns.	918-628-1916
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Almac/Arrow	503-629-8090
OR	Beaverton, Component Resources Inc.	503-641-8488
OR	Portland, Bell Inds.	503-635-6500
OR	Tigard, TTi, Inc.	503-684-3707
PA	Bristol, Bell/Wire & Cable	215-788-5000
PA	Mars, Sager Elctrns.	412-772-2233
PA	Philadelphia, Bell Inds.	215-953-2899
PA	Philadelphia, Capstone Elctrns.	609-596-7500
PA	Philadelphia, Sager Elctrns.	215-464-4336
PA	Trevose, Bell/Cable & Components	215-990-9183
SC	Greenville, Hammond/Emsco	803-233-4121
TX	Austin, Norvell Elctrns.	512-343-2900
TX	Dallas, Bell Inds.	214-690-0466
TX	Dallas, Capstone Elctrns.	214-380-9049
TX	Dallas, Force Elctrns.	214-247-9955
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Fort Worth, Allied	817-595-3500
TX	Fort Worth, TTI	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-740-9000
TX	Ft. Worth, TTI, Inc. (Connector Div.)	817-834-2202
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Norvell Elctrns.	713-462-1666
UT	Salt Lake City, Bell Inds.	801-255-9611
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184
WA	Bellevue, Almac/Arrow	206-643-9992
WA	Kent, Components Resources	206-454-8666
WA	Redmond, Deanco/Acacia Div.	206-881-5566
WA	Redmond, TTI	206-882-0291
WI	Milwaukee, Bell Inds.	414-547-8879
Intl	Ft. Worth, TX, TTI, Inc.	817-847-6666
Can	Ottawa, Wackid Radio	613-728-1821

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010, TELEX: 9103506176, FAX: 516-599-3274; Empl.: 150; *Sls. Mgr.:* Carol McDevitt

THE
BERGQUIST
COMPANY

FAX: 612-835-4156

THE BERGQUIST CO., 5300 Edina Ind'l, Minneapolis, MN 55439, Tel: 800-347-4572; FSC No.: 55285; Empl.: 275; *Sls. Mgr.:* Bob Savage; *Dist. Mgr.:* Duane Dungey .... **B•1822-1823; C•1654-1657, 1710-1711**

Local Sales Offices & Reps

CA	Canyon Country, Bergquist Co.	805-252-9930
CA	San Mateo, Larson Assoc.	415-358-9559
CO	Westminister, Glennmar, Inc.	303-423-1572
DE	Newark, Bergquist Co.	302-738-5080
GA	Atlanta, Bergquist Co.	404-816-7113
MI	Minneapolis, Bergquist	612-835-2322
MA	Brookline, Harman Assocs.	617-232-6687
MN	Eden Prairie, Hanna-Lind	612-942-8554
NY	No. Syracuse, Leonard D. Allen	315-458-7470
OH	Cleveland, Staff Co.	216-331-5100
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
TX	Lewisville, Bergquist	214-317-1502
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

AL	Huntsville, Component Dist., Inc.	205-883-7501
CA	Fountain Valley, Components Center	213-582-0667
CA	Mtn. View, Energy Sls.	415-969-0800
CO	Aurora, JET Elctrns.	303-364-1000
FL	Ft. Lauderdale, Components Dist. Inc.	305-973-6915
GA	Norcross, Components Dist. Inc.	404-441-3320
IL	Chicago, NEP Elctrns.	312-625-8400
NC	Raleigh, Components Dist. Inc.	919-834-9465
TX	Dallas, Components Dist. Inc.	214-694-0373
WA	Redwood, Murphy Elctrns.	206-881-1234

BNC DIGITAL DELAY AND LIGHT PULSE GENERATORS

FAX: 510-236-3105

BERKELEY NUCLEONICS CORP., 1121 Regatta Sq., Richmond, CA 94804, Tel: 510-234-1100; Empl.: 30; *Sls. Mgr.:* E. J. Buchs .... **D•1239**

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BERKELEY PROCESS CONTROL, INC., 1001 West Cutting Blvd., Richmond, CA 94804, Tel: 510-236-3333, FAX: 510-236-1186; Empl.: 50; *Sls. Mgr.:* Ken Shane; *Dist. Mgr.:* Ken Shane

BERKSHIRE TRANSFORMER CORP., 3 Segar Mtn. Rd., P O Box 129, Kent, CT 06757, Tel: 203-927-3541, FAX: 203-927-4583; FSC No.: 89870; Empl.: 45; *Sls. Mgr.:* George Kraemer

BERK-TEK INC., 132 White Oak Road, New Holland, PA 17557-9722, Tel: 717-354-6200, FAX: 717-354-7944; FSC No.: 19449; Empl.: 350; *Sls. Mgr.:* John Osborn, Sls. Mgr.; *Dist. Mgr.:* Allan Schoonover, V.P. Dist. Sls.

BERMAR CORP., P.O. Box 12844, Research Triangle Park, NC 27709, Tel: 919-489-4316, FAX: 919-419-1394; *Sls. Mgr.:* M. Conland

BERTAN

THE HIGH VOLTAGE PEOPLE

FAX: 516-935-1766

BERTAN HIGH VOLTAGE, 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Paul Oranges ...... **D•1618-1623**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak, Frazier	205-536-1506
AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Encino, King-Way Assoc.	818-788-4124
CA	Los Altos, Cain-White & Co.	415-948-6533
CO	Boulder, H. Bass Assocs.	303-530-7509
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
GA	Norcross, Currie, Peak, Frazier	404-449-7662
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
KS	Lenexa, Midtec Assoc.	913-541-0505
MD	Randallstown, Beacon North	703-591-1300
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Detroit, Geotronix, Inc.	216-659-6100
MN	Minneapolis, Electronic Instrs.	612-374-5628
MO	St. Louis, Midtec Assoc.	314-275-8666
NM	Albuquerque, Thorson/Desert States Co.	505-293-8555
NY	Elmont, Crane & Egert Corp.	516-872-0800
NY	Hicksville, Bertan Assocs., Inc.	516-433-3110
NY	Liverpool, Northern Tech. Sls. Co.	315-451-1091
OH	Cleveland, Geotronix	216-659-6100
PA	Audubon, Holmes Assocs.	215-666-0636
TX	Dallas, Automated Motion Control	214-340-4192
UT	Bountiful, H. Bass Assoc.	801-295-7100
VA	Fairfax, Beacon North	703-591-1300
WA	Bellevue, Cain-White & Co., Inc.	206-462-2118
WI	Milwaukee, Coombs Assocs.	414-351-6123

BERTSCH U.S.

FAX: 619-727-4436

BERTSCH U.S., 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; *Sls. Mgr.:* B. Linko ...... **B•1242-1243**

BEST POWER TECHNOLOGY, INC., P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, TELEX: 701934, FAX: 608-565-2221; Empl.: 6000; *Sls. Mgr.:* Donald Soe

BESTECHNOLOGY

FAX: 206-382-0186

BEST TECHNOLOGY INC., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300; Empl.: 8 ...... **B•1863**

Local Sales Offices & Reps

CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890

BETA AUTOMATION, INC., 3541 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-5785, FAX: 805-499-9071; Empl.: 8

BETA PHASE, 1200 Chrysler Dr., Menlo Park, CA 94025, Tel: 415-494-8410, FAX: 415-853-8228

BETA REVIEW, INC., PO Box 38, Millwood, VA 22646, Tel: 703-837-1436, FAX: 703-837-3063; Empl.: 2; *Sls. Mgr.:* Norman M. Fine

FAX: 508-842-0748

BETATHERM CORP., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545, Tel: 508-842-0516; Empl.: 80 ...... **B•1864-1869**

BETA TRANSFORMER TECH. CORP., ILC Data Device Corp., 40 Orville Drive, Bohmia, NY 11716, Tel: 516-244-7393, FAX: 516-244-8893; FSC No.: 64948; Empl.: 80; *Sls. Mgr.:* Carol Sauer, V.P.

BEY ELECTRIC, INC., 362 Main St., Box 548, Lincoln Park, NJ 07035, Tel: 201-694-5000, FAX: 201-694-7975; *Sls. Mgr.:* Fred DeMauro, Gen. Mgr. ...... **A•2295**

BG ELECTRONICS, EPC Corp., 519 South 5th Avenue, Mt. Vernon, NY 10550-4430, Tel: 914-664-5591, FAX: 914-664-4729; FSC No.: 33791; Empl.: 6; *Sls. Mgr.:* Don Edwards

B-G INSTRUMENTS, INC., Route 1, Box 258, Mead, WA 99021, Tel: 206-567-5000, FAX: 509-238-4920; *Sls. Mgr.:* John Baum ...... **D•1083**

Local Sales Offices & Reps

WA	Spokane, B-G Instrs., Inc.	509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 70

BH ELECTRONICS, INC., 12219 Wood Lk. Dr., Burnsville, MN 55337, Tel: 612-894-9590, FAX: 612-894-9380; FSC No.: 08450; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ...... **A•1196-1197, 2296-2297**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	San Mateo, Halbar North, Inc.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Denver, Electro Comp. Sys.	303-762-9576
IL	Wheaton, EMTronics	708-665-6222
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Southfield, Chapman Tech. Assocs.	313-352-1645
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Montville, Astrum Sls.	201-263-8438
NC	Raleigh, Tingen Tech. Sls.	919-870-6670
OH	Worthington, R J Mktg.	614-888-7638
TX	Dallas, Precision Sls.	214-701-9031
WA	Redmond, Halbar PNW, Inc.	206-882-0990
WI	Theinsville, TFL Assoc.	414-242-6800

BIBCO, INC., 326 East Main, Benton Harbor, MI 49022, Tel: 616-925-8445, 800-851-5701, FAX: 616-925-3081; Empl.: 150; *Sls. Mgr.:* Phil Wilcox

BICC-VERO ELECTRONICS, INC., 1000 Sherman Ave, Hamden, CT 06514, Tel: 203-288-8001, 1-800-242-2863, TWX: 510-227-8890, FAX: 203-287-0062; Empl.: 50; *Sls. Mgr.:* Richard Milne

BICRON ELECTRONICS, 50 Barlow Street, Canaan, CT 06018, Tel: 203-824-5125, FAX: 203-824-1137; FSC No.: 10617; Empl.: 120; *Sls. Mgr.:* Frank Pierzga ...... **A•2299-2301; B•1627, 1919**

Local Sales Offices & Reps

AL	Madison, Southern Elec. Rep.	205-461-8925
CA	San Clemente, ATA Assocs.	714-661-9700
CO	Denver, Omega, Ltd.	303-762-1921
NH	Bow, George T. Molleur	603-228-0557
NY	Pittsford, W.A. Franklin Sls.	716-248-8251
PA	Pittsburgh, S.K.A. Co.	203-582-5897
UT	Salt Lake City, Omega, Ltd.	303-762-1921
WI	Milwaukee, KMA Sls. Co.	414-259-1771

BIKOR, Microsemi Corporation, 1504 W. 228th St., Torrance, CA 90501, Tel: 213-539-6320, FAX: 213-539-0296; FSC No.: 58996; Empl.: 70; *Sls. Mgr.:* James Rorke

BINDICATOR, P.O. Box 61009, 1915 Dove St., Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 BINICATOR P THY, FAX:; Empl.: 60; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Ayers

BIOMATION INSTRUMENTS, 335 Perth St., PO Box 156, Almonte, Ont., Canada K0A1A0, Tel: 613-256-2821, FAX: 613-256-5872; FSC No.: OAG53; Empl.: 3; *Sls. Mgr.:* Andy Guest

BIOMATION, 19050 Pruneridge Ave., Cupertino, CA 95014-0718, Tel: 408-988-6800, FAX: 408-988-1647; *Sls. Mgr.:* John Adam; *Dist. Mgr.:* Walt Klees

BIOMEDICAL TECHNOLOGY, Triangle Biomedical Sciences, Inc., 2604G Carver St., Durham, NC 27705, Tel: 919-471-2237, FAX: 919-477-5883; Empl.: 8

BIOSOFT, Acropolis Computers Ltd., P.O. Box 10938, Ferguson, MO 63135, Tel: 314-524-8029, FAX: 314-524-8129

BIRD ELECTRONIC CORP., 30303 Aurora Rd., Cleveland, OH 44139-2794, Tel: 216-248-1200, TELEX: 706898 Bird Elec. UD, FAX: 216-248-5426; FSC No.: 70998; Empl.: 267; *Sls. Mgr.:* William Yochum, VP of Sls. & Mktg.; *Dist. Mgr.:* Greg Johns, Sls. Mgr.

BIRTCHER CORP., See EG & G Birtcher

BISHOP ELECTRONICS CORP., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 310-695-0446, 310-692-9391, FAX: 310-692-4008

BIT 3 COMPUTER CORPORATION, 8120 Penn Avenue S., Minneapolis, MN 55431-1393, Tel: 612-881-6955, FAX: 612-881-9674; FSC No.: 7Y590; *Sls. Mgr.:* Merle Lonnon

Bivar

FAX: 714-951-3974

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808, TELEX: 852348; FSC No.: 32559; Empl.: 20; *Sls. Mgr.:* Thomas Silber; *Dist. Mgr.:* Thomas Silber ...... **C•1537**

Local Sales Offices & Reps

AZ	Phoenix, Jarko Assocs.	602-596-8533
AZ	Tempe, Jarko Assocs.	602-596-8533
CA	Chatsworth, Alatec	818-727-7800
CA	Cupertino, Prism Tech. Sls.	408-366-6766
CO	Englewood, Delltron Co.	303-741-2122
GA	Norcross, Electro-Mech Sls.	205-447-6478
IL	Downers Grove, Richmar Elec. Corp.	708-968-0118
IN	Indianapolis, Richmar Elec. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MA	Norwood, The MacInnis Co.	617-762-8090
NY	Fairport, Senntec Sls.	716-425-3954
NC	Raleigh, Electro-Mech Sls.	919-790-9300
OH	Cleveland, Marlow Assocs.	216-831-8232
NY	Glen Cove, Dyno Rep, Inc.	516-676-1598
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Plano, Richmar Elec. Corp.	214-424-8388
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WI	Butler, Richmar Elec. Corp.	414-781-1730
Can	Markham, Ont., Avotronics, LTD.	416-475-2024

Local Distributors

AL	Huntsville, All American	206-837-1555
AL	Huntsville, Century Fasteners	205-883-5344
AZ	Phoenix, Aero-Space SW.	602-582-2779
AZ	Phoenix, EKO Sales	602-437-4646
AZ	Tucson, PSN Distbn., Inc.	602-623-9800
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Chatsworth, Jacon Fasteners	818-700-2901
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Fremont, Alatec	415-657-7701
CA	Fremont, Vic/Tal Sls.	415-651-6420
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	Milpitas, MS Inserts	408-946-6565
CA	Mission Hills, Coast Air Inc.	818-898-2288
CA	Mission Viejo, Opto Plus, Inc.	714-380-8654
CA	Monrovia, Erik-A-Elctrn. Distb.	818-574-1020

CA	North Hollywood, Elctrn. Hardware Ltd.	818-982-6100
CA	Oxnard, R. C. Dudek	805-988-4882
CA	San Diego, Western Fasteners	619-292-5115
CA	San Jose, R. C. Dudek	408-321-9011
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Torrance, MS Inserts	213-539-1530
CO	Littleton, Indelco	303-795-3431
CO	Wheatridge, Colorado Elctrn. Hdwr.	303-431-4334
CT	Milford, Plastic & Metal Comps. Co.	203-877-2723
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Apopka, Tropic Fasteners	407-880-4777
FL	Delray Beach, Fastbolt Corp.	407-272-3100
FL	Largo, Elctrn. Precepts of FL	813-544-3636
FL	Pompano Bch., Peerless Radio	305-973-4141
FL	Winter Park, Servtronics	407-677-8191
GA	Norcross, Atlanta Hardware Specialty	404-449-3000
GA	Peachtree City, Engineered Comps.	404-487-7600
IL	Chicago, EMF	312-889-8323
IL	Downers Grove, S.W. Anderson Co.	708-964-2600
IL	Elmhurst, Miltex Sls.	708-941-7100
IL	Lisle, Comps. Inc.	312-852-7707
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, MAR Elctrns.	317-633-6699
MD	Beltsville, Petricko Sls.	301-937-4960
MD	Gaithersburg, Capital Fasteners	301-948-9310
MA	Ashland, Quality Comps.	508-881-6504
MA	Billerica, MS Inserts	508-670-5600
MA	Marlborough, Hardware Spec. Co.	508-481-8622
MA	Waltham, Electronic Fasteners	617-890-7780
MA	Winchester, Webb Distbn.	617-729-5800
MI	Livonia, Tri-West Prods.	313-422-7900
MN	Bloomington, Aero-Space Computor Supp.	612-884-4725
MN	Eden Prairie, S. W. Anderson Co.	612-934-2700
MN	Hibbing, Minn-Tech Elctrns.	218-267-5228
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Peters, Heartland Elctrns.	314-928-6010
NH	Manchester, Crown Comps.	603-626-1717
NJ	So. Hackensack, Fastbolt Corp.	201-440-9100
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Dists.	716-887-2800
NY	Elmhurst, Century Fasteners	718-446-5000
NY	Holtsville, Tower Fastener Co.	516-289-8800
NY	Long Island City, Hardware Specialty Co.	718-361-9393
NY	Mt. Vernon, All American	914-699-2224
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Century Elctrn. Comps.	919-782-2116
NC	Raleigh, Century Fasteners	919-787-1800
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes-Peters	614-294-5351
OH	Englewood, ADS	513-836-8636
OH	Solon, Repco	216-248-8900
OR	Beaverton, Component Resources	503-641-8488
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Harrisburg, Ad-Tech Elctrns.	717-561-9905
PA	Huntingdon Valley, Plastic & Metal Prods.	215-322-2000
PA	Norristown, Century Elctrns.	215-631-5400
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	West Columbia, Century Fasteners	803-791-1800
TX	Dallas, Global Fasteners	214-340-6068
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Seattle, Component Resources	206-454-8666
WA	Seattle, Radar Elec. Co. Inc.	206-282-2511
EXP	CA/Bakersfield, Gray-Weatherhead Equip.	805-397-4281
Can	Mississauga, Ont., Gould Fasteners	416-677-8253
Can	Ontario, Rush Elctrns. Ltd.	416-677-7280
Can	Richmond Hill, Ont., Irwin Indl.	416-889-9100
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999
Can	St. Laurent, Quebec, Carsten Elctrns.	514-334-8321
Can	Ste-Foy, Que., Crobel L.T.E.	418-687-1171
Can	Surry, British Columbia, Memco	604-590-1553

BIW CABLE SYSTEMS, INC., 22 Joseph E. Warner Blvd., N. Dighton, MA 02764, Tel: 508-520-1200, FAX: 508-541-8951; Empl.: 230; *Sls. Mgr.:* S. Adams

BKC SEMICONDUCTORS INCORPORATED., 6 Lake Street, Lawrence, MA 01841, Tel: 508-681-0392, FAX: 508-681-9135; FSC No.: 66891; Empl.: 110; *Sls. Mgr.:* Elizabeth J. Pucci; *Dist. Mgr.:* Patricia Sullivan .... **A•2131-2133**

Local Sales Offices & Reps

AL	Huntsville, Giesting	205-830-4554
AZ	Scottsdale, BKC Western Sls. Off.	602-951-8010
CA	Chatsworth, Wes-K Raltech	818-700-0933
CA	San Jose, Loroco Sls.	408-436-8770
CO	Englewood, Comp Sls.	303-779-8060
FL	Altamonte Spr., Kinetic	407-339-3855
FL	Deerfield Bch., Kinetic	305-480-6040
FL	Palm Harbor, Kinetic	813-934-3768
GA	Duluth, Giesting	404-476-0025
ID	Meridan, Comp Sls.	208-888-3554
IL	Elk Grove Vl., Oasis	708-640-1850
IN	Carmel, Giesting	317-844-5222
IA	Cedar Rapids, Oasis	319-377-8738
KY	Versailles, Giesting	606-873-2330
MD	Baltimore, Tai	410-732-5353
MA	Salem, Diamond Ltd.	508-744-2050
MA	Westborough, Anchor	508-898-2724
MI	Coloma, Giesting	616-468-4200
MI	Comstock Pk., Giesting	616-784-9437
MI	Livonia, Giesting	313-478-8106
MN	Burnsville, 2M Sls.	612-890-7774
NJ	Moorestown, Tai	609-778-5353
NY	N. Syracuse, Entec Grp.	315-458-7936
OH	Cincinnati, Giesting	513-385-1105
OH	Cleveland, Giesting	216-261-9705
OH	Columbus, Giesting	614-459-4800
OR	Tigard, Vantage	503-620-3280
PA	Pittsburgh, Giesting	412-828-3553
TX	Austin, Mrep	512-250-0820
TX	Dallas, Mrep	214-484-5711
UT	Midvale, Comp Sls.	801-561-5099
VA	Charlottesville, Tai	804-971-7840
WA	Bellevue, Vantage	206-455-3460
WI	Brookfield, Oasis	414-782-6660
Can	Kanata, Indigo	613-591-1053
Can	Mississauga, Indigo	416-670-0284
Can	Quebec, Indigo	514-696-6104

Local Distributors

AL	Huntsville, Nu Horizons	205-722-9330
CA	Agoura Hills, Zeus	818-889-3838
CA	Costa Mesa, Hamilton/Avnet	714-641-4199
CA	San Diego, Zeus	619-277-9681
CA	San Jose, All American	408-943-1200
CA	San Jose, Zeus	408-629-4789
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CA	Torrance, All American	310-320-0240
CA	Walnut, ACI	714-594-1731
CA	Woodland Hills, Hamilton/Avnet	818-594-0404
CA	Yorba Linda, Zeus	714-921-9000
CT	Killingworth, ACI	203-663-3311
CT	Monroe, Nu Horizons	203-265-0162
FL	Ft. Lauderdale, Nu Horizons	305-735-2555
FL	Miami, All American	305-621-8282
FL	Oviedo, Zeus	407-365-3000
FL	Sunrise, All American	305-572-7999
FL	Winter Park, Hamilton/Avnet	407-657-3300
GA	Norcross, Nu Horizons	404-416-8666
IL	Bensenville, Hamilton/Avnet	708-860-7780
MD	Columbia, Nu Horizons	410-995-6330
MD	Columbia, Zeus	301-997-1118
MA	Peabody, Hamilton/Avnet	617-532-3701
MA	Wakefield, All American	617-246-2300
MA	Wakefield, Nu Horizons	617-246-4442
MA	Wakefield, Zeus	617-246-8200
MA	Woburn, ACI	617-935-7230
MN	Eden Prairie, All American	612-944-2151
NJ	Cherry Hill, Hamilton/Avnet	609-424-0110
NJ	Mt. Laurel, Nu Horizons	609-231-0900
NJ	Pine Brook, Nu Horizons	201-882-8300
NJ	Totowa, ACI	201-812-0507
NY	Amityville, Nu Horizons	516-226-6000
NY	Plainview, ACI	516-293-6630
NY	Port Chester, Zeus	914-937-7400
NY	Rochester, Nu Horizons	716-292-0777
NY	Ronkonkoma, All American	516-981-3935
NY	Ronkonkoma, Zeus	516-737-4500
OH	Dayton, Hamilton/Avnet	513-439-6730
OH	Dayton, Zeus	513-293-6162
TX	Addison, Hamilton/Avnet	214-308-8140
TX	Richardson, All American	214-231-5300
TX	Richardson, Zeus	214-783-7010
Can	Ontario, Hamilton/Avnet	416-564-6060

BKL, 421 Feheley Dr., King of Prussia, PA 19406, Tel: 215-277-2910, FAX: 215-277-2956; Empl.: 40 .... **B•1134**

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, FAX: 608-752-8701; FSC No.: 12724; Empl.: 10; *Sls. Mgr.:* D. Adee

BLACKHOLE TECHNOLOGY, 225 East St., Winchester, MA 01890, Tel: 617-721-7690, FAX: 617-721-7260; Empl.: 5; *Sls. Mgr.:* John W. McDonough, Jr.

BLATEK, INC., 2820 E. College Ave., Ste. F, State College, PA 16801, Tel: 814-231-2085, 814-231-2086, FAX: 814-231-2087; Empl.: 20

BLH ELECTRONICS, INC., 75 Shawmut Road, Canton, MA 02021-9111, Tel: 617-821-2000, FAX: 617-828-1451; FSC No.: 03089; Empl.: 170; *Sls. Mgr.:* Ron Burke

BLILEY ELECTRIC CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, FAX: 814-833-2712; FSC No.: 71034;3098; Empl.: 140 .... **A•1340-1345**

Local Sales Offices & Reps

AL	Madison, R.W. Mitscher Co., Inc.	205-464-0745
CA	Chatsworth, Cygnus Sls. Engrg.	818-727-0312
CA	Los Altos, Jay Stone & Assocs.	415-948-4563
CO	Boulder, Alfred A. Steinberg Rep Co.	303-442-6018
CT	Plainfield, R. W. Mitscher Co., Inc.	203-564-1691
FL	Lutz, R. W. Mitscher Co., Inc.	813-948-2351
FL	Tequesta, R.W. Mitscher Co., Inc.	407-575-4485
GA	Lawrenceville, R. W. Mitscher Co., Inc.	404-923-3239
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
NJ	Collingswood, R. W. Mitscher Co., Inc.	609-858-6440
NM	Albuquerque, Border States Tech. Assocs.	505-884-9100
NY	Binghamton, R. W. Mitscher Co., Inc.	607-724-6561
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313
NY	Pittsford, R. W. Mitscher Co., Inc.	716-586-4012
NC	Davidson, R.W. Mitscher Co., Inc.	704-896-7434
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Alpha, Poliquin & Co., Inc.	513-426-8055
OR	Portland, Temper Tech. Mktg.	503-292-8201
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Austin, Electra Reps, Inc.	512-339-1163
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Richmond, R. W. Mitscher Co., Inc.	804-320-7350
EXP	CT, Stamford, Dage Corp.	203-324-3123

BLUE M, A GENERAL SIGNAL COMPANY, 2218 W. 138th St., Blue Island, IL 60406, Tel: 708-385-9000, FAX: 708-331-2515; Empl.: 300; *Sls. Mgr.:* Gary Carlin

BODINE ELECTRIC COMPANY, 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, FAX: 312-478-3232; *Sls. Mgr.:* James C. Stormont

BOGEN COMMUNICATIONS, INC. MPD PRODS., See Memory Protection Devices, Inc.

BOGEN COMMUNICATIONS, INC., Sound Prods., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, FAX: 201-934-9832; *Sls. Mgr.:* David A. Chambers; *Dist. Mgr.:* Christopher Wildfoerster

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406-1937, Tel: 612-729-9365, FAX: 612-729-8910; FSC No.: 85446; Empl.: 110; *Sls. Mgr.:* Andy Tscholl

BOMAR CRYSTAL COMPANY, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 908-356-7787, 800-526-3935, FAX: 1-908-356-7362; Empl.: 40; *Sls. Mgr.:* Beth Shapiro, OEM Sls. Mgr. .... **A•1346**

Local Distributors

NY	E. Setauket, Dove Elctrn. Comps.	800-232-9825
TX	Ft. Worth, Allied Elctrns.	1-800-433-5700

BOMAR INTERCONNECT PRODUCTS, 1850 Route 46, Ledgewood, NJ 07852, Tel: 201-347-4040, FAX: 201-347-2111; Empl.: 12; *Sls. Mgr.:* Don Cornelius; *Dist. Mgr.:* Don Cornelius

BOMCO, See MuShield Co.

BOMEM INC., 450 Ave. St-Jean Baptiste, Quebec, Canada G2E-5S5, Tel: 418-877-2944, 1-800-888-FTIR, TELEX: 051-31543, FAX: 418-877-2834; Empl.: 120; *Sls. Mgr.:* Henry Buijs

BONAR-KARD-O-LITE, See BKL (formerly Bonar-Kard-O-Lite)

BONDHUS CORPORATION, 1400 E. Broadway, Monticello, MN 55362, Tel: 612-295-2162, FAX: 612-295-4440; Empl.: 100; *Sls. Mgr.:* Hans Wegner

BOONTON ELECTRONICS CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, FAX: 201-584-3037; FSC No.: 04901; Empl.: 74; *Sls. Mgr.:* Rich Anlas

BOPLA ENCLOSURES, 7330 Executive Way, Frederick, MD 21701-8353, Tel: 301-696-9300, FAX: 301-696-9494; FSC No.: 4Y520; Empl.: 35

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BOSCH

FAX: 708-865-5301

BOSCH, ROBERT, CORP. 2800 S. 25th Ave., Broadview, IL 60153, Tel: 708-865-5301; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson .... **B•1435**

Local Sales Offices & Reps

CA	Montrose, Luscombe Engrg.	818-249-9000
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
IA	Davenport, QIPS	319-388-0189
MN	Minneapolis, H.M.R., Inc.	612-888-2122
OH	Richfield, Geotronix Inc.	216-659-6100
PA	Nornstown, Brandon Assocs.	215-278-0500
TX	The Colony, Juliana Co.	214-625-1075

Local Distributors

AL	Huntsville, World Distrs.	205-539-0441
CA	Carson, Accele Elctrns.	213-637-3533
CA	Cerritos, David Levy Co.	800-421-3536
CA	N. Hollywood, Mobile Sound	213-668-1699
CA	Santa Monica, Distr. Specialties	213-452-3445

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
BOURNS
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

CAL SWITCH
CALIFORNIA SWITCH AND SIGNAL, INC.
THE SOURCE FOR
BOURNS INC
Ultra-Miniature Switches
[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
(800) CAL-SWCH

FL	Naranja, LES, Distrs.	305-248-6701
GA	Norcross, Whitehead Elctrns.	404-923-6667
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
IL	N. Chicago, Sound Quest/Delta	708-473-1200
IL	Waukegan, Vanco	708-689-0210
MI	Livonia, Delta Supp. Co.	313-525-5858
MI	Troy, Terminal Supp. Co.	313-362-0790
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	St. Louis, Wes Garde Comp.	314-567-7776
NY	Elmsford, Kin-Tronics, Inc.	914-968-7736
PA	Norristown, Brandon Assocs.	215-278-0500
TX	The Colony, The Juliana Co.	214-625-1075

BOSCHERT, INC., See Computer Products, Inc.

BOSTON GEAR, IMO Industries Inc., 14 Hayward St., Quincy, MA 02171, Tel: 617-328-3300, 1-800-225-5280, FAX: 617-479-6238; Empl.: 402

BOURNS, INC., Electronic Components Sls., 1200 Columbia Ave., Riverside, CA 92507-2114, Tel: 909-781-5500, 801-750-7200, FAX: 909-781-5273; Empl.: 4000; *Sls. Mgr.:* Dennis Lause; *Dist. Mgr.:* Patricia Moorman .. **A•1869-1874, 2052, 2058-2067; B•1656, 1675-1680, 1920-1923**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Auburn, QuadRep Inc.	916-269-2701
CA	Irvine, QuadRep Southern	714-727-4222
CA	San Diego, QuadRep Southern	619-755-1188
CA	San Jose, QuadRep Inc.	408-432-3300
CO	Parker, Parker Webster Co.	303-841-4888
CT	Wallingford, John E. Boeing Co., Inc.	203-265-1318
FL	Casselberry, Dyne-A-Mark	407-831-2822
FL	Palm Bay, Dyne-A-Mark	407-725-7470
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Meridian, Intermountain Tech. Mktg., Inc.	208-888-6071
IL	Elk Grove Village, Oasis Sls. Corp.	708-640-1850
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IN	Kokomo, Technlg. Mktg. Corp.	317-459-5152
IA	Cedar Rapids, Rep Assocs. Corp.	319-373-0152
KY	Louisville, Technlg. Mktg. Corp.	502-245-7411
MD	Baltimore, Micro-Comp, Inc.	410-644-5700
MA	Chelmsford, John E. Boeing Co., Inc.	508-256-5800
MI	Farmington Hills, Rathburg Assocs., Inc.	313-489-1500
MI	Troy, Epsco, Inc.	313-528-0983
MN	Edina, Mel Foster Tech. Sls. Inc.	612-941-9790
MO	Bridgeton, Centech, Inc.	314-291-4230
MO	Raytown, Centech, Inc.	816-358-8100
NJ	Moorestown, Thomas Assocs., Inc.	609-778-5353
NY	Hicksville, J-Square Mktg. Inc.	516-935-3200
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
NC	Indian Trail, CSR Elctrns.	704-882-3995
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Centerville, Bear Mktg., Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
OK	Tulsa, Ammon & Rizos	918-749-6116
OR	Beaverton, J.J. Backer Co.	503-627-0775
PA	Allison Park, Bear Mktg., Inc.	412-492-1150
TN	Knoxville, CSR Elctrns.	615-637-0293
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
UT	Murray, Parker Webster Co.	801-266-9939
VA	Lynchburg, Micro-Comp, Inc.	804-239-2626
WA	Seattle, J. J. Backer Co.	206-285-1300
WI	Brookfield, Oasis Sls. Corp.	414-782-6660
PR	Rio Piedras, P.C. Elctrns., Inc.	809-753-9805
Can	Burnaby, B.C., Davetek Mktg. Inc.	604-430-3680
Can	Dorval, Quebec, John G. Weiss Co., Ltd.	514-685-6644
Can	Mississauga, Ont., John G. Weiss Co., Ltd.	416-673-0011
Can	Nepean, Ont., John G. Weiss Co., Ltd.	613-225-1810

Local Distributors

CA	Los Angeles, Bell Inds.	213-826-6778
CA	Culver City, Hamilton/Avnet	213-558-2071
CA	El Monte, Marshall Ind.	818-307-6186
CA	Gardena, California Switch & Signal	310-538-9830
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Riverside, Elctrn. Supp. Corp.	909-683-7300
CA	San Diego, Time/Harper	619-674-2800
CA	Santa Ana, Teknopak	714-558-8840
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	312-359-5500
MD	White Marsh, Radio Elec. Svc. Co.	410-931-8200
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Livonia, RS Elctrns.	313-525-1155
MN	Thief River Falls, Digi-key Corp.	218-681-6674, 800-344-4539
NJ	Camden, General Radio Supply	609-964-8560
NJ	Teterboro, EAC Corp.	201-288-4477
NY	Rome, Rome Elctrns.	315-337-5400
NY	Binghamton, Pioneer Std.	607-722-9300
NY	Buffalo, Summit Distrs. Inc.	716-887-2800
NY	Ronkonkoma, Mast Distbtrs.	516-471-4422
NY	Woodbury, Seymour Elctrns.	516-496-7474
OH	Cleveland, Pioneer Std.	216-587-3600
PA	McKean, Advacom, Inc.	814-476-7774
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Fort Worth, Allied Elctrns.	817-595-3500
TX	Fort Worth, TTI, Inc.	817-429-4600
TX	Stafford, Harrison Equip. Co.	713-879-2600
WA	Bellevue, Almac Elctrns.	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Concord, Ont., ITT Multicomponents	416-736-1144
Can	Willowdale, Ont., Electro Sonic	416-494-1666

BOURNS INSTRUMENTS INC., 1200 Columbia, Riverside, CA 92507, Tel: 714-781-5148, FAX: 714-781-5178; FSC No.: 80294; Empl.: 220; *Sls. Mgr.:* Al Lara

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BOWMAR INSTRUMENT CORP., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809, Tel: 219-747-3121, FAX: 219-747-9601; FSC No.: 99479; Empl.: 170; *Sls. Mgr.:* Gary McClintick, V.P. Mktg.

BRADFORD ELECTRONICS, INC., See Dale Electronics, Columbus Div.

BRADY USA, INC., Indl. Prods. Div., P.O. Box 2131, Milwaukee, WI 53201, Tel: 1-800-537-8791, TELEX: 26-677, TWX: 910-262-3151, FAX: 1-800-292-2229; *Sls. Mgr.:* Brian P. Connolly; *Dist. Mgr.:* Brian P. Connolly

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BRAND DIELECTRICS, INC., Route 203, N. Windham, CT 06256, Tel: 203-423-6321, FAX: 203-423-4406; Empl.: 5; *Sls. Mgr.:* Philip Harvey

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BRENTEK INTERNATIONAL, INC., 150 W. Beaver St., York, PA 17406, Tel: 717-755-8000, FAX: 717-840-0988; *Sls. Mgr.:* Roberta Breneman

BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, TELEX: 22-1213 TTCUR, FAX: 516-499-5504; FSC No.: 51828; Empl.: 75; *Sls. Mgr.:* Don Fagon

BRILL ELECTRONICS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 310-452-8002, FAX: 310-392-9585; *Sls. Mgr.:* Sam Nizam; *Dist. Mgr.:* Kelly Garcia .... **B•1390, 1454, 1591, 1692, 1874, 1934; C•1648, 1724, 1752; D•1258**

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AZ	Phoenix, Mactronix	602-951-3437
MA	Stow, GH Assocs.	508-897-3534
TN	Industrial Elctrns., Inc.	615-573-7135
EXP	NY, N.Y.C., Roburn Agencies	914-968-1016

Local Distributors

AL	Dothan, Carmichael Whls. Supp.	205-793-7066
CA	Canoga Park, Tim-Co. Sls.	818-992-5040
CA	San Diego, Shanks & Wright	619-239-0176
CT	Manchester, IMS	203-649-4415
CT	Waterbury, Century Elec.	203-755-0405
FL	Lake Mary, Electronic Fasteners	305-321-4000
KS	Topeka, Acme Radio Supp. Co.	913-235-1363
LA	New Orleans, Radio Parts	504-581-5959
MA	Billerica, Eastern Video Sys.	617-667-0009
MA	Lexington, Wholesale Elect. Supp.	617-862-3590
MA	Springfield, Electro-Term	413-734-6469
MA	Waltham, Linear Elect.	617-894-7300
NH	Dover, American Radio Corp.	603-742-6800
NJ	Hackensack, Milcor	201-489-1313
NY	LIC, H.L. Dalis	212-361-1100
NY	N.Y.C., Center Indl.	718-458-6363
OK	Oklahoma City, Huhzicker Bros., Inc.	405-275-2121
OK	Tulsa, Radio, Inc.	918-587-9123
RI	Newport, J & S Elctrn. Distb.	401-847-2977
TN	Knoxville, Indl. Elctrns., Inc.	615-573-7135
TX	Denison, Denison Elctrns.	214-465-0341
TX	Texarkana, McCulloch Elctrns.	214-792-6923
VT	Cavendish, C S Svc. & Supp. Co.	802-226-7582
VA	Norfolk, Todd Elec.	804-855-3111
WA	Seattle, Amateur Radio Supp.	206-767-3222
MN	Minneapolis, Boerger & Assoc.	612-636-4339

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BROOKS ELECTRONICS, 4001 N. American St., Philadelphia, PA 19140, Tel: 215-228-4433, FAX: 215-227-7687; Empl.: 100; *Sls. Mgr.:* Gary J. Brooks; *Dist. Mgr.:* Gary J. Brooks

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Local Sales Offices & Reps

AZ	Glendale, Sunbird Inds., Inc.	602-439-0134
CA	Los Angeles, Brown Applied Technlg. Intl.	310-541-4751
CA	Santa Clara, Brown Applied Technlg. Intl.	408-727-8551
CO	Monument, Sunbird Inds., Inc.	719-481-2900
IL	Inverness, Heartland Tech.	708-358-6622
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
NH	Salem, OEM Mktg. Sls.	603-893-0009
OR	Portland, Power Resources	503-452-1859

B.R.T.B. INC., 80 Citizen CRT 7, Markham, Ont., Canada L6G 1A7, Tel: 416-475-8903, FAX: 416-475-0157; Empl.: 12

BRUEL & KJAER INSTRS. INC., 2364 Park Central Blvd., Decatur, GA 30035, Tel: 404-981-6225, FAX: 404-981-8370; Empl.: 80

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BTC ELECTRONIC COMPONENTS, 139 White Oak Lane, Old Bridge, NJ 08857, Tel: 908-679-9300, FAX: 908-679-9311; FSC No.: 63365; Empl.: 50; *Sls. Mgr.:* Jim Messina

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CA	San Diego, Vale Elctrns, Assocs.	619-693-0113
CA	Santa Clara, Engrg. Assocs.	408-988-5001, FAX:408-727-1860
CO	Aurora, Moss Mktg.	303-340-8535, FAX:303-341-7930
FL	Indian Rock Bch., PAR Assocs., Inc.	813-596-8841, FAX:813-595-8523
GA	Atlanta, Par Assoc.	404-391-9117, FAX:404-395-6346
IL	Long Grove, Robert Adams Sls.	708-634-3384, FAX:708-634-3585
KS	Lenexa, Midtec Assoc.	913-541-0505, FAX:913-541-1729
MD	Columbia, Tyler Griffin Co.	301-995-1215, FAX:301-995-0344
MA	Belmont, Elctrn. Comps. & Svc.	617-484-8680, FAX:617-484-8693
MI	Beachwood, Elctrn. Sls. Masters, Inc.	216-831-9555,FAX:216-831-8647
MN	Minneapolis, A. J. Warner Co.	612-823-8272
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666, FAX:314-275-8859
NJ	Ocean, P. Saftler Assocs.	908-922-3014, FAX:908-922-8198
NM	Albuquerque, Moss Mktg.	505-292-7505, FAX:602-249-4767
NY	Fulton, P. Saftler Assocs.	315-592-7184, FAX:315-592-4152
NY	Lynbrook, P. Saftler Assoc.	516-593-7880, FAX:516-593-7637
NC	Charlotte, PAR Assocs., Inc.	704-535-9858, FAX:704-535-5347
OH	Columbus, McFadden Sls.	614-761-3177, FAX:614-761-2487
OR	Hillsboro, Doran Sls. Assocs., Inc.	503-640-4500, FAX:503-640-4555
PA	Paoli, T. Griffin Co.	215-647-1550, FAX:215-640-4652
TX	Dallas, REM Comps.	214-234-1069, FAX:214-234-1082
UT	Salt Lake City, Moss Mktg.	801-363-5875, FAX:801-328-8236
WA	Bothel, Doran Sls. Assocs., Inc.	206-488-1200, FAX:206-488-1217

Local Distributors

AZ	Phoenix, Dalis Elctrns.	602-275-2626, FAX:602-275-0578
CA	Los Angeles, Elect. Switches	213-664-1141, FAX:213-660-5130
CO	Littleton, Display Plus	303-730-7333, FAX:303-795-8298
GA	Marietta, Peach State Instrs.	404-971-5050
ID	Boise, Radar Elec.	208-336-2227, FAX:208-336-2322
MA	Waltham, Linear Elctrns.	617-894-7300
MI	Ann Arbor, Wedemeyer Elctrns.	313-665-8611, FAX:313-665-5896
NJ	Dover, Electrospec	201-361-6300, FAX:201-361-7868
NM	Albuquerque, Bestech	505-298-0034, FAX:505-296-3422
NY	Hauppauge, Broadline Elctrn. Dist.	516-231-4100
NC	Charlotte, Lakeland Engrg. & Equip.	704-597-0044, FAX:704-597-7957
OR	Portland, Radar Elec.	503-232-3404
TX	El Paso, Ideal Indl. Elctrn.	915-779-6647
WA	Richland, Radar Elec.	509-943-8336, FAX:509-943-6790
WA	Seattle, Radar Elec.	206-282-2511, FAX:206-282-1598
WA	Spokane, Radar Elec.	509-747-3053, FAX:509-456-8069

BUD INDUSTRIES, INC., 4605 E. 355th St., Willoughby, OH 44094-0431, Tel: 216-946-3200, FAX: 216-951-4015; FSC No.: 71218; Empl.: 200; *Sls. Mgr.:* Bill DeRoche; *Dist. Mgr.:* Bill DeRoche

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CA	Tustin, Sierra Pacific Engrg.	714-731-3411
CA	Van Nuys, Halbar	818-906-3941
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FL	Melbourne, Synergistic Technlgs.	407-242-9661
FL	Odessa, Synergistic Technlgs.	813-920-5814
FL	Orlando, Motion Prods. Inc.	407-381-8480
FL	Orlando, Motion Prods., Inc.	407-381-8480
FL	Palm Harbor, Synergistic Technlgs.	813-785-7238
FL	Pompano,Bch., Motion Prods. Inc.	305-783-9003
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Addison, Vikeland Sls.	708-832-8425
IL	Glen Ellyn, Lincoln Hodges Inc.	708-469-6750
KS	Overland Pk., Singer Indl. Sls.	913-381-3684
KS	Overland Pk., Singer Indl. Sls.	913-897-2008
KS	Shawnee Mission, Mertens Co.	913-432-9323
MD	Glenarm, Hodgins Assocs.	301-592-7047
MA	Braintree, R.F. Duffy Assocs.	617-848-3550
MA	Monson, R.F. Duffy Assoc. Inc.	413-267-9884
MI	Royal Oak, Elctrl. Sys. Co.	313-542-1747
MN	St. Paul, Kencotronics	612-645-7717
MN	St. Paul, Vikeland Sls. Inc.	612-645-4647
MO	St. Louis, Mertens Co.	314-993-6600
NH	Manchester, Peak Sls.	603-625-2250
NJ	Hackensack, A.P. Tech. GCF Inc.	201-487-6222
NJ	Sussex, Carbone Assocs.	201-875-1882
NY	E. Syracuse, Applications Specialists	315-437-2814
NY	Rochester, Application Specialists	716-586-6226
OH	Cincinnati, Anderson-Bolds, Inc.	513-528-5680
OH	Cleveland, Anderson-Bolds, Inc.	216-360-9800
OH	Dayton, Electrical Sys. Co.	513-434-9822
OH	Orrville, Electrical Sys. Co.	216-682-5530
OH	Worthington, Anderson-Bolds Inc.	614-885-3933
OR	Hillsboro, Doran Sls. Assocs.	503-640-4500
OR	Tigard, Halbar-RTS	503-624-5741
PA	Philadelphia, Kenneth B. Erdman, Co.	215-233-0172
PA	Wayne, Hodgins Assocs.	215-688-9056
TN	Knoxville, Hughes Assocs.	615-558-0283
WA	Bothel, Doran Sls. Assocs.	206-488-1200
WA	Redmond, Halbar-RTS	206-882-0990
WI	St. Francis, Vikeland Sls.	414-744-7253
Can	Ottawa, Ont., Graham Dewar Assoc.	613-744-8463
Can	Pickering, Ont., Graham Dewar Assoc.	416-839-9955
Can	Scarborough, Ont., Burgess Switch Co.	416-299-0852

Local Distributors

AL	Muscle Shoals, Jones Elctrns., Inc.	205-383-1241
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Fresno, Control Elec.	209-268-4411
CA	Long Beach, Elctrl. Power & Controls	213-498-6699
CA	Redwood City, HdB Elec.	415-368-1388
FL	Boca Raton, Zelcon Inc.	407-451-1600
FL	Miami, B & R Elctrns. Supp. Inc.	305-255-4510
FL	W. Palm Bch., Atlantic Elec. Inc.	407-686-8553
IL	Chicago, Leeds Electro Comp.	312-625-3800
IL	Harvey, George Elctrns.	708-331-1983
MA	Fall River, Broadway Elec. Sls.	508-673-3339
MA	Holyoke, Falcetti & Clark Elec.	413-532-9402
MA	Medford, Empire Elec.	617-395-5000
NJ	Rockaway, NASCO	201-625-7777
MI	Grand Rapids, S & F Elctrns. Supp.	616-459-0216
MI	St. Clair Shores, Spemco	313-771-2700
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NH	Bedford, Cohen Machinery Co. Inc.	603-624-4324
NJ	Oakland, Relay Specialties	201-337-1000
NJ	South Hackensack, NASSOR	201-641-3737
NY	Bronx, Equiptex Ind. Prod.	212-324-1190
NY	Roosevelt, Automated Equip. Co.	516-538-7417
NY	Woodside, Switches Unlimited	718-478-5000
NC	Durham, Triangle Elec. Motor	919-596-1333
NC	Gastonia, JMT Elctrns. & Control	704-867-4401
OH	Cincinnati, Richards Elec. Supp.	513-242-8800
PA	Bristol, Aim Elctrns.	215-785-3500
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Lansdale, County Elec.	215-368-1960
RI	Providence, J & H Elec. Co., Inc.	401-421-7840
SC	Greenville, Sawyer Elctrns. Corp.	803-235-0438
TX	San Antonio, Sherman Elec. Supp. Inc.	512-224-1004
VA	Charlottsville, Virginia Elect. Comp.	804-296-4184
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BURLING INSTRUMENTS, INC., P.O. Box 298, Chatham, NJ 07928-0298, Tel: 201-635-9481, FAX: 201-635-9530; Empl.: 20; *Sls. Mgr.:* Michael Wetterer

Local Sales Offices & Reps

CA	Costa Mesa, Robinson Tech. Assoc.	714-557-1622
CA	Mountain View, Claypool Controls Co.	415-968-7488
CT	Stratford, M. A. Selmon Co.	203-377-3525
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
IL	Lisle, WG Controls	708-963-5954
MI	Dearborn Hgts., CVA	313-274-4959
NC	Kernersville, Heritage Elctrl. Sls.	919-996-4374
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
OK	Tulsa, Ernie Graves Co.	918-584-4707
PA	Edgemont, White/Whiddett Co.	215-353-6343
TN	Chattanooga, Eclipse Thermal Sys.	615-266-4831
Can	Concord, Ont., Baker Instrs. Ltd.	416-738-4780
Can	Vancouver, B.C., John Sherman Agcs. Ltd.	604-254-9622

BURNDY CORPORATION, An FCI Company, 51 Richards Ave., Norwalk,, CT 06856, Tel: 203-838-4444, FAX: 203-852-6227; Empl.: 3500; *Sls. Mgr.:* Frank Zavattaro

BURR-BROWN CORP., P.O. Box 11400, Tucson, AZ 85734, Tel: 602-746-1111, TELEX: 66-6491, TWX: 910-1111, FAX: 609-741-3895; Empl.: 1500; *Sls. Mgr.:* M.Dickey/B.Filiault .... **D•2077-2081**

Local Sales Offices & Reps

AL	Huntsville, Rep Inc.	205-881-9270
CA	Agoura Hills, Burr-Brown Corp.	818-991-8544
CA	Los Angeles, Burr-Brown Corp.	818-991-8544, 805-496-7581
CA	Santa Ana, Burr-Brown Corp.	714-835-0712
CA	Santa Clara, I2, Inc.	408-988-3400
CO	Denver, Burr-Brown Corp.	303-452-3545
GA	Atlanta, Rep Inc.	404-938-4358
IL	Arlington Hgts., Burr-Brown Corp.	708-437-2877
IA	Cedar Rapids, Rep Assoc. Corp.	319-373-0152
MD	Rockville, Marktron Inc.	301-251-8990
MA	N. Billerica, Burr-Brown Corp.	508-670-9800
MI	Farmington, Burr-Brown Corp.	313-474-6533
MN	Bloomington, Electronic Sls. Agency	612-884-8291
MO	Bridgeton, BC Elctrn Sls., Inc.	314-739-6683
NM	Albuquerque, Morrison & Fern, Inc.	505-271-8433
NY	Buffalo, Advanced Comp. Corp.	716-832-6791
NY	Endicott, Advanced Comps. Corp.	607-785-3191
NY	Syracuse, Advanced Comps. Corp.	315-699-2671
NY	Yonkers, Burr-Brown Corp.	914-964-5252
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Aurora, Meta Tech. Sls. Inc.	216-562-8772
OH	Cincinnati, Burr-Brown Corp.	513-891-4711
OH	Cleveland, K-T/Depco Mktg.	216-442-6200
PA	Pittsburgh, K-T/Depco Mktg.	412-367-1011
PA	Spring House, QED Elctrns.	215-643-9200
TN	Jefferson City, Rep Inc.	615-475-4105
TX	Dallas, Burr-Brown Corp.	214-783-4555
TX	Houston, Acudata Inc.	713-580-2451
TX	Houston, Burr-Brown Corp.	713-988-6546
TX	Plano, Acudata Inc.	214-424-3567
UT	Salt Lake City, Aspen Sls., Inc.	801-467-2401
WA	Kent, Burr-Brown Corp.	206-859-9220

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BUSSCO INC., 119 Standard St., El Segundo, CA 90245, Tel: 310-322-6580, FAX: 310-322-8130; FSC No.: 29593; Empl.: 43

BUSSMANN DIVISION, Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, TELEX: 44 841; FSC No.: ;Multiple; Empl.: 3000; *Sls. Mgr.:* Scott Robinson; *Dist. Mgr.:* Scott Robinson

BYTE CRAFT LIMITED, 421 King St. N., Waterloo, Ont., CAN N2J 4E4, Tel: 519-888-6911, FAX: 519-746-6751; Empl.: 5; *Sls. Mgr.:* Karen McMurray

BYTEK CORP., Instrument Systems Div., 543 NW 77th St., Boca Raton, FL 33487-1323, Tel: 407-994-3520, TELEX: 4998369 BYTEK, FAX: 407-994-3615; Empl.: 45; *Sls. Mgr.:* Madeline Selwitz

BYTEX CORP., 4 Technology Dr., Westborough, MA 01581, Tel: 508-366-8000, FAX: 508-366-0244; Empl.: 273; *Sls. Mgr.:* Stephen Nesbit, VP Sls.; *Dist. Mgr.:* Robert Welch, VP Indirect Channels

CABLE & COMPUTER TECHNOLOGY INC., 1555 S. Sinclair St., Anaheim, CA 92806, Tel: 714-937-1341, FAX: 714-937-1225; Empl.: 65

CABLEC CONTINENTAL CABLES CO., BICC Cables Corp., 2555 Kingston Rd., York, PA 17402-9950, Tel: 717-757-6600, FAX: 717-755-4717; Empl.: 750; *Sls. Mgr.:* John Turcich, Sls. V.P.; *Dist. Mgr.:* Dennis Myers

CABLEFORM INC., Zion Cross Roads, Troy, VA 22974, Tel: 804-589-8224, TELEX: 822434, FAX: 804-589-3803; *Sls. Mgr.:* Richard L. Shannon .... **A•1875**

CABLESCAN, INC., Subsidiary of Eubanks Engrg. Co., 145 E. Emerson Ave., Orange, CA 92665, Tel: 714-998-1961, FAX: 714-921-2493; *Sls. Mgr.:* Richard Heintz

CABLESTAR, INCORPORATED, 310 S. Franklin St., Glasgow, KY 42141, Tel: 800-338-8223, FAX: 502-651-2973; Empl.: 25; *Sls. Mgr.:* Larry Hollon

CABLE SYSTEMS, INC., The HVT Group, 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, FAX: 617-389-4758; FSC No.: 33426; Empl.: 70; *Sls. Mgr.:* James R. Collmer

CABLETEST INTERNATIONAL INC., 400 Alden Rd., Markham, Ont., Canada L3R 4C1, Tel: 416-475-2607, 800-667-2518, FAX: 416-475-2609; Empl.: 50 .... **D•1240-1241**

Local Sales Offices & Reps

NJ	Toms River, Heyco Stamped Prods.	908-286-4336
PA	Downington, Cabletest Intl. Inc.	215-873-9753

CABLETEST PRODUCTS CO., P.O. Box 494, Malden, MA 02148, Tel: 617-665-2932; Empl.: 28; *Sls. Mgr.:* H. E. Holley; *Dist. Mgr.:* H. E. Holley

CABLETRON SYSTEMS, INC., 35 Industrial Way, Rochester, NH 03867, Tel: 603-332-9400, FAX: 603-332-4616; Empl.: 1500; *Sls. Mgr.:* Jack Branowski

CABLE USA, INC., 2584 So. Horseshoe Dr., Naples, FL 33942-3560, Tel: 813-643-6400, FAX: 813-643-4230; FSC No.: 67050; Empl.: 55; *Sls. Mgr.:* Joe Giordano

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CABTRON SYSTEMS, INC., 200 N. Anets Dr., Northbrook, IL 60062, Tel: 708-498-6090; Empl.: 45; *Sls. Mgr.:* Bob Dalton .... **C•1017**

Local Sales Offices & Reps

FL	Orlando, D.A.I.	407-299-7754
GA	Lilburn, Phillip Matthews Corp.	404-381-1662,
IN	Indianapolis, Liberty Sls.	317-888-8396
KS	Wichita, Buckman & Assocs.	316-267-2052
MN	St. Paul, Countryman Assocs.	612-645-9151

MO	St. Charles, Buckman & Assocs.	314-947-4727
NC	Kings, Phillip Matthews Corp.	919-983-9790,

CADDELL-BURNS MFG., 258 E. 2nd St., Mineola, NY 11501-3508, Tel: 516-746-2310, FAX: 516-742-2416; FSC No.: 04213; Empl.: 30 .... **A•1198-1212**

CADDELL COIL CORP., P.O. Box 1232, South St., Middletown Springs, VT 05757, Tel: 802-235-2019, FAX: 802-235-2019; Empl.: 6; *Sls. Mgr.:* James Caddell .... **A•1213**

Local Sales Offices & Reps

FL	Vero Bch., R.B. Caddell	305-562-4496

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CADDOCK ELECTRONICS, INC., 1717 Chicago Ave., Riverside, CA 92507, Tel: 909-788-1700, TWX: 910-332-6108; FSC No.: 19647; Empl.: 300 .... **A•1876-1903**

Local Sales Offices & Reps

OH	Cleveland, Arthur H. Baier Co.	216-292-7500
OH	Dayton, Arthur H. Baier Co.	513-233-0087
OR	Beaverton, Elctrn. Sources	503-627-0838
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

TX	Houston, Lenert Co.	713-225-1465

CAD ENGRG. & ASSEMBLY INC., 8663 Tyler Blvd., Mentor, OH 44060, Tel: 216-255-7744, FAX: 216-255-5900; Empl.: 28

CADILLAC PLASTIC & CHEM. CO. DIV. OF M.A. HANNA, P.O. Box 7035, Troy, MI 48007-7035, Tel: 313-583-1200, TWX: 810-232-1886, FAX: 313-583-4715; Empl.: 1000

CAD UTILITY CO., 21115 Devonshire St., Ste.318, Chatsworth, CA 91311, Tel: 805-527-8630, FAX: 805-526-5093; Empl.: 6; *Sls. Mgr.:* Stan Chambers

CAIG LABORATORIES, 16744 West Bernardo Dr., Rancho Bernardo, CA 92127-1904, Tel: 619-451-1799, FAX: 619-451-2799; Empl.: 15; *Sls. Mgr.:* Mark Lohkemper; *Dist. Mgr.:* Laurie Skultety

CAL-AV LABS, INC., 515B Westchester Drive, Campbell, CA 95008, Tel: 408-369-1000, FAX: 408-371-0672; Empl.: 5

CAL-CHIP ELECTRONICS, 69 Steam Whistle Dr., Ivyland, PA 18974, Tel: 215-953-9770

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, FAX: 714-491-9825; Empl.: 30; *Sls. Mgr.:* Audrey Zarrow; *Dist. Mgr.:* Audrey Zarrow

CALEX MFG. CO., INC., 2401 Stanwell Drive, Concord, CA 94520, Tel: 510-687-4411, FAX: 510-687-3333; FSC No.: 29988; Empl.: 75; *Sls. Mgr.:* Linda Hearne .... **D•1624, 2083-2089**

Local Distributors

OH	Richfield, Alpha Distr.	216-659-7100

CALIBRON INSTRUMENTS, Burton-Rogers Co., 220 Grove St., Waltham, MA 02154, Tel: 617-894-6440, FAX: 617-893-8393; Empl.: 10; *Dist. Mgr.:* W. Burton

CALIFORNIA AUTOMATION INC., 11815 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-452-1341

CALIFORNIA AVIONICS LABS., See Cal-Av, Inc.

CALIFORNIA EASTERN LABS. INC., 4590 Patrick Henry Dr., Santa Clara, CA 95056-0964, Tel: 408-988-3500, TELEX: 346393, TWX: 171197; Empl.: 118

California
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FAX: 619-279-8139

CALIFORNIA INSTRUMENTS CORP., 9025 Balboa Ave., San Diego, CA 92123-1509, Tel: 619-279-8620, 800-4AC-POWER; FSC No.: 16067; Empl.: 70; *Sls. Mgr.:* D.R. Chilcoat, G.R. Holland, G. Gartman .... **D•2250-2252**

Local Sales Offices & Reps

AZ	Mesa, SDW Mountain States Reps	602-839-6626
CA	Los Alamitos, Tritek Solutions	714-236-1190
CA	Santa Clara, Tritek Solutions	408-554-0455
CO	Louisville, SDW Mountain States Reps	303-665-8089
FL	Clearwater, Beacon Microwave & Inst.	813-796-2378
GA	Norcross, Beacon Microwave & Inst.	404-449-8464
IL	Arlington Hts., Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assoc.	317-844-0114
KS	Lenexa, Midtec Assocs. Inc.	913-541-0505
MD	Mt. Airy, Electronic Resources, Inc.	301-865-3771
MN	Minneapolis, Berndt Assoc.	612-546-2021
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NJ	Ridgefield Park, Sci. Dvcs., Inc.	201-440-3430
NM	Albuquerque, SDW Mountain States Reps	505-883-3668
NY	Rochester, Tae-Rep, Inc.	512-388-9961
NY	Whitney Pt., Tae-Rep, Inc.	607-692-3705
OH	Cincinnati, Dietrich & Assocs., Inc.	513-984-8924
OH	Cleveland, Dietrich & Assocs.,Inc.	216-642-7965
OR	Beaverton, Northwest Test & Meas.	503-645-9000
PA	Horsham, Sci. Dvcs., Inc.	215-956-0700
PA	Pittsburgh, Dietrich & Assocs., Inc.	412-892-2992
PA	West Chester, Electronic Resources, Inc.	215-431-0198
RI	Narragansett, PAT Assocs.	401-783-9598
TX	Austin, Sci. Dvcs. SW	512-338-9961
TX	Richardson, Sci. Dvcs. SW	214-231-8106
VA	Harrisonburg, Electronic Resources, Inc.	703-289-5571
WA	Bellevue, N.W. Test & Measurement	206-881-8857
WI	Milwaukee, Berndt Assocs., Inc.	414-545-8400
Can	Downsview, Ont., Testforce Sys., Inc.	416-398-1375
Can	N. Vancouver, B.C., Jerome & Francis Co., Ltd.	604-986-1286
Can	St. Laurent, Que., TestForce Sys., Inc.	514-856-0970

CALIFORNIA MICRO DEVICES, INC., 215 Topaz Street, Milpitas, CA 95035, Tel: 408-263-3214, FAX: 408-263-7846; FSC No.: 56427; Empl.: 180; *Sls. Mgr.:* Ted Beloin; *Dist. Mgr.:* Ashok Chalaka

Local Sales Offices & Reps

AL	Athens, WLA & Assocs.	205-233-7893
AZ	Chandler, Techni-Source Corp.	602-497-0711
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Monument, Pinnacle Sls.	719-488-9097
FL	Boca Raton, Tech. Sls. Specs.	407-391-3718
GA	Lawrenceville, WLA & Assocs.	404-339-9443
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Indianapolis, CC Electro Sls.	317-921-5000
IN	Minneapolis, Intl. Elec.	612-571-0000
MD	Columbia, Delta III	410-730-4700
MA	Hudson, Compak, Inc.	508-568-0331
MI	Detroit, CC Electro Sls.	313-455-0000
NM	Albuquerque, Techni-Source Corp.	505-268-4232
NY	Hicksville, J-Square Mktg.	516-935-3200
NC	Raleigh, WLA & Assocs.	919-231-9939
OH	Cleveland, CC Electro Sls.	216-228-4338
OR	Beaverton, Elctrn. Sources	503-627-0838
PA	Ft. Washington, SMC Inc.	215-628-3394
TX	Dallas, Innovative Tech. Sls.	214-699-3485
UT	Salt Lake City, Pinnacle Sls.	801-264-8366
VA	Midlothian, Delta III	804-379-1816
WA	Belleview, Elctrn. Sources	206-451-3500

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Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-536-9775
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Oceanside, Noo Rep. Tech. Sls.	619-941-0558
CA	San Gabriel, Calmark Corp.	818-287-0451
CA	Sunnyvale, Calmark Corp.	408-737-0123
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Woodbridge, Golten Assoc.	708-985-5100
IA	Blue Grass, Rothkopf & Assoc.	319-381-4396
KS	Olathe, Rothkopf & Assoc.	913-829-8897
MD	Towson, Dalbrook Corp.	410-296-3165
MA	Norwood, Tom Maguire Assoc.	617-551-0500
MI	Brighton, W.R.Hummon	313-486-5333
MN	St. Paul, Innovate Sls.	612-225-9772
MO	St. Louis, Rothkopf & Assoc.	314-961-4485
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NY	Plainview, Neptune Elect.	516-349-1600
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Miamisburg, Electronics Comps., Inc.	513-866-3340
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Lansdale, Dalbrook Corp.	215-362-8033
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Richardson, Zonk Assocs.	214-238-7651
VA	Fredericksburg, Dalbrook Corp.	703-786-0335
WA	Snohomish, Unicomp, Inc.	206-568-0511
EXP	Ireland/Cappoquin, Calmark Ireland, Ltd.	353-58-54205
EXP	San Gabriel, CA, Calmark Corp.	818-287-0451
PR	Santruce, SISCO	809-726-3137
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

Local Distributors

CA	Fremont, Connex Elctrns.	510-656-7722
CA	San Jose, Rose Elctrns.	408-263-9700
CO	Denver, Solder Tec.	303-623-5000
IL	Elk Grove, Martec Assocs.	708-956-8090
MD	Beltsville, Petricko, Inc.	301-937-4960
MA	Haverhill, Webb Distbn.	508-374-0100
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
NJ	Nutley, Nationwide Circuit Prod.	201-667-1333
NM	Albuquerque, Betatron	505-821-1122
NY	Elmsford, Multimetrics Co.	914-347-3667
OH	Miamisburg, E.C.I. Distrs.	513-866-3340
TX	Richardson, Zec Sls.	214-669-0895
UT	Salt Lake City, Standard Supply	801-486-3371
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280

CAL-POWER CORP., Standard Magnetic Corp., 7231 Garden Grove Blvd., Ste. C, Garden Grove, CA 92641, Tel: 714-379-5672, FAX: 714-379-5673; FSC No.: 94660; Empl.: 15

CAL-SCOPE, Exceltron Inc., 473-707 Macara Ave., Sunnyvale, CA 94086, Tel: 408-730-4573, 1-800-828-3547, FAX: 408-730-9537; Empl.: 4; *Sls. Mgr.:* Michi A. Kawaguchi

CAL-TEK ENGINEERING, 36 Riverside Drive, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

CAMBRIDGE AEROFLO, INC., 900 Mt. Laurel Circle, Shirley, MA 01464, Tel: 508-425-2346, TELEX: 948503, FAX: 508-425-2338; Empl.: 25; *Sls. Mgr.:* George Lawton

CAMBRIDGE ELECTRONICS LABORATORIES, 20 Chester St., Somerville, MA 02144, Tel: 617-629-2805, TELEX: 948580 RACE

CAMBRIDGE TECHNOLOGY, INC., 23 Elm Street, Watertown, MA 02172, Tel: 617-923-1181, FAX: 617-924-8378; Empl.: 33; *Sls. Mgr.:* Jack Kelley

C.A.M. GRAPHICS CO., INC., 15 Ranick Dr. W., Amityville, NY 11701, Tel: 516-842-3400, FAX: 516-842-1005; FSC No.: 63203; Empl.: 50; *Sls. Mgr.:* Karen Henderson

CANADIAN THERMOSTATS & CONTROL DEVICES LTD., 8415 Mountian Sights, Montreal, PQ, Canada H4P2B8, Tel: 514-739-3274, TELEX: 05-825619, FAX: 514-739-2902; Empl.: 30; *Sls. Mgr.:* Richard W. Murk

C & C JETRONIC, INC., 6 Waterbury Ct., Allentown, NJ 08501, Tel: 609-259-8855, FAX: 609-259-9347; Empl.: 30; *Sls. Mgr.:* C. Jerry Chiang .... **A•2302; C•1274**

C&D CHARTER POWER SYSTEMS, 3043 Walton Rd., P.O. Box 239, Plymouth Meeting, PA 19462, Tel: 215-828-9000, TELEX: 685 1059 CD BAT UW, FAX: 215-834-7306; Empl.: 1500; *Dist. Mgr.:* Paul McLaughlin

C & K COMPONENTS, INC., 2035 Hwy. 70 East, Clayton, NC 27520, Tel: 919-553-3131, ESYLNK: 62951859, FAX: 919-553-4758; Empl.: 150 .... **B•1684-1685**

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Local Sales Offices & Reps

AL	Homewood, DHR Mktg., Inc.	205-879-9197
AL	Huntsville, DHR Mktg., Inc.	205-536-9775
AZ	Phoenix, Reptronix, Ltd.	602-230-2630
CA	Auburn, Ewing-Foley, Inc.	916-885-6591
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CA	Montrose, Luscombe Eng.	818-249-9000
CA	San Diego, Luscombe Eng.	619-689-0018
CO	Boulder, Front Range Mktg.	303-443-4780
CT	Hartford, D.A. Crowley & Assoc.	203-727-9007
FL	Altamonte Springs, DHR Mktg., Inc.	407-331-1199
FL	Lauderhill, DHR Mktg., Inc.	305-742-7555
FL	Tampa, DHR Mktg., Inc.	813-987-2950
GA	Duluth, DHR Mktg., Inc.	407-331-1199
IL	Elk Grove Vlg., Control Sls.	708-595-2110
IA	Cedar Rapids, Rep Assoc. Corp.	319-373-0152
KY	Louisville, Bromberg & Assoc.	502-456-1498
MN	Eden Prairie, Electro Mark	612-944-5850
MS	Pascagoula, DHR Mktg., Inc.	601-769-1122
MO	Bridgeton, Cen Tech, Inc.	314-291-4230
MO	Raytown, Cen Tech, Inc.	816-358-8100
NH	Amherst, D.A. Crowley & Assoc.	603-673-7050
NM	Albuquerque, Reptronix	505-292-1718
NY	Port Washington, Ashtec, Inc.	516-767-0336
NY	Syracuse, L.D. Allen, Inc.	315-437-8387
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
NC	Statesville, DHR Mktg., Inc.	704-872-0242
OR	Beaverton, J.J. Backer Co.	503-627-0168
PA	Wayne, Quality Comps.	215-687-3553
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Knoxville, DHR Mktg., Inc.	615-690-0870
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Austin, R. F. Kimball Co., Inc.	512-443-5284
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
UT	Murray, Front Range Mktg.	801-288-2500
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Can	St. Laurent, Que., Tech-Trek, Ltd.	514-337-7540

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CA Santa Clara, Canon USA, Comps. Div. 408-982-5200,FAX:408-986-1325

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CAPACITOR TECHNOLOGY PRODUCTS, INC., 5015 Speedway Dr., Ft. Wayne, IN 46825, Tel: 219-484-9054, FAX: 219-484-8275; *Sls. Mgr.:* Kevin Kurtz

CAPCON, INC., 147 West 25th Street, New York, NY 10001, Tel: 212-243-6275, FAX: 212-645-0185; *Sls. Mgr.:* Ed Reeves; *Dist. Mgr.:* B. Cameron

CAPEWELL COMPONENTS, 46 Nooks Hill Rd., Cromwell, CT 06416, Tel: 203-635-4045, FAX: 203-635-3631; Empl.: 55; *Sls. Mgr.:* Chris Haelsen

CAPINTEC INSTRUMENTS, 6 Arrow Rd., Ramsey, NJ 07446, Tel: 201-825-9500, TELEX: 642375, FAX: 201-825-1336; FSC No.: 6666;6685; Empl.: 150; *Sls. Mgr.:* Eric Weis; *Dist. Mgr.:* Robert Kanzler

CAPITAL EQUIPMENT CORPORATION, 76 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-1818, FAX: 617-273-9057; FSC No.: 3825; *Sls. Mgr.:* Richard P. Santos

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SWITCH INC.

FAX: 203-744-3304

CAPITOL SWITCH INC., Box 609, Bethel, CT 06801, Tel: 203-744-3300; FSC No.: 01548; Empl.: 30 ...... **B•1687**

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OH	Dayton, Lessis Assoc.	513-294-1551
PA	Southampton, Campbell Assoc.	215-322-6630

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CARDION, INC., A Siemens Company, 100 Sunnyside Blvd., Woodbury, NY 11797-2925, Tel: 516-921-7300, TELEX: 221683 CARD, FAX: 516-921-7330; FSC No.: 12909; Empl.: 350; *Sls. Mgr.:* A.C. Heckler

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CARISTRAP INTERNATONAL, INC., 1760 Fortin Blvd., Chomedey, Laval, Quebec, Canada H7SIN8, Tel: 1-800-361-9466, TELEX: 05-24463; FSC No.: 05-24463;;;514-663-1520; Empl.: 50; *Sls. Mgr.:* Audrey Karass; *Dist. Mgr.:* Audrey Karass

CARITRONICS INC., PO Box 821 Dept. E89M, West Caldwell, NJ 07007, Tel: 201-575-8916; Empl.: 30; *Sls. Mgr.:* Richard Nelson

CARLINGSWITCH, INC., 60 Johnson Avenue, Plainville, CT 06062-1177, Tel: 203-793-9281, 1-800-243-8556, FAX: 203-793-9231; Empl.: 1200; *Sls. Mgr.:* Alex Jamieson, Natl.Sls. Mgr.; *Dist. Mgr.:* Chris Dostaler .... **B•1350-1351, 1688-1691**

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CT	Plainville, Carlingswitch, Inc.	203-793-9281
FL	Tampa, Florida Comp. Sls. Inc.	813-873-3622
IN	Indianapolis, D-M Assoc.	317-842-4424
KS	Shawnee, Mertens Co.	913-432-9323

MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MN	Crystal, Technical Comp.	612-561-5556
MN	Farmington Hills, R.C. Merchant	313-476-4600
MO	Clayton, Mertens Co.	314-993-6600
NH	Nashua, Berkshire Elctrns.	603-888-1668
NJ	Burlington, VDE Elctrns.	609-387-9331
NJ	Eatontown, Pacent Engrg.	908-264-2202
NY	Great Neck, Pacent Engrg.	516-482-4678
NY	Rochester, Application Specialists	716-586-6226
NC	Siler City, Crossroads Elctrns. Assoc.	919-742-2372
OH	Columbus, Gerry Bryant	614-870-7338
OR	Hillsboro, Temco Northwest	503-645-2030
TX	Dallas, Control Comps.	214-458-8877
UT	Salt Lake City, GTM Assocs.	801-943-3334
WA	Bothell, Temco Northwest	206-481-6150
WI	Mequon, Wm. Bolles Assocs.	414-241-3320
Can	Markham, Ont., Deskin Sls.	416-475-1412

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AR	Little Rock, Carlton Bates	501-562-9100
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CA	Gardena, Cal Switch	213-770-2330
CA	Hayward, Electro Comps.	415-783-5800
CA	Los Angeles, Electric Switches	213-660-1310
CA	San Carlos, Campbell & George	415-594-1994
CA	San Diego, Cal Switch	619-231-6740
CA	San Diego, Control Design	619-457-9822
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CT	Hartford, Wes-Garde Comps.	203-527-7705
CT	Wallingford, Sager Elec. Supp.	203-265-4600
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FL	Orlando, Sager Elec. Supp.	407-240-3114
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IL	Carol Stream, Wes-Garde Comps.	708-653-1460
IL	Chicago, Leeds-Electro Comp.	312-625-3800
IL	Chicago, Newark Elctrns.	800-367-3573
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Mar Elctrns.	317-633-6699
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LA	Shreveport, Carlton Bates Co.	318-636-9975
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MN	Minneapolis, Stark Elctrns.	612-332-1325
IL	Lincolnshire, Grainger	708-913-8333
MO	St. Louis, Wes-Garde Comp.	314-567-7776
NH	Mt. Laurel, Wes Garde Comps.	609-778-8190
NH	Nashua, Wes-Garde Comp.	603-880-1971
NH	Salem, Sager Elec. Supp.	603-898-1348
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NY	Woodside, Switches Unltd.	718-478-5000
NC	Raleigh, Sager Elec. Supp.	919-850-9550
OH	Cincinnati, Schuster	513-489-1400
OH	Twinsburg, Schuster	216-425-8134
OH	Westerville, Wes-Garde Comps.	614-885-0319
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PA	McKean, Advacom, Inc.	814-476-7774
PA	Philadelphia, Sager Elec.	215-464-4336
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WA	Spokane, Radar Elec.	509-747-3053
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CASIO LCD SALES, Kanematsu USA Inc., 543 W. Algonquin Rd., Arlington Hgts., IL 60005, Tel: 708-981-5692, FAX: 708-981-6764; *Sls. Mgr.:* David Ross; *Dist. Mgr.:* David Ross

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PA	Emmaus, Castall	215-965-2911
TX	Spring, Castall	713-320-2445

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FL	Longwood, Merit Fasteners Corp.	407-331-4815
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GA	Norcross, Georgia Indl. Fasteners	404-448-6375
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IL	Crystal Lake, Sub-Sem Inc.	815-459-4139
IN	Ft. Wayne, Wayne Fasteners Inc.	219-484-0393
MD	Baltimore, Whitney Distrs., Inc.	301-944-8080
MI	Kentwood, Select Fasteners Fast, Inc.	616-698-1000
MN	Minneapolis, Patton Indl. Prods., Inc.	612-944-9120
MS	Jackson, Sunbelt Bolt & Screw Co., Inc.	601-354-4215
OH	Solon, Fasteners Tool & Supp.	216-248-2710
OH	West Chester, BGR Inc.	513-771-9811
OR	Beaverton, Oregon Connector Co.	503-628-1600
PA	Huntingdon Valley, Plastic & Metal Prods. Corp.	215-322-2000
TN	Knoxville, Knoxville Bolt & Screw	615-573-1991
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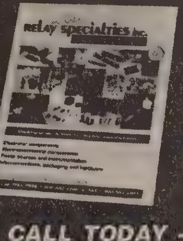

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IN	Indianapolis, Metropolitan Sls.	800-262-9994
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Can	Ottawa, Ont, Prime Peripherals	613-782-2430
Can	St. Laurent, Que, Prime Peripherals	514-956-7553
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C-COR ELCTRNS., INC., 60 Decibel Rd., State College, PA 16801, Tel: 814-238-2461, 800-233-2267, FAX: 814-238-4065; FSC No.: 12775; Empl.: 535; *Sls. Mgr.:* J. Hastings-CATV/S.Day-Mktg.; *Dist. Mgr.:* Ed Kopakowski

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CEC, 330 W. Taft Ave., Orange, CA 92665, Tel: 714-637-2970, FAX: 714-637-8654; Empl.: 58

CEC

FAX: 516-582-4922

CEC ELECTRONICS CORP., 1324 Motor Pkwy., Hauppauge, NY 11788, Tel: 516-582-4422; FSC No.: 57973; Empl.: 100; *Sls. Mgr.:* John Carroll

CEC INSTRUMENTS, Imo Industries Inc., 955 Overland Ct., San Dimas, CA 91773, Tel: 909-394-4410, TELEX: 200445 RCA, FAX: 909-394-4400; Empl.: 200; *Sls. Mgr.:* Jim Eakins

CELCO, 70 Constantine Dr., Mahwah, NJ 07430, Tel: 201-327-1123, FAX: 201-327-7047; FSC No.: 05954; Empl.: 25; *Sls. Mgr.:* Art Weirgen, Engrg. Sls. Mgr.

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CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 14; *Sls. Mgr.:* A. Freimanis

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CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61821, Tel: 217-359-8010, FAX: 217-359-6904; Empl.: 50; *Sls. Mgr.:* Earl D. Jacobsen; *Dist. Mgr.:* Avon Morgan

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Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
CA	Mission Viejo, Avtec	714-855-2800
CA	San Jose, Exxus	408-249-3526
CO	Golden, J. F. Hurlbut Co.	303-279-7796
IL	Des Plaines, Byron Ellis Assoc., Inc.	708-298-7626
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Baltimore, Wafer, Spindler & Assoc.	410-744-1133
MA	Plymouth, DC Assoc.	617-585-5085
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Teaneck, DC Assocs.	201-692-7924
NY	E. Syracuse, R.M. Scanlon Assoc.	315-463-7682
OH	Middleburg Heights, Byron Ellis Assoc., Inc.	216-826-0559
PA	Willow Grove, Tech. Sls. Assoc.	215-784-0170
TX	Dallas, THT Sls.	214-783-1501
WA	Seattle, J.J. Assocs.	206-246-6619

CERAMAWIRE, Box 1084, Cranford, NJ 07016, Tel: 908-276-1170; Empl.: 4; *Sls. Mgr.:* Edward Hamilton

CERAMIC DEVICES INC., 8145 Ronson Rd., San Diego, CA 92111, Tel: 619-560-7575, FAX: 619-560-4906; FSC No.: 66230; Empl.: 40; *Sls. Mgr.:* Dick Guerena

CERAMIC MAGNETICS, INC., 16 Law Dr., Fairfield, NJ 07004, Tel: 201-227-4222, FAX: 201-227-6735; Empl.: 90

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500, FAX: 414-377-7309; Empl.: 215; *Sls. Mgr.:* Claude Marquardt

CET TECHNOLOGY, 26 Winslow Farm Road, Hudson, NH 03051, Tel: 603-883-5912, FAX: 603-882-8348; Empl.: 125

CGRS MICROTECH, P.O. Box 102L, Langhorne, PA 19047, Tel: 215-757-0284; Empl.: 5; *Sls. Mgr.:* J. Swope; *Dist. Mgr.:* J. Swope

CHACE PRECISION METALS, INC., 1704 Barnes St., Reidsville, NC 27320, Tel: 919-342-2381, TELEX: 574493, FAX: 919-342-4012; Empl.: 200; *Sls. Mgr.:* Pat J. Urban

CHA INDUSTRIES, 4201 Business Center Dr., Fremont, CA 94538, Tel: 510-683-8554, FAX: 510-683-3848; *Sls. Mgr.:* John Levin

CHALCO ENGRG. CORP., Chalco Industries, Inc., 15126 S. Broadway, Gardena, CA 90248-1898, Tel: 213-321-0121, 213-323-5525, FAX: 213-323-0405; Empl.: 95; *Sls. Mgr.:* Steven Kierman, Dir. Sls.

Champion
Technologies, Inc.

FAX: 708-451-7585

CHAMPION TECHNOLOGIES, INC., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 708-451-1000; Empl.: 140 .... **A•1347**

Local Sales Offices & Reps

AZ	Scottsdale, Integrated Sys. & Dvc. Sls.	602-951-1172
CA	Orange, Prism Assocs.	714-283-8744
CA	San Jose, Kottmeier Assocs.	408-371-8700
FL	Orlando, Comp. Design Mkt.	407-240-3903
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Glen Ellyn, Lincoln Hodges	708-469-6750
MD	Columbia, Third Wave Solutions	301-290-5990
MA	Natick, Wayland Engrg. Sls.	508-655-6080
MN	Bloomington, Horizon	612-884-6515
CO	Littleton, Contec Mktg., Inc.	303-973-8490
NY	Great Neck, Trionic Assoc.	516-466-2300
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Dallas, Sunbelt Comps.	214-248-8000
Can	Brampton, Ont., Cantec Reps. Inc.	416-791-5922
WA	Redmond, Electronic Mktg. Grp.	206-882-0962
IL	Franklin Pk., Champion Technlgs.	708-451-1000

Local Distributors

CA	Manhattan Bch., Prime Electro	310-379-3642
CA	Reseda, Jan Dvcs.	818-708-1100
CA	San Jose, Passive Technlgs.	408-435-5566
IL	Palatine, OHM Elctrns.	708-359-5500
NY	Bayshore, Brookdale Elctrns.	516-242-8033

CHAMPLAIN CABLE CORP., Huber & Suhner(USA)Corp., 12 Hercules Dr., Colchester, VT 05446, Tel: 802-655-2121, FAX: 802-655-2025; FSC No.: 05973; Empl.: 3000; *Sls. Mgr.:* M.Brennan; *Dist. Mgr.:* J. Brooks

CHANDLER PRODUCTS, 1491 Chardon Rd., Cleveland, OH 44117, Tel: 216-481-4400; *Sls. Mgr.:* Nick Andos

CHANNEL INDUSTRIES, 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, TELEX: 658416, FAX: 805-683-3420; Empl.: 75

CHAPMAN CORP., P.O. Box 10700, 125 Presumpscot St., Portland, ME 04104, Tel: 207-773-4726, FAX: 207-775-1369; Empl.: 42; *Sls. Mgr.:* John Goodwin; *Dist. Mgr.:* Barry Godowsky

CHASSIS-TRAK, See General Devices

CHATHAM CONTROLS, 33 River Rd., Chatham, NJ 07928, Tel: 201-635-8892, FAX: 201-635-6345; FSC No.: 04814; Empl.: 11

CHATSWORTH DATA CORPORATION, 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 80; *Sls. Mgr.:* Hank Boehm .... **D•1243**

CHAUVIN ARNOUX, Chauvin Arnoux-France, 15 Faraday Dr., Dover, NH 03820, Tel: 603-749-6434, FAX: 603-742-2346

CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, 800-645-5244, TELEX: 968567, FAX: 516-582-3046; FSC No.: 21267; Empl.: 112; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

FAX: 714-838-4742

CHEROKEE INTERNATIONAL, INC., Core Industries, 2841 Dow Avenue, Tustin, CA 92680-7211, Tel: 714-544-6665, TWX: 510-101-0493; Empl.: 425; *Sls. Mgr.:* Dennis Pouliot .... **D•1625-1629**

Local Sales Offices & Reps

FL	Del Ray Beach, Phelps Assoc.	407-276-7591
GA	Atlanta, Naylor Assoc.	404-373-5036
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IL	Prairie Vl., Crosslink Elctrns.	913-649-7100
IN	Indianapolis, Richmar Elctrns. Corp.	317-846-6383
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MN	Minneapolis, Robt. W. Marshall Co., Inc.	612-929-0457
NH	Amherst, Bennetron	603-880-7008
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NJ	Lawrenceville, DVS Co.	609-896-1112
NC	Resch. Triangle Pk., Naylor Assocs., Inc.	919-544-6630
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix, Inc.	216-659-6100
OR	Beaverton, R-Tron	503-645-4323
PA	Allison Pk., Geotronix, Inc.	412-487-1770
TX	Dallas, Richmar Elctrns.	214-424-8388
VA	Charlottesville, DVS Co.	804-973-0303
WA	Redmond, R-Tron	206-557-0851

FAX: 708-360-3566

CHERRY ELECTRICAL PRODUCTS, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, Tel: 708-662-9200; Empl.: 1,000; *Dist. Mgr.:* George Di Martino .... **B•1023, 1693-1698, 1824**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Culver City, Combined Svcs.	213-558-2859
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. N., Inc.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	310-781-2255
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Orlando, So. Atlantic Comp. Sls.	407-857-3650
GA	Norcross, So. Atlantic Comp. Sls.	404-447-6154
IL	Schaumburg, Martan, Inc.	708-303-5660
IL	Waukegan, Cherry Elctrl. Prods.	708-662-9200
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, Cherry Elctrl. Prods., Automotive	313-477-4477
MI	Kentwood, Miltimore Sls., Inc.	616-554-9292
MI	Novi, Miltimore Sls., Inc.	313-349-0260
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs., Inc.	201-575-9300
NM	Albuquerque, O'Donnell Assocs., S.W.	505-889-4522
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967
NC	Raleigh, So. Atlantic Comp. Sls.	919-859-9970
OK	Catoosa, Comptech Sls., Inc.	918-266-1966
OR	Portland, Venture Elctrns.	503-624-0617
TX	Austin, Comptech Sls., Inc.	512-343-0300
TX	Houston, Comptech Sls., Inc.	713-492-0005
TX	Irving, Comptech Sls., Inc.	214-751-1181
VA	Chantilly, Colrud Corp.	703-904-0240
WA	Bellevue, Venture Elctrns.	206-454-4594
Can	Calgary, Alberta, r.n. Longman Sls., Inc.	403-295-6324
Can	Kirkland, Que., r.n. Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., r.n. Longman Sls., Inc.	416-670-8100
Can	Neapean, Ont., r.n. Longman Sls., Inc.	613-564-0100

Local Distributors

AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AL	Huntsville, Powell Elctrns.	205-837-5300
AL	Huntsville, Time Elctrns.	205-721-1134
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	San Jose, Powell Elctrns.	408-943-9020
AZ	Tempe, L Comp, Inc.	800-325-1393
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Gardena, Cal Switch	310-770-2330
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Sacramento, Integrated Elec.	916-363-6030
CA	San Diego, Time Elctrns.	619-674-2800
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager Elctrns.	203-265-4600
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Colorado Springs, Avnet/Ampex Store	719-637-0055
CO	Denver, Integrated Elec.	303-292-6121
CO	Denver, Newark Elctrns.	303-757-8531
CO	Englewood, Time Elctrns.	303-721-8882
CT	Hartford, Wes-Garde Comps. Grp.	203-527-7705
CT	Wallingford, G.R.S. Midan Elec. Inc.	203-265-2077
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Reptron Elctrns.	305-979-8227
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Lakeland, Wes-Garde Comps. Grp.	813-644-7564
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Orlando, Time Elctrns.	407-841-6565
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Sager Elctrns.	404-446-0085
GA	Norcross, Time Elctrns.	404-368-0969
IL	Champaign, Klaus Radio, Inc.	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, OHM Elctrns., Inc.	708-359-5500
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Bell Inds./Graham	317-875-8200
IN	Indianapolis, PEI Genesis Elec.	317-328-0700
IN	South Bend, PEI Genesis Elect.	219-287-2911
IA	Cedar Rapids, Advent Elec., Inc.	319-363-0221
GA	Norcross, Reptron Elctrns.	404-446-1300
MD	Annapolis Jct., Powell Elctrns.	301-953-3435
MD	Columbia, Sager Elctrns. Inc.	301-995-4900
MD	Columbia, Time Elctrns.	301-964-3090
MD	Savage, Pyttronic Inds., Inc.	301-792-0780
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Peabody, Time Elctrns.	508-532-6200
MI	Livonia, Reptron Elect., Inc.	313-525-2700
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Kansas City, L Comp, Inc.	816-241-0111
MO	Manchester, Time Elctrns.	314-391-6444
MO	Maryland Hgts., L Comp, Inc.	314-291-6200
MO	St.Louis, Wes-Garde Comps. Grp.	314-567-7776
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Little Falls, Powell Elctrns., Inc.	201-890-0010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Oakland, Relay Specs.	800-526-5376
NJ	Wayne, Time Elctrns.	201-785-8250
NY	Buffalo, Summit Dists.	716-887-2800
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Hauppauge, Time Elctrns.	516-434-3344
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Summit Dists.	716-334-8110
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Cary, Powell Elctrns.	919-467-1212
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Raleigh, Time Elctrns.	919-847-9650
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Akron, Aesco Elctrns. Comps.	216-762-8818
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Bell Inds.	513-435-5922
OH	Dayton, Stotts Friedman	513-298-5555
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Integrated Elec.	503-641-1690
OR	Portland, Radar Elec.	503-232-3404
OR	Portland, Tek-Elec.	503-246-5451
OR	Portland, Time Elctrns.	503-626-2979
PA	Mars, Sager Elctrns.	412-772-2233
PA	Montgomeryville, Pyttronics Inds., Inc.	215-643-2850
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Philadelphia, PEI Genesis Elect.	800-523-0727, 800-222-1772
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Wes-Garde Comps.	214-357-1768
TX	Ft. Worth, Allied Elctrns., Inc.	817-595-6477
TX	Ft. Worth, Carlton-Bates	817-293-5558
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Carlton-Bates	713-956-2244
TX	Houston, Newark Elctrns.	713-270-4800
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Southwest Elec., Inc.	713-240-4000
UT	Salt Lake City, Stand. Supp. Co.	801-486-3371
UT	W. Valley City, Integrated Elctrns.	801-977-9750
UT	W. Valley City, Time Elctrns.	801-973-8494
WA	Bellevue, Integrated Elctrns., Inc.	206-455-2727
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	Waukesha, Hawk Elctrns.	414-547-4457
Can	Burnaby, B.C., ITT/Rae Ind. Elect.	604-291-8866
Can	Calgary,Alberta, ITT/Rae Ind. Elect.	403-273-2780
Can	Concord, Ont., ITT/RAE Ind. Elect.	416-798-4884
Can	Don Mills, Ont., Saynor Varah, Inc.	416-445-0723
Can	London, Ont., Saynor Varah Inc.	519-649-1414

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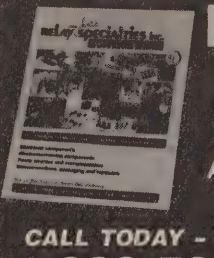

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CHESSELL EUROTHERM, EUROTHERM, INTL., 1 Pheasant Run, Newtown, PA 18940, Tel: 215-968-0660, FAX: 215-968-0662; Empl.: 82; *Sls. Mgr.:* Howard Sherer; *Dist. Mgr.:* Howard Sherer

CHESTEC CORPORATION, 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700, FAX: 516-883-7155; Empl.: 3; *Sls. Mgr.:* J.P. Schindler

CHESTERFIELD PRODUCTS, INC., Microwave Filter Co., Inc., 6743 Kinne St, East Syracuse, NY 13057, Tel: 800-666-9655, 315-463-2309, FAX: 315-463-1467; *Sls. Mgr.:* Marian Frair .... **A•1655**

Local Sales Offices & Reps

CA	Carlsbad, MTM Intl., Inc.	619-729-6338
IL	Chicago, Tech. Sls.	312-237-7210
MD	Baltimore, Advanced Tech. Sls.	301-323-3140
MA	Framingham, Bengal Assocs.	617-877-2639
MA	Randolph, Bengal Assocs.	617-961-4120
NJ	Elmwood Park, L & M Assoc., Inc.	201-797-0441
NY	Syracuse, Microwave Filter Co., Inc.	315-437-3953

CHICAGO BLOWER CORP., 1675 Glen Ellyn Rd., Glendale Heights, IL 60139, Tel: 708-858-2600, ESYLNK: 62912209, FAX: 708-858-7172; Empl.: 250; *Sls. Mgr.:* R.W. Wessel

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070, FAX: 312-227-6646; FSC No.: 5910; *Sls. Mgr.:* Joan Looi ..... **A•1029**

CHICAGO LASER SYSTEMS, INC., 1798 Sherwin, Des Plaines, IL 60018, Tel: 708-827-9620, TELEX: 6505123515MCI UW, FAX: 708-827-9710; *Sls. Mgr.:* Bernard Alpiner, V.P.

CHICAGO LOCK CO., 4311 W. Belmont Ave., Chicago, IL 60641, Tel: 312-282-7177, TELEX: ITT 4994023, FAX: 312-282-8199; Empl.: 300; *Sls. Mgr.:* William R. Shinn

CHIPS AND TECHNOLOGIES, INCORPORATED, 3050 Zanker Road, San Jose, CA 95134, Tel: 408-434-0600, TWX: 272929 CHIPS UR

CHIU TECHNICAL CORP., 252 Indian Head Rd., Kings Park, NY 11754, Tel: 516-544-0606, FAX: 516-544-0809; FSC No.: 38-32, 38-41; Empl.: 25; *Sls. Mgr.:* Frank A. Denny, V.P. Mktg.

CHLORIDE ELECTRO NETWORKS, Chloride Power Electronics, Inc., 1 Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; Empl.: 350; *Sls. Mgr.:* Gary Balfour

CHLORIDE EL PASO, Chloride Power Elctrns., 9-B Founders Blvd., El Paso, TX 79906, Tel: 915-592-9985, FAX: 915-595-1664; FSC No.: 08715; Empl.: 1000; *Sls. Mgr.:* Robin Lee

CHLORIDE POWER ELECTRONICS, One Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; FSC No.: 3698; Empl.: 300; *Sls. Mgr.:* Steve Olson

CHOMERICS, INC.:W.R. GRACE & CO., 77 Dragon Ct, Woburn, MA 01888, Tel: 617-935-4850, FAX: 617-933-4318; Empl.: 650; *Sls. Mgr.:* William Lionetta; *Dist. Mgr.:* William Flanders .... **C•1659-1661**

Local Sales Offices & Reps

AZ	Mesa, Chomerics	602-964-0771
CA	Carson, Chomerics	310-518-6921
CT	Trumbull, Chomerics	203-452-0253
FL	Longwood, Chomerics	407-876-5800
GA	Kennesaw, Chomerics	404-928-4243
IL	Chicago, Chomerics	708-458-0649
MA	Woburn, Chomerics	617-935-4850
NY	Bohemia, Chomerics	516-567-6186
NC	Greensboro, Chomerics	919-674-3144
OH	Beavercreek, Chomerics	513-427-0002
TX	Dallas, Chomerics	214-960-7236
WA	Seattle, Chomerics	206-624-3763
Can	Trenton, Ont., Chomerics	613-965-6161

Local Distributors

AZ	Phoenix, Cupps Indl. Supp.	602-869-0600
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CO	Denver, R.S.I.	303-373-1812
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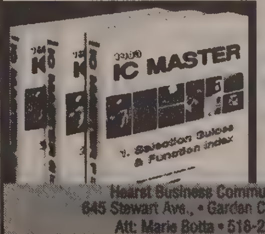

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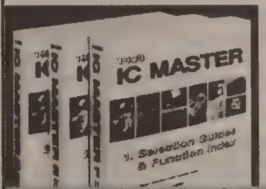

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FAX: 214-233-0481

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MA	Randolph, Bengal Assocs.	617-961-4120
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CT	New Fairfield, Sales Engrg.	203-746-6905
GA	Atlanta, Effective Mktg. Force	404-948-6023
IL	Rockford, Rockford Controls	708-960-2447
NH	Salem, Sales Engrg.	603-893-5521
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Can	Markham, Matrix Technlg. Ltd.	416-477-4442

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IL	Chicago, Leeds Electro Comps.	312-625-3800
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IA	Cedar Rapids, Wes-Tech Assoc.	319-393-9790
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OH	Dayton, Ashbacher & Assocs.	513-252-7785
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Local Sales Offices & Reps

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FL	Oviedo, Conley & Assocs.	407-365-3283
IL	Arlington Hts., MB Sls.	708-392-9499
IN	Kokomo, Schillinger Assocs.	317-455-2708
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	Wichita, Baka	316-682-2166
MA	Needham, Component Technlg., Inc.	617-449-8490
MI	Grosse Pointe Park, Greiner Assocs., Inc.	313-499-0188
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PA	Philadelphia, Tech. Sls. Assoc.	215-784-0170
TX	Dallas, Electra Reps	214-248-3852
WA	Seattle, Eclipse Mktg.	206-885-6991
Can	Don Mills, Ont., RD Assocs.	416-441-9667

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	San Diego, Time Elctrns.	619-578-2500
CA	Santa Ana, Norstan Elctrns.	213-924-7651
CA	Santa Monica, Master Elctrns.	213-452-1229
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Time Elctrns.	714-669-0100
CO	Englewood, Time Elctrns.	303-721-8882
CT	Enfield, Gemcap	203-745-3410
FL	Orlando, T & T Prods., Inc.	407-857-2282
FL	Orlando, Time Elctrns.	407-841-6565
FL	Pompano Beach, Peerless Radio	305-973-4141
GA	Norcross, Time Elctrns.	404-448-4448
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Schaumburg, Time Elctrns.	708-303-3000
KS	Wichita, Airtechnics	316-267-2849
MD	Columbia, Peerless Radio	301-997-1717
MD	Columbia, Time Elctrns.	301-964-3090
MD	Jessup, Treeko	301-792-0112
MA	Peabody, Time Elctrns.	508-532-9900
MO	Manchester, Time	314-391-6444
MO	Maryland Heights, L Comp	314-291-6200
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Oakland, Relay Specialties	201-337-1000
NY	Centereach, Gemcap Comps.	516-331-0069
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Lynbrook, Peerless Radio	516-593-2121
TX	Richardson, Time Elctrns.	214-644-4644
WA	Kirkland, Time Elctrns.	206-820-1525

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1026 6th. AVENUE
OAKLAND, CA 94606

COMMUNICATION SOLUTIONS, INC., 7014 Golden Ring Rd., Baltimore, MD 21237, Tel: 410-574-4557, FAX: 410-574-4559; FSC No.: OPXL4; Empl.: 8

COMMUNICATIONS SYS. TECHNOLOGY, INC., 2018 Rhodes Street, Hermosa Beach, CA 90254, Tel: 213-374-3849; Empl.: 4; *Sls. Mgr.:* A.L. Perry

COMPAC™
FAX: 516-585-3534

COMPAC, 1320-13 Lincoln Ave., Holbrook, NY 11741, Tel: 516-585-3400; FSC No.: 62099; Empl.: 35; *Sls. Mgr.:* Peter C. Rao .... **C•1020**

Local Sales Offices & Reps

AL	Huntsville, EMA Inc.	205-837-7363
CA	Campbell, Senah	408-374-1031
CA	Westlake Village, CAL-Rep.	818-991-1940
GA	Atlanta, EMA Inc.	404-448-1215
MA	Haverill, L-K Assoc.	617-373-1313
MO	St. Louis, Abrams & Assocs.	314-569-0447
NC	Raliegh, EMA Inc.	919-847-8800
SC	Greenville, EMA Inc.	803-233-4637
TX	Dallas, Talo Products	214-644-6010
VA	Fairfax, Schibley Assocs.	703-591-3008

COMPACT POWER COMPANY, 17282 Orange Drive, Yorba Linda, CA 92686, Tel: 714-996-5826; *Sls. Mgr.:* Charles Lindberg .... **D•2256**

COMPAR, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, Canada L3R 4Z4, Tel: 416-475-8500, FAX: 416-475-4158; Empl.: 36; *Sls. Mgr.:* Rick Lewis

COMPAS, 100 Chimney Point Dr., Ogdensburg, NY 13669, Tel: 315-393-3573, FAX: 315-393-7638; Empl.: 350; *Sls. Mgr.:* James L. Clare

COMPENSATED DEVICES INCORPORATED, 166 Tremont Street, Melrose, MA 02176, Tel: 617-665-1071, FAX: 617-665-7379; FSC No.: 55801; Empl.: 65; *Sls. Mgr.:* Tom Briand

COMPEX CORP., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055, Tel: 609-596-9388, FAX: 609-596-3482; Empl.: 24

COMPIX, INC., 15824 SW Upper Boones Ferry Rd., Lake Oswego, OR 97035-4066, Tel: 503-639-8496; Empl.: 14; *Sls. Mgr.:* James G. Walcutt-VP Sls. Mktg.

COMPONENT GENERAL, INC., 2445 Success Dr., Odessa, FL 33556, Tel: 813-376-6655, FAX: 813-372-9096; FSC No.: 61732; Empl.: 30; *Sls. Mgr.:* Thomas Floridio

Local Sales Offices & Reps

CA	Los Angeles, L & M Engrg. South	310-417-3044
CA	Mountain View, Bridge Mktg.	415-965-8045
MO	Florissant, Central Tech. Sls.	314-831-4069
NH	Merrimack, DBM Tech. Sls., Inc.	603-424-5700
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NY	Rye Brook, Tekmar Sls.	914-632-7464
TX	Dallas, Rep-Tec, Inc.	214-956-8700
EXP	Odessa, FL, Comp. Gen. Inc.	813-376-6655

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 508-580-0111, FAX: 508-559-9893; Empl.: 600; *Sls. Mgr.:* Wayne Douglas; *Dist. Mgr.:* Wayne Douglas

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 310-829-3615, FAX: 310-829-9584; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman .... **A•1030-1057**

Local Sales Offices & Reps

SC	Greenville, Walter Lamphier	803-232-4687

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290, FAX: 201-361-5801; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* Fred Bielenberg

COMPONENTS ELECTRONICS CORP., 629A Lowther Rd., Lewisberry, PA 17339, Tel: 717-938-4151, FAX: 717-938-5910; Empl.: 45; *Sls. Mgr.:* J.Galli; *Dist. Mgr.:* J.Galli

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015, FAX: 818-287-7189; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPTUS INC., 342 Lyndeboro Rd., New Boston, NH 03070, Tel: 603-487-5512, FAX: 603-487-5513; Empl.: 5; *Sls. Mgr.:* Leander Nichols; *Dist. Mgr.:* Leander Nichols

COMPUCART, Versa Tec, P.O. Box 2095, Tampa, FL 33601-2095, Tel: 800-237-9024, 813-251-2431; Empl.: 25

COMPUCRAFT FABRICATORS INC., 669 Mary St., Warminster, PA 18974, Tel: 215-443-7107, FAX: 215-443-7195; FSC No.: 76977; Empl.: 18; *Sls. Mgr.:* Stephen Dalton

COMPUMOTOR DIVISION, Parker Hannifin Corp., 5500 Business Park Dr., Rohnert Park, CA 94928, Tel: 707-584-7558, FAX: 707-584-8015; Empl.: 150; *Sls. Mgr.:* A. Statz; *Dist. Mgr.:* A. Statz

COMPUTER AVIONICS, See CAC Microcircuits, Inc.

COMPUTER COMPONENTS, INC., P.O. Box 1378, 18-B Kripes Rd., East Granby, CT 06026, Tel: 203-653-9909, FAX: 203-653-9901; FSC No.: 12965; Empl.: 25

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, FAX: 516-261-3308; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard .... **D•1172-1175**

Local Sales Offices & Reps

MA	Brookline, Technology Prod. Grp.	617-731-0858
MI	Neewport, Industrial Sensors Inc.	313-383-8300
NY	Moravia, Electrotech Sys.	315-497-1598
NC	Charlotte, Motion Technology	704-525-9855
OH	Cincinnati, Rilco	513-271-0630
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Bedford, Automated Dynamics	817-267-5716
UT	Salt Lake City, Protronix	804-265-9105
Can	Downsview, Electromate Ind. Sls.	416-665-0221

COMPUTER DEVICES, 34 Linnell Cir., Nutting Lake, MA 01865, Tel: 508-663-4980, FAX: 508-667-8561; Empl.: 13; *Sls. Mgr.:* Sandra R. Clark

COMPUTER DOCTORS, 9204-B Baltimore Blvd., College Park, MD 20740, Tel: 1-800-RAM-STAR, 301-474-3095, FAX: 301-474-0805

COMPUTER DYNAMICS SALES, 107 S. Main St., Greer, SC 29650, Tel: 803-877-8700, FAX: 803-879-2030

COMPUTER INSTRUMENTS CORP., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-876-8400, FAX: 516-876-9153; Empl.: 40

COMPUTER INSTRUMENTS DIV., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-876-8400, FAX: 516-876-9153; Empl.: 42; *Sls. Mgr.:* Brian Peskin

COMPUTER KEYBOARD SYSTEMS, 1640 Fifth Street, Ste. 224, Santa Monica, CA 90401, Tel: 310-395-4639, FAX: 310-393-6040; Empl.: 25; *Sls. Mgr.:* Trevor Bray; *Dist. Mgr.:* Trevor Bray

COMPUTER PERIPHERALS INC., 667 Rancho Congo Blvd., Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 100; *Sls. Mgr.:* Davius Antia; *Dist. Mgr.:* Mike Krunic

COMPUTER POWER INC., 124 W. Main St., High Bridge, NJ 08829, Tel: 908-638-8000, 800-526-5088, FAX: 908-638-4931; FSC No.: 3643; Empl.: 170; *Sls. Mgr.:* Leslie P. Listwa; *Dist. Mgr.:* Todd Smith

CPS

FAX: 503-684-8164

COMPUTER POWER SUPPLIES (CPS), 15800 Upper Boones Ferry Rd., #150, Lake Oswego, OR 97035, Tel: 503-684-8026; *Sls. Mgr.:* Clifford Gaw

COMPUTER PRODUCTS, INC, Process Automation, 2900 Gateway Dr., Pompano Beach, FL 33069, Tel: 305-974-5500, FAX: 305-979-7371; Empl.: 150; *Sls. Mgr.:* Jack Sloan, VP Sls.

COMPUTER PRODUCTS
POWER CONVERSION

FAX: 617-464-6612

COMPUTER PRODUCTS/POWER CONVERSION AMERICA, 7 Elkins Street, So. Boston, MA 02127, Tel: 800-733-9288, 617-464-6600; FSC No.: 62125; Empl.: 1050; *Dist. Mgr.:* Jim O'Sullivan, VP Distbn. & Sls. .... **D•1486, 1631-1635, 2048, 2090-2095**

Local Sales Offices & Reps

AZ	Phoenix, C.T. Carlberg	602-488-0750
CA	Encinitas, Jones & McGeoy Sls.	619-753-6784
CA	San Diego, Jones & McGeoy Sls.	714-756-6269
CA	Santa Ana, Jones & McGeoy Sls.	714-547-6466
CA	Santa Clara, Criterion Sls.	408-988-6300
CO	Aurora, Electrodyne	303-695-8903
FL	Altamonte Springs, Electra Mark	407-830-0844
FL	Plantation, Electra Mark	305-452-2872
FL	Tampa, Electramark	813-962-1882
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IL	Itasca, Janus, Inc.	708-250-9650
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-tronix, Inc.	913-339-6333
KS	Wichita, Dy-tronix, Inc.	316-838-0884
MD	Columbia, Third Wave Solutions, Inc.	410-290-5990
MA	N. Reading, Alpha-Omega Sls.	508-664-1118
MA	North Reading, Alpha Omega Sls.	508-664-1118
MN	Edina, Mel Foster	612-944-3456
MO	Bridgeton, Dy-tronix, Inc.	314-291-4777
NJ	Cherry Hill, Tritek	609-667-0200
NM	Albuquerque, C.T. Carlberg	505-899-2155
NY	Rochester, Empire Tech	719-381-8500
NY	Rockville Centre, S-J Assocs.	516-536-4242
NY	Skanealeles, Empire Tech	315-685-5703
NC	Raleigh, Zucker Assocs., Inc.	919-782-8433
OH	Cleveland, Elctrn. Salesmasters	216-831-9555
OK	Tulsa, Ammon & Rizos	918-749-6116
OR	Beaverton, Micro Sls., Inc.	503-645-2841
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
UT	Salt Lake City, Electrodyne, Inc.	801-264-8050
WA	Bellevue, Micro Sls., Inc.	206-451-0568
WI	Delafield, Janus, Inc.	414-646-5420
Can	Montreal, Electro Source	514-630-7486
Can	Ottawa, Ont., Electro Source	613-592-3214
Can	Toronto, Electro Source	416-675-4490

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Marshall Inds.	602-496-0290
CA	Calabasas, Marshall Inds.	818-878-7000
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Capstone	714-587-0638
CA	Irvine, Marshall Inds.	714-458-5380
CA	Irvine, Milgray	800-466-9277
CA	Milpitas, Marshall Inds.	408-943-4600
CA	N. Hollywood, B. J. Wolfe Entprs.	213-877-5518
CA	Sacramento, Marshall Inds.	916-635-9700
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, B.J. Wolfe Entprs.	408-371-3443
CA	San Jose, Capstone Elctrns.	408-453-9804
CO	Denver, Capstone Elctrns.	303-451-8383
CO	Denver, Marshall Inds.	303-451-8383
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880
FL	St. Petersburg, Marshall Inds.	813-573-1399
GA	Atlanta, Marshall Inds.	404-923-5750
GA	Atlanta, Milgray	800-241-5523
IL	Chicago, Capstone Elctrns.	708-250-0300
IL	Chicago, Marshall Inds.	708-490-0155
IL	Chicago, Milgray	800-322-6271
IN	Indianapolis, Marshall Inds.	317-297-0483
KS	Kansas City, Marshall Inds.	913-492-3121
KS	Kansas City, Milgray	800-255-6576
MD	Columbia, Capstone	609-596-7500
MD	Columbia, Milgray	800-638-6656
MD	Silver Springs, Marshall Inds.	301-622-1118
MD	Spencerville, United States Elctrns.	301-384-3300
MD	Spencerville, US Elctrns.	301-384-3300
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, Marshall Inds.	508-658-0810
MA	Winchester, Webb Distbn.	617-729-6839
MI	Detroit, LWC Distrs.	313-464-7700
MI	Detroit, Marshall Inds.	313-525-5850
MN	Minneapolis, Capstone	612-250-0300
MN	Minneapolis, Marshall Inds.	612-559-2211
MO	St. Louis, Marshall Inds.	314-291-4650
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Marlton, Capstone Elctrns.	609-596-7500
NJ	Marlton, Milgray	800-257-7111
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Milgray	800-622-0291
NY	Farmingdale, Milgray	800-645-4729
NY	Rochester, Marshall Inds.	716-235-7620
NY	Syracuse, Marshall Inds.	607-785-2345
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Century Elctrns.	919-596-2220
NC	Raleigh, Marshall Inds.	919-878-9882
OH	Cleveland, Electronic Mktg. Corp. (EMC)	800-366-3625
OH	Cleveland, Marshall Inds.	216-248-1788
OH	Columbus, Elctr. Mktg. (EMC)	800-366-3621
OH	Dayton, Marshall Inds.	513-898-4480
OH	Westerville, Marshall Inds.	614-891-7581
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Beaverton, Marshall Inds.	503-644-5050
PA	Philadelphia, Century Elctrn. Comps.	215-631-5400
PA	Pittsburgh, Marshall Inds.	412-788-0441
TX	Austin, Marshall Inds.	512-837-1991
TX	Austin, Norvell Elctrns.	512-343-2900
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Dallas, Marshall Inds.	214-233-5200
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Marshall Inds.	713-467-1666
TX	Houston, Milgray	800-962-1849
TX	Houston, Norvell Elctrns.	713-777-1666
UT	Salt Lake City, Marshall Inds.	801-485-1551
UT	Salt Lake City, Milgray	800-537-9739
WA	Seattle, Almac Elctrns.	206-643-9992
WA	Seattle, Marshall Inds.	206-486-5747
WA	Spokane, Almac Elctrns.	509-924-9500
WI	Milwaukee, Marshall Inds.	414-797-8400
Can	Brampton, Ont., Marshall Inds.	416-458-8046
Can	Calgary, Alb., Zentronics	403-295-8838
Can	Mississauga, Ont., Capstone Elctrns.	416-670-2010
Can	Mississauga, Ont., Zentronics	416-451-9600
Can	Montreal, Que., Zentronics	514-737-9700
Can	Nepean, Ont., Zentronics	613-226-8840
Can	Pointe Claire, Que., Marshall Inds.	514-694-8142
Can	Richmond, B.C., Zentronics	604-273-5575

COMPUTER PRODUCTS/POWER CONVERSION, See Power Conversion America, Computer Prods.Inc.

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N., Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 90; *Sls. Mgr.:* Mick Maher; *Dist. Mgr.:* Mick Maher

COMPUTER SYSTEMS TECHNICAL SUPPORT, 4015 E. Leaverton Ct., Anaheim, CA 92807, Tel: 714-632-1300, FAX: 714-632-1937; FSC No.: 9J740; Empl.: 13; *Sls. Mgr.:* Reuven Arad

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22182-2266, Tel: 703-821-8200, FAX: 703-821-1746; Empl.: 18; *Sls. Mgr.:* John Dargo

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, FAX: 913-829-0810; Empl.: 27; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTRON DISPLAY SYSTEMS, Excel Corporation, 835 Bonnie Lane, Elk Grove Village, IL 60007, Tel: 708-952-8800, FAX: 708-952-0232; Empl.: 100; *Sls. Mgr.:* W. Miller .... **B•1035**

Local Sales Offices & Reps

CA	Ontario, Xcel Corp.	909-391-4321
CA	San Diego, El-Com	619-578-0900
CO	Littleton, Romulus	303-770-4888
FL	Margate, EPM Corp.	305-977-0331
IL	Palatine, Technlg. Sls.	708-991-6600
MI	Troy, C.B. Jensen & Assoc.	313-643-0506
NJ	Hasbrouk Hgts., Comp-Tech	201-288-7400
NJ	Hasbrouk Hgts., Tory Sls.	201-288-5656
NJ	Toms River, Xcel Corp.	908-830-7525
NY	Rochester, Apex	716-272-7040
OH	Cleveland, Xcel Corp.	216-239-4998
OR	Beaverton, J.J. Backer	503-627-0775
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Richardson, Pro-Comp	214-669-1500
WA	Seattle, J.J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	San Jose, Powell Elctrns	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Elctrns./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
MD	Columbia, Powell Elctrns.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	W. Borough, Powell Elctrns.	617-336-6100
MI	St. Clair Shores, Specialties Mktg.	313-771-2700
NC	Cary, Powell Elctrns.	919-467-1212
NC	Raleigh, Comp. Distrs,	919-834-9465

COMSPEC DIGITAL PRODUCTS INC., 2313 W. Sam Houston Pkwy N.S. 141, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 3; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

COMSTRON A DIV. OF AEROFLEX, 35 S. Service Road, Plainview, NY 11803, Tel: 516-752-2351, TWX: 310-497-3525, FAX: 516-694-6771; Empl.: 120; *Sls. Mgr.:* William J. Meditz

COMTECH MICROWAVE CORP, Comtech Telecommunications Corp., 105 Baylis Rd., Melville, NY 11747, Tel: 516-777-8900, FAX: 516-777-8877; FSC No.: 31196; *Sls. Mgr.:* B. Diers

COM-2, INC., 1556 Woodland Dr., Saline, MI 48176, Tel: 313-429-9027, FAX: 313-429-1902; Empl.: 70; *Sls. Mgr.:* Robert Green

COMUS INTERNATIONAL, 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-667-6200, 1-800-35-COMUS, FAX: 201-667-6837; *Sls. Mgr.:* Gene Moran .... **B•1449, 1700**

Local Sales Offices & Reps

MA	Sharon, Adcour	617-784-8123

Local Distributors

MA	Sharon, Adcour	617-784-8123,FAX:617-784-5563

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, FAX: 716-372-1594; Empl.: 135

CONAX BUFFALO CORPORATION, 2300 Walden Ave., Buffalo, NY 14225, Tel: 716-684-4500, FAX: 716-684-7433; FSC No.: 03688; Empl.: 190; *Sls. Mgr.:* R.C. Paluch

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: MFR 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton .... **C•1290-1291, 1540**

Local Distributors

AL	Huntsville, Century Fasteners	205-883-5344
AZ	Tucson, PSN Distrbn.	602-623-9800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Mission Hills, Coast Air	818-898-2288
CA	San Jose, Bisco	408-996-8420
CO	Denver, CSID/Integrated	303-292-5538
CT	Danbury, Heilind	208-797-8600
DE	New Castle, Electronics Exchange	302-322-5401
FL	Sanford, Electronic Fasteners	407-321-4000
GA	Norcross, Atlanta Hardware Specialty	404-449-3000
HI	AIEA, Newark Elctrns.	808-487-8951
ID	Coeurd' Alene, A-I Consolidated	208-765-3280
IL	Franklin Park, Bisco	312-451-1230
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Wichita, RSC Elex	216-267-5213
KY	Bowling Green, Crescent Elctrns.	502-842-2444
LA	New Orleans, Radio Pts.	504-581-5959
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Billerica, MS Inserts	508-670-5600
MI	Farmington Hills, Advent Elctrns.	313-477-1650

MN	New Brighton, Chris ELctrns.	612-631-2647
MS	Jackson, Newark Elctrns.	601-956-3834
MO	St. Charles, Finnegan Elctrns.	314-946-6201
NE	Omaha, Omaha Elctrns.	402-341-3440
NV	Reno, Richco	702-323-4939
NH	Nashua, Brevan	603-889-7230
NJ	Kenilworth, Federated Purchasers	201-272-0505
NM	Albuquerque, Electronic Pts.	505-293-6161
NY	Bohemia, Car-Lac	516-567-4200
NC	Raleigh, Century Elec. Comp.	919-782-2116
OH	Dayton, Stotts-Friedman	513-298-5555
OK	Tulsa, Altair	918-252-5781
OR	Beaverton, Comp. Resources	503-641-8488
PA	Philadelphia, PEI Genesis	215-673-0400
RI	Pawtucket, Major Edwards	401-725-7400
SC	Charleston, Wholesale Indl. Elex	803-577-6388
TN	Knoxville, Industrial Elect	615-573-7135
TX	Richardson, Aero Glen	214-234-0984
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VT	Colchester, Hooker Elctrns.	802-864-0885
VA	Springfield, Southern Fasteners	703-922-8048
WA	Redmond, Olander	206-881-3488
WV	Beckley, State Elec.	304-256-2219
WI	Grafton, Lakeview Elex	414-377-8250
EXP	Taipei, Taiwan, Gold-Tek Elec. Co.	20-717-2302
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280

Condenser Products

FAX: 904-799-0221

CONDENSER PRODUCTS CORP., 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561; FSC No.: 16727; Empl.: 22; *Sls. Mgr.:* Terry Baker .... **A•1058-1060**

Local Sales Offices & Reps

TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772

CONDOR

D.C. POWER SUPPLIES, INC.

FAX: 805-487-8911

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565,; Empl.: 250; *Sls. Mgr.:* Michael F. Kirkowski, Exec. VP Mktg.; *Dist. Mgr.:* Mary Shaw .... **D•1636-1645**

Local Sales Offices & Reps

AL	Huntsville, Adams Elctrns.	205-882-2988
AZ	Phoenix, Howe & Howe	602-264-7971
CA	San Dimas, AF Sls.	909-599-4412
CA	Sunnyvale, Tritiny Technlg.	408-733-9000
CO	Denver, AKI Entprs.	303-388-4488
CT	Madison, Focus Elctrns. Sls.	203-245-4314
FL	Altamonte Springs, Semtronic Assoc.	407-831-8233
GA	Lilburn, Adams Elctrns.	404-925-9115
IL	Elk Grove Vlg., Tristar	708-593-0200
IN	Carmel, Current Elctrns. Mktg.	317-844-1770
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Overland Park, Lorenz Sls., Inc.	913-469-1312
MD	Columbia, Delta III Assocs.	410-730-7400
MA	Taunton, Focus Elctrns. Sls., Inc.	508-824-3840
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Minneapolis, ECS	612-933-2594
MO	St. Louis, Lorenz Sls. Inc.	314-997-4558
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Pittsford, C W Beach Co.	716-586-3200
NY	Yonkers, Sonkin Assocs.	914-968-8282
OH	Dayton, Thompson & Assocs.	513-435-7733
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
TX	Austin, M Rep	512-205-0828
TX	Dallas, M Rep	214-484-5711
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
Can	Mississauga, GMA, Inc.	416-671-6111

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Huntsville, Future Elctrns.	205-830-2322
AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Aerospace S.W.	602-582-2779
AZ	Phoenix, Allied Elctrns.	602-437-9080
AZ	Phoenix, Future Elctrns.	602-968-7140
AZ	Scottsdale, Kent Elctrns.	602-998-0399
AZ	Tempe, Cypress Elctrns.	602-966-2256
AZ	Tucson, SWS Elctrns.	602-628-1613
CA	Camarillo, Milgray	805-484-4055
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Chatsworth, Future	818-772-6240
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Costa Mesa, FLW	714-751-7512
CA	Fremont, Allied Elctrns.	510-505-0220
CA	Fremont, FLW	415-651-6511
CA	Irvine, Milgray	714-753-1282
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	San Diego, Allied Elctrns.	619-279-2550
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Future	619-625-2800
CA	San Diego, Kent Elctrns.	619-453-7133
CA	San Jose, Future Elctrns.	408-434-1122
CA	San Jose, Milgray	408-456-0900
CA	Santa Ana, Foresight	714-833-2134
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Foresight	408-980-9700
CA	Torrance, Kent Elctrns.	310-320-2700
CO	Broomfield, Future Elctrns.	303-421-0123
CO	Englewood, Allied Elc.	303-790-1664
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Kent Elctrns.	303-762-0670
CT	Berlin, Kent Elctrns.	203-829-2100
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Allied Elctrns.	203-272-7730
CT	Milford, Milgray	203-878-5538
FL	Altamonte Springs, Future	407-767-8414
FL	Casselberry, Allied	800-433-5700
FL	Deerfield Beach, Vantage Comp.	305-729-1001
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lake Mary, Milgray	800-367-0780
FL	Largo, Future	813-530-1222
FL	Largo, Kent Elctrns.	813-545-0057
FL	Orlando, Hammomd Elctrns.	407-841-1010
GA	Duluth, Allied Elctrns.	800-433-5700
GA	Norcross, Future Elctrns.	404-441-7676
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Milgray	404-446-9777
IL	Chicago, Dalec Distrs.	312-283-0300
IL	Elk Grove, Kent Elctrns.	708-364-1300
IL	Hoffman Estate, Future Elctrns.	708-882-1255
IL	Palatine, Milgray	708-202-1900
IL	Schaumberg, Bortech Sls.	708-882-7640
IL	Wood Dale, Allied Elctrns.	800-433-5700
IN	Indianapolis, Allied Elctrns.	800-433-5700
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
IA	Des Moines, Allied Elctrns.	800-433-5700
KS	Lenexa, Allied Elctrns.	800-433-5700
KS	Overland Park, Kent Elctrns.	913-338-4300
KS	Overland Pk., Milgray	913-236-8800
KS	Shawnee Mssn, Aerospace Comp.	913-432-8508
KY	Louisville, Allied Elctrns.	800-433-5700
LA	Metairie, Allied Elctrns.	800-433-5700
MD	Columbia, Allied Elctrns.	800-433-5700
MD	Columbia, Future Elctrns.	301-290-0600
MD	Columbia, Kent Elctrns.	301-720-6200
MD	Columbia, Milgray	301-621-8169
MD	Columbia, Vantage	410-720-5100
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Andover, Vantage Comp	508-687-3900
MA	Billerica, Allied Elctrns.	800-433-5700
MA	Billerica, Mayor Elctrns.	617-229-2255
MA	Boston, Future Elctrns.	508-779-3000
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Wilmington, Milgray	508-657-5900
MI	Ann Arbor, McNaughton-McKay	313-995-9515
MI	Livonia, Future Elctrns.	313-261-5270
MI	Madison Heights, McNaughton-McKay	313-399-7500
MI	Plymouth, Allied Elctrns.	800-433-5700
MN	Bloomington, Allied Elctrns.	800-433-5700
MN	Eden Prairie, Cypress	612-934-2104
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Edina, Bortech Sls.	612-835-9005
MN	Minneapolis, Aerospace Comp. Prod.	612-884-4725
MN	St. Paul, Kent Elctrns.	612-642-2828
MO	Earth City, Allied	800-433-5700
MO	Hazelwood, Kent Elctrns.	314-895-1515
NE	Omaha, Allied Elctrns.	800-433-5700
NH	Nashua, Allied Elctrns.	800-433-5700
NJ	Clifton, Vantage Comp.	201-777-4100
NJ	Marlton, Future Elctrns.	609-596-4080
NJ	Marlton, Milgray	609-983-5010
NJ	Parsippany, Allied Elctrns.	800-433-5700
NJ	Parsippany, Milgray	201-335-1766
NY	All Cities, Allied Elctrns.	800-433-5700
NY	Farmingdale, Milgray	516-391-3000
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Mt. Sinai, Kent Elctrns.	516-447-2000
NY	Pittsford, Milgray	716-381-9700
NY	Rochester, Future Elctrns.	716-272-1120
NY	Smithtown, Vantage Comp.	516-543-2000
NY	Yonkers, Kintronics	914-347-2530
NC	Concord, Future Elctrns.	704-455-9030
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Allied	800-433-5700
NC	Raleigh, Century Elctrns. Comp.	919-596-2220
NC	Raleigh, Future Elctrns.	919-790-7111
NC	Raleigh, Milgray	919-790-8094
OH	All Cities, Allied Elec	800-433-5700
OH	Cleveland, Milgray	216-447-1520
OH	Mayfield Hts., Future Elec	216-449-6996
OK	Tulsa, Allied Elctrns.	800-433-5700
OK	Tulsa, Norvell Elec.	918-628-1916
OR	Beaverton, EOFF	503-645-9454
OR	Beaverton, Kent Elctrns.	503-626-8300
OR	Bend, EOFF	503-388-1544
OR	Eugene, EOFF	503-342-1277
OR	Salem, Eoff	503-363-9251
PA	All Cities, Allied Elctrns.	800-433-5700
PA	Norristown, Century Elctrns. Comp.	215-631-5400
RI	Pawtucket, Major Edwards	401-725-7400
SC	Greenville, Allied Elctrns.	800-433-5700
TN	Memphis, Allied Elctrns.	800-433-5700
TX	All Cities, Allied Elctrns.	800-433-5700
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Norvell Elctrns.	214-233-0020
TX	Dallas, Milgray	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Future Elctrns.	713-556-8696
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Norvell Elctrns.	713-462-1666
TX	Irvine, Cypress Elctrns.	214-255-0065
TX	Richardson, Future Elctrns.	214-437-2437
TX	Richardson, Kent Elctrns.	214-669-2600
TX	Stafford, Milgray	713-240-5360
UT	Salt Lake City, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Milgray	801-261-2999
VA	All Cities, Allied Elctrns.	800-433-5700
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Redmond, Future Elctrns.	206-881-8199
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Seattle, Allied	800-433-5700
WA	Vancouver, Eoff	206-694-7504
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	Waukesha, Future Elctrns.	414-786-1884
Can	Calgary, Alb., Future Elctrns.	403-250-5550
Can	Edmonton, Alb., Future Elctrns.	403-438-2858
Can	Mississauga, Ont., Future Elctrns.	416-612-9200
Can	Mississauga, Ont., Milgray	416-678-0955
Can	Montreal, Que., Elctrn. Wholeslrs.	514-769-8851
Can	Ottawa, Ont., Elctrn. Wholeslrs.	613-746-4413
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pt. Claire, Que., Ferrotronic Comp.	514-426-0300
Can	Pt. Claire, Que., Future Elctrns.	514-694-7710
Can	Pt. Claire, Que., Milgray	514-426-5900
Can	Quebec, Que., Future Elctrns.	418-877-6666
Can	Toronto, Ont., Duncan Inst. Ltd.	416-742-4448
Can	Vancouver, B.C., Future Elctrns.	604-294-1166
Can	Winnipeg, Man., Future Elctrns.	204-786-7711

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 110

CONDOR SYSTEMS, INC., 2133 Samaritan Dr., San Jose, CA 95124, Tel: 408-371-9580, FAX: 408-371-9589; FSC No.: 62065; Empl.: 318; *Sls. Mgr.:* Dave Klingler

CONDUCTIVE RUBBER TECHNOLOGY, INC., 22125 17th Ave. S.E. Ste. 117, Bothell, WA 98021, Tel: 206-486-8559, FAX: 206-487-0945; Empl.: 30; *Sls. Mgr.:* K. Grant

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, FAX: 518-843-5829; Empl.: 25; *Sls. Mgr.:* Walter G. Bruce

CONDUCTUS, INC., 969 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-737-6700, FAX: 408-737-6699; Empl.: 40

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777, FAX: 419-729-3779; Empl.: 35

CONKLIN INSTRUMENT CORP., West Rd., P.O. Box 650, Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 120; *Sls. Mgr.:* Steve A. Muise, VP Sls.

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 10 B Trackside Business Park, Cheshire,, CT 06410, Tel: 203-250-9678, FAX: 203-250-9688; FSC No.: 50974; Empl.: 15; *Sls. Mgr.:* Joseph W. Raines

CONNECTOR ACCESSORIES, INC., See Mueller Elec. Co.

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059, FAX: 312-539-3825; *Sls. Mgr.:* Michael Gits .... **C•1292**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 10340 Julian Dr., Cincinnati, OH 45215, Tel: 513-772-3680; FSC No.: 32076; Empl.: 60; *Sls. Mgr.:* Bob Cain

Connectronics Corp.

FAX: 419-537-0007

CONNECTRONICS CORP., 2745 Avondale Ave., Toledo, OH 43607, Tel: 419-537-0020; FSC No.: 0LE36; Empl.: 15; *Sls. Mgr.:* Bruce A. Begitschke ...... **C•1293**

Local Sales Offices & Reps

AZ	Tucson, Blackhart Assocs.	602-579-0399
CA	Morgan Hill, Power Connection, Inc.	408-779-8888
CO	Silt, Blackhart Assocs.	303-876-5605
GA	Atlanta, Electro Technlg. Prods.	404-262-1522
MA	Lexington, Jesco, Inc.	617-863-1598
MN	Stillwater, Prof. Elctrn. Reps	612-436-1950
NJ	Summit, Intl. Cable Corp.	908-273-4470
NY	Victor, Kirby Mktg.	716-248-8750
OH	Toledo, Connectronics	419-537-0020

CW

FAX: 708-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505-1335, Tel: 708-851-4722; FSC No.: 5955; Empl.: 45; *Sls. Mgr.:* Tom Grabowski ..... **A•1350-1355**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Scottsdale, Spectrum Mktg. Assoc.	602-890-9000
CA	Campbell, Shur Sls.	408-374-5577
CA	San Diego, A.T.A. Assoc.	619-792-6079
CA	Westlake Village, First Rep	805-373-0887
CO	Denver, Spectrum Mktg. Assoc.	303-480-9991
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Boca Raton, APM Assoc.	407-395-7308
FL	Tampa, APM Assoc.	813-886-2457
FL	Winter Park, APM Assoc.	407-678-2777
ID	Boise, Q.R. Crown	208-344-9588
IN	Ft. Wayne, R.O. Whitesell	219-489-0588
IN	Indianapolis, R.O. Whitesell	317-876-9000
IN	Kokomo, R.O. Whitesell	317-457-9127
KY	Versailles, R.O. Whitesell	606-873-1182
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Lexington, Kanan Technlgs.	617-861-7300
MI	Grand Blanc, R.O. Whitesell	313-695-0770
MI	Grand Rapids, R.O. Whitesell	616-942-5420
MI	Southfield, R.O. Whitesell	313-352-5454
MI	St. Joseph, R.O. Whitesell	616-983-7337
NC	Charlotte, Quantum Mktg.	704-523-8822
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Cincinnati, R.O. Whitesell	513-528-5644
OH	Cleveland, R.O.Whitesell	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R.O.Whitesell	513–298-9546
OR	Portland, Q.R. Crown	503-620-8320
PA	Glenside, Koebert Assocs.	215-887-2310
PA	Pittsburgh, R.O. Whitesell	412-963-6161
TX	Austin, Synergistic Sls.	512-346-2122
TX	Houston, Synergistic Sls.	713-937-1990
TX	Richardson, Synergistic Sls.	214-644-3500
WA	Bellevue, Q.R. Crown	206-453-5100
WI	Mequon, Artmor Ltd.	414-242-4127
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Kanata, Ont., J-Squared Tech., Inc.	613-592-9540

Local Distributors

PA	Glenside, Mark Elctrns.	215-887-2317

CONRAC DISPLAY PRODUCTS, INC., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TELEX: 67-0437, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 96; *Sls. Mgr.:* G.L. Ives, Dir. Mktg. & Sls.

Consolidated electronic wire & cable

FAX: 708-455-8979

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131-1412, Tel: 708-455-8830; FSC No.: 73612; Empl.: 97; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ... **C•1294-1298, 1726-1739**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
AR	N. Little Rock, Leo Baker Co.	501-834-2537
CA	Irvine, Vale Elctrns. Assoc.	714-551-4004
CA	San Diego, Vale Elctrns. Assocs.	619-487-7025
CA	San Jose, Westron Assoc.	408-264-4070
CO	Denver, Diversified Mktg. Grp.	303-231-6039
CT	Consolidated Elctrn. Wire	708-455-8830
FL	Winter Park, Technlg. Mktg. Assoc.	407-671-2245
GA	Newnan, New Age Elctrns.	404-476-0079
IL	Mt. Prospect, The Dombrow Co.	708-253-3326
IN	Carmel, Frank Kahsar Sls.	317-844-9353
IA	Cedar Rapids, R.W. Kunz	319-396-5386
IA	Des Moines, Jerry Bunch Elec. Sls.	515-287-7057
KS	Prairie Village, R.W. Kunz	913-648-3535
MI	Sterling Heights, Frank Kahsar Sls.	313-795-3530
MN	Minneapolis, Tecteam Sls., Inc.	612-854-6616
MO	St. Louis, R.W. Kunz	314-966-4977
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Woodside, Greater Metro Sls.	718-424-1911
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Cincinnati, Frank Kahsar Sls., Inc.	513-598-1484
OH	Columbus, Frank Kahsar Sls.	614-252-4009
OH	Elyria, Frank Kahsar Sls.	216-365-5219
OH	Mentor, Frank Kahsar Sls.	216-257-1166
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Wexford, Frank Kahsar Sls.	412-935-8561
SC	Walhallia, Overton Assoc.	803-638-7101
TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Plano, B&R Elctrn. Sls. Corp.	214-985-0028
VA	Merchanicsville, R.B. Marsland Assocs.	804-746-5770
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
WI	Mequon, E.A. Dickinson	414-241-9140
Can	Con. Elctrn. Wire & Cable	800-621-4278

CONTACT, INC., Rte. 27 Box 2230, Edgecomb, ME 04556, Tel: 207-882-6116, FAX: 207-882-6122; FSC No.: MO7015; Empl.: 11; *Sls. Mgr.:* R.Reid; *Dist. Mgr.:* R.Reid

CONTACT EAST, 335 Willow St. S., N. Andover, MA 01845, Tel: 508-682-2000, FAX: 508-688-7829; *Sls. Mgr.:* Richard Sullivan

CONTAQ TECHNOLOGIES CORP., 15 Main St., Bristol, VT 05443, Tel: 802-453-3332, FAX: 802-453-4250; FSC No.: 6680

CONTEC MICROELECTRONICS USA, 2188 Bering Drive, San Jose, CA 95131, Tel: 408-434-6767, 1-800-888-8884, FAX: 408-434-6884; Empl.: 50; *Sls. Mgr.:* Nayan Pradhan

CONTINENTAL DEVICE INDIA LIMITED, C-120 Naraina Industrial Area, New Delhi, India 110028, Tel: 536150-53 (4 lines), TELEX: 031-76209, TWX: 031-76230; FSC No.: I.J.; Empl.: 1100; *Sls. Mgr.:* P. Gulati, Gen. Mgr. & VP Mfg.

CONTINENTAL ELECTRONICS CORPORATION, P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, TELEX: 73-398, FAX: 214-381-4949; FSC No.: 52151; Empl.: 270

CONTINENTAL MICROWAVE TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* Robert Herrmann, Gen. Mgr. .... **A•1357**

Local Sales Offices & Reps

CA	Palo Alto, Microwave Mktg. Assoc.	415-326-4143
CA	Westlake Vl., Westtech Microwave, Inc.	805-373-0033
FL	Melbourne Beach, EDSI Sls.	407-952-1240
MD	Laurel, CSDS, Inc.	301-953-7884
NY	Melville, R.F. Elctrn. Sls.	516-420-8890
MA	Wayland, High Tech Sls.	508-653-3838
TX	Richardson, SW Microwave Elctrns. Corp.	214-669-1195
Can	Montreal, Que., Solid State Engrg. Co.	514-481-3313

CONTINENTAL RESOURCES, Computer & Peripherals Div., 175 Middlesex Tpke., Bedford, MA 01730-1469, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-6563; Empl.: 250; *Sls. Mgr.:* Mark Berling

CONTINENTAL RESOURCES, INC, Test Instruments Div., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-2046; Empl.: 250

CONTROL CABLE, INC., 7261 Ambassador Rd., Baltimore, MD 21244, Tel: 410-298-4411, FAX: 410-265-1646; FSC No.: 510124759; Empl.: 90; *Sls. Mgr.:* Bill Cook; *Dist. Mgr.:* Bill Cook

CONTROL COMPONENTS & SYSTEMS, INC., 557 Long Road, Pittsburgh, PA 15235, Tel: 412-371-1111, FAX: 412-371-1112

CONTROL CONCEPTS CORP., Liebert Corp., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484, FAX: 607-722-8713; Empl.: 85; *Sls. Mgr.:* Pat Gillette, VP Sls.; *Dist. Mgr.:* Jim Harrison

CONTROL ELECTRONICS, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, Tel: 516-694-0125, FAX: 516-694-0133; FSC No.: 95924; Empl.: 25; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Sandy Walthers

CONTROL ENGRG., INC., 190 Doty Circle, West Springfield, MA 01089, Tel: 413-781-1330, FAX: 413-732-3367; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROL LASER CORP., 7503 Chancellor Dr., Orlando, FL 32809, Tel: 407-438-2500, TELEX: 514215; Empl.: 70; *Sls. Mgr.:* Steven Graham, Sls. Mgr.

CONTROLLED ENVIRONMENT EQUIPMENT CORP., 29 Sanford Dr., Gorham, ME 04038, Tel: 207-854-9126, TELEX: 62903721, FAX: 207-854-4357; FSC No.: 25254; Empl.: 10; *Sls. Mgr.:* M. F. Peck

CONTROLLED POWER COMPANY

FAX: 313-528-0411

CONTROLLED POWER CO., 1955 Stephenson Hwy, Troy, MI 48083, Tel: 313-528-3700, 1-800-521-4792, TWX: 810-2323401; Empl.: 160; *Sls. Mgr.:* Timothy Tazzia; *Dist. Mgr.:* Ken Krause .... **D•2253-2255**

Local Sales Offices & Reps

AL	Controlled Power Co.	1-800-521-4792
AK	Anchorage, Alaska Computer Environment	907-248-7168
AZ	Phoenix, Controlled Power Co.	1-800-521-4792
CA	Foster City, Controlled Power Co.	1-800-521-4792
CO	Denver, Computer Facility Components	303-778-8488
DC	Quality Power Sys. (GSA)	1-800-521-4792
FL	Orlando, KO Power	1-800-229-4250
GA	Atlanta, Gallagher Electric	1-800-521-4792
IL	Controlled Power Co.	1-800-521-4792
IN	Indianapolis, C.M. Buck	317-293-5704
KS	Shawnee Mission, Maxima Elec. Sls.	913-722-1591
KY	Corydon, C.M. Buck	812-738-4373
LA	Metaire, Rapco Assocs.	1-800-521-4792
MD	Baltimore, Controlled Power Co.	1-800-521-4792
MI	Troy, Controlled Power Co.	1-800-521-4792
MN	Minnetonka, Automated Process Sys.	612-935-4766
MO	St. Louis, Controlled Power Co.	1-800-521-4792
NE	Omaha, Computer Protection	402-571-2322
NH	Bedford, Innovative Technologies, Inc.	603-624-4163
NJ	Nutley, Controlled Power Co.	1-800-521-4792
NM	Albuquerque, D.E.S.I.	505-292-1022
NY	Bay Shore, Controlled Power Co.	1-800-521-4792
NY	Buffalo, Controlled Power Co.	1-800-521-4792
NC	Charlottte, Glen & Larson Co.	704-847-7418
OH	Westerville, Power Com Systems	614-890-1124
OK	Oklahoma City, Controlled Power Co.	1-800-521-4792
OK	Tulsa, Controlled Power Co.	1-800-521-4792
OR	Portland, NRG	503-242-2506
PA	Philadelphia, Controlled Power Co.	1-800-521-4792
PA	Pittsburgh, Controlled Power Co.	1-800-521-4792
SC	Charleston, Glenn & Larson Co.	803-763-8640
TN	Memphis, Total Environmental Sys.	901-743-7154
TN	Memphis/Nashville, Controlled Power Co.	1-800-521-4792

TX	Dallas, Controlled Power Co.	1-800-521-4792
TX	Elpaso, Controlled Power Co.	1-800-521-4792
TX	Houston, Controlled Power Co.	1-800-521-4792
UT	Salt Lake City, Controlled Power Co.	1-800-521-4792
VA	Sterling, Quality Power Sys. (GSA)	703-709-2224, 1-800-521-4792
WA	Seattle, Tech Source	206-292-1656
WI	Wisconsin Rapids, Controlled Power Co.	1-800-521-4792
EXP	Various Offices, Controlled Power Co.	1-800-521-4792
PR	San Juan, RFF	809-755-5679
Can	Various Offices, Controlled Power Co.	1-800-521-4792

CONTROL LOGIC, See Hancock Electronics Corp.

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, TELEX: 643167, FAX: 203-741-6064; Empl.: 160; *Sls. Mgr.:* James W. Bianco

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400, FAX: 201-887-5083; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* H.M. Stuhler; *Dist. Mgr.:* H.M. Stuhler

CONTROL RESOURCES INC., 325 Ayer, Harvard, MA 01451, Tel: 508-772-4043, FAX: 508-772-4142; Empl.: 10; *Sls. Mgr.:* James Quirk .... **C•1575**

CSI CONTROL SCIENCES INCORPORATED

FAX: 818-709-8546

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510; FSC No.: 53317; Empl.: 20; *Sls. Mgr.:* Rhod Zimmerman .... **D•1176-1181**

Local Sales Offices & Reps

CA	Luguna Niguel, Aktron Sls.	714-496-5057
FL	Oldsmar, Suncoast Elctrn. Sls.	813-787-9221

CAL SWITCH
CALIFORNIA SWITCH AND SIGNAL INC
THE SOURCE FOR
COOPER
Belden
[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
(800) CAL-SWCH

IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MD	Annapolis, Homersmith, Inc.	410-269-6493
MA	Salem, Forbes Engrg.	508-744-1693
MN	St. Paul, Northstar Motion & Control	612-770-5311
NJ	Williamstown, Homersmith, Inc.	609-567-7464
NC	Jamestown, Homersmith, Inc.	919-883-3999
PA	Springfield, Homersmith Inc.	215-543-2434
TX	Richardson, Beacon Microwave	214-437-1505
TX	Roundrock, Beacon Microwave	512-244-6675
VA	Shawsville, Homersmith Inc.	703-268-9720
WI	Cedarburg, Hi-Tech Dvcs. Corp.	414-375-9595

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500, FAX: 216-259-5015; Empl.: 45; *Sls. Mgr.:* Paul Adams

CTC

FAX: Fax 718-361-6386

CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ... **D•2314-2315**

Local Sales Offices & Reps

Can	Montreal, Que., Control Tech. Elctrns. CTC Canada	514-733-3279,FAX:514-733-2132

CONTROL TECHNOLOGY, INC., 7608 N. Hudson, Oklahoma City, OK 73116, Tel: 405-840-3163, FAX: 405-848-0489; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONTROLTEK, INC., 14201 NW Science Park Dr., Portland, OR 97229, Tel: 503-641-0876, FAX: 503-641-7349; Empl.: 16; *Sls. Mgr.:* Kevin Caswell

cdi CONVERSION DEVICES, INC.
EXCELLENCE IN POWER CONVERSION TECHNOLOGY

FAX: 508-559-9288

CONVERSION DEVICES, INC., 15 Jonathan Drive, Brockton, MA 02401, Tel: 508-559-0880; Empl.: 70; *Sls. Mgr.:* Wayne Carlson .... **D•2096-2097**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
AZ	Phoenix, Howe & Howe, Sls.	602-264-7971
CA	Camarillo, The Tricamo Co.	805-388-0039
CA	Mountain View, L.S. Engrg.	415-967-5880
CA	San Diego, The Tricamo Co.	619-689-1000
CO	Englewood, Odyssey 1	303-773-8176
CT	Fairfield, Bossaco	203-255-2326
FL	Melbourne, Saber Assocs., Inc.	407-724-0920
FL	Oviedo, Conley & Assocs.	407-365-3283
GA	Lilburn, South Tech. Sls.	404-381-2088
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
IA	Cedar Rapids, M.I.N.K. Assocs.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs.	919-341-8309
MD	Ellicott City, VPI	410-461-2525
MA	Brockton, Conversion Dvcs., Inc.	508-559-0880
MA	Scituate, N.E.A.R.	617-545-6327
MI	Livonia, Electro Sls. Assocs.	313-421-7500
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
MO	Bridgeton, M.I.N.K. Assocs.	315-291-5454
NJ	Paramus, Eltech Sls., Inc.	201-967-1309
NM	Albuquerque, H.E.R. Elctrns.	505-265-8609
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Raleigh, South Tech. Sls.	919-571-1313
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Broken Arrow, D. J. Sls.	918-258-1445
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Pittsburgh, Electro Sls. Assocs.	412-322-9000
PA	Plymouth Meeting, CMS Sls. & Mktg.	215-834-6840
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, D.J. Sls.	214-783-8876
UT	Salt Lake City, Odyssey 1	801-485-4728
WA	Mountlake Ter., SPS Elctrns.	206-323-4140
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
Can	Mississauga, Ont., Andy Baumen Assocs. Ltd.	416-828-2600

CONVERTER CONCEPTS™

FAX: 608-429-9241

CONVERTER CONCEPTS, INC., 100 Industrial Pkwy., Pardeeville, WI 53954, Tel: 608-429-3000; Empl.: 125 .... **D•1646-1647**

Local Sales Offices & Reps

CA	San Jose, Vernexx & Assocs.	408-972-9072
FL	Clearwater, Dan-Tech Sls.	813-441-2609
FL	Davie, Dan-Tech Sls.	305-581-2884
MD	Kensington, Koebert Assocs.	301-439-8924
MA	Arlington, Interstate Sls. Assocs.	617-646-3914
MA	Chelmsford, Interstate Sls. Assocs.	508-256-2287
NY	Rochester, KLM Garner	716-385-2103
NY	Smithtown, Koebert Assocs.	516-979-6683
PA	Glenside, Koebert Assoc.	215-887-2310
RI	Warren, Interstate Sls. Assocs.	401-245-8364
TX	Houston, Scientific Sls. Co.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Alexandria, Koebert Assocs.	703-461-3655
Can	Rexdale, Valtrie Mktg.	416-851-0335
Can	Vancouver, BC, Davetek Mktg.	604-430-3680

Local Distributors

AL	Huntsville, Comp. Distrs., Inc.	205-851-7800
CA	Santa Anna, Foresight Elctrns.	714-833-2134
CA	Santa Clara, Foresight	408-980-9700
CO	Englewood, Comp. Distrs.,Inc.	303-770-6214
FL	Clearwater, Comp. Distrs., Inc.	813-796-0466
FL	Palm Bay, Comp. Distrs., Inc.	407-724-9910
GA	Norcross, Comp. Distrs., Inc.	404-441-3320
IL	Roselle, Foresight Elctrns.	708-980-9890
PA	Glenside, Mark Elctrns.	215-887-2317
TX	Dallas, Comp. Distrs., Inc.	214-644-0373
Can	Markham, Ont., Wm. Saynor & Assocs.	416-415-1044
Can	Rexdale, Valtrie Mktg.	416-798-2555

CONVERTER POWER, INC., Locust Rd., Ipswich, MA 01938, Tel: 508-356-2558, FAX: 508-356-5729; *Sls. Mgr.:* Barry Essig

COOKE VACUUM PRODS., INC., 13 Merritt St., S. Norwalk, CT 06854, Tel: 203-853-9500, FAX: 203-838-9553; Empl.: 45; *Sls. Mgr.:* Louis W. Genuario

THE COOL-AMP CONDUCTO-LUBE CO., 15834 Upper Boones Ferry Rd., Lake Oswego, OR 97035, Tel: 503-624-6426, FAX: 503-624-6436; FSC No.: 31628; Empl.: 7; *Sls. Mgr.:* Marian Bomber

COOL CORPORATION, 14170 23rd Ave. N., Minneapolis, MN 55447, Tel: 1-612-559-3117, FAX: 1-612-559-9679; Empl.: 5; *Sls. Mgr.:* Will Mielenz

COONER WIRE CO., 9265 Owensmouth Ave., Chatsworth, CA 91311, Tel: 818-882-8311, FAX: 818-709-8281; *Sls. Mgr.:* Steven W. Smith

COOPER INDUSTRIES/BELDEN DIV., P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, 800-BELDEN-1, TWX: 810-345-1393, FAX: 317-983-5294; Empl.: 3500; *Sls. Mgr.:* Dan Trotta, Mgr. OEM Sls.; *Dist. Mgr.:* Rick Schneldewind, Mgr. Dist. Sls.

COOPER TOOLS, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, FAX: 919-783-2067

COORS CERAMICS CO., Electronics, 17750 W. 32nd Ave., Golden, CO 80401, Tel: 303-277-4591, FAX: 303-277-4779; Empl.: 1700

COORS ELECTRONIC PACKAGE CO., 511 Manufacturers Rd., Chattanooga, TN 37405, Tel: 615-755-5452, FAX: 615-755-5438; Empl.: 200; *Sls. Mgr.:* Jim F. Wade

COPAL (USA), INC., 2341 205th St., Ste 102, Torrance, CA 90501, Tel: 310-618-0225, FAX: 310-618-9984; *Sls. Mgr.:* Hugh Namekawa

CORBY INDUSTRIES, INC., 1501 E. Pennsylvania St., Allentown, PA 18103, Tel: 215-433-1412, FAX: 215-435-1963; Empl.: 31; *Sls. Mgr.:* Sharon Cain; *Dist. Mgr.:* Sharon Cain corcom

FAX: 708-680-8169

CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 708-680-7400; FSC No.: 05245; Empl.: 800; *Sls. Mgr.:* Ken Bons .... **A•1586-1587; B•1352; C•1300-1302**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell Assocs.	205-883-5110
AZ	Tempe, Westrep	602-820-9932
CA	Montrose, Luscombe	818-249-9000
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Westrep	619-566-6580
CO	Westminster, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
FL	Altamonte Springs, Semtronic Assoc.	407-831-8233
GA	Norcross, Robert O. Whitesell	404-449-9190
ID	Boise, Jas J. Backer Co.	208-343-9831
IL	Itasca, Beta Technlg. Sls. Inc.	708-250-9586
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-876-9000
IN	Kokomo, Robert O. Whitesell	317-457-9127
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Versailles, Robert O. Whitesell	606-873-1182
MD	Columbia, Third Wave Solutions	301-290-5990
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-352-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	Englewood, MOS Mktg.	201-569-2071
NM	Albuquerque, Rontek, Inc.	505-299-4124
NY	Great Neck, MOS Mktg.	516-487-3966
NY	Skaneateles, Empire Tech Sls.	315-685-5703
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Knoxville, Robert O. Whitesell	615-694-9476
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Beta Technlg. Sls. Inc.	414-543-6609
Can	Ontario, R.N. Longman	416-670-8100

CORECO, INC., 6969 Trans-Canada Hwy, Ste. 113, St. Laurent, Que., Canada H4T 1V8, Tel: 800-361-4914, 514-333-1301, FAX: 514-333-1388; Empl.: 32

CORLUND ELECTRONICS CORP., 2330 Teller Rd., Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 805-499-4072; Empl.: 100; *Sls. Mgr.:* Bruce MacDonald

CDE CORNELL DUBILIER

FAX: 508-996-3830

CORNELL-DUBILIER ELCTRNS. (INTL. SLS., DISTBN. WAREHOUSE), 1605 E. Rodney French Blvd., New Bedford, MA. 02744, MA 02741, Tel: 508-996-8564, TELEX: 929 419; Empl.: 500ò; *Sls. Mgr.:* Anthony M. Cavuto, VP Sls. .... **A•1062-1065; B•1450**

Local Sales Offices & Reps

CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI Inc.	813-894-4556
KS	Overland Park, Electri-Rep	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Madison Heights, Pine Sales, Inc.	313-589-0350
MN	Eden Praire, PWC Incorporated	612-934-1409
MO	St. Louis, Electra-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Beaverton, Elctrn. Sources, Inc.	503-620-0441
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comp. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, P.R., E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projections Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, The Greene-Shaw Co.	617-969-8900
MN	St. Paul, Kent/Shelley-Ragon ELctrns.	612-642-2828
NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rome, Rome Elctrns.	315-337-5400
OH	Cleveland, Pioneer-Standard	216-587-3600
PA	No. Versailles, CMD Elctrns.	412-678-6020
TX	Dallas, Hallmark Elctrns.	214-553-4300
TX	Fort Worth, TTI, Inc.	817-740-9000
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL-DUBILIER ELCTRNS. (CORPORATE HEADQUARTERS), 1700 Route 23 North, Wayne, NJ 07470, Tel: 201-694-8600; Empl.: 500ò; *Sls. Mgr.:* A. Cavuto .... **A•1062-1065**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev. Sls.	602-438-1547
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI, Inc.	813-894-4556
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
KS	Overland Park, Electri-Rep.	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Madison Hgts., Pine Sls., Inc.	313-589-0350
MN	Eden Prairie, PWC Inc.	612-934-1409
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
NY	Syracuse, L.D. Allen	315-437-8387
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Tigard, Earl & Brown Co., Inc.	503-639-2100
PA	Erdenheim, Omni Sls.	215-233-4600
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comps. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830
Can	N. Vancouver, B.C., Arwin Tech. Sls.	604-980-4557

Local Distributors

AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projection Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, Greene-Shaw, Co.	617-969-8900
MN	St. Paul, Kent/Shelley-Ragon	612-642-2828
NY	Hauppauge, Jaco Elctrns., Inc.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rome, Rome Elctrns.	315-337-5400
OH	Cleveland, Pioneer-Standard	216-587-3600
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Dallas, Hallmark Electronics	214-553-4300
TX	Ft. Worth, TTI, Inc.	817-740-9000
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL MANUFACTURING, An Elgin Co., 25 Ramland Road, Orangeburg, NY 10962, Tel: 914-365-0400, FAX: 914-359-6809; Empl.: 50; *Sls. Mgr.:* Lou Schnur; *Dist. Mgr.:* Lou Schnur

CORNING INCORPORATED, Advanced Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-7920, TELEX: 932498, FAX: 607-974-7618; *Sls. Mgr.:* Paul Marx; *Dist. Mgr.:* Brian Gray

CORNING INCORPORATED, Opto-Electronics Group, MP-RO-03, Corning, NY 14831, Tel: 1-800-525-2524, FAX: 607-974-7522; Empl.: 26,000

CORONA MAGNETICS, INC., 201 Corporate Terrace, Corona, CA 91719, Tel: 909-735-7558, FAX: 909-735-6753; Empl.: 60; *Sls. Mgr.:* Uwe Paasch

CORTEC, INC., 15672 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

CORTRON INC., 1 Aegean Dr., Methuen, MA 01844, Tel: 508-975-5445, FAX: 508-975-0357; Empl.: 75; *Sls. Mgr.:* Philip P. Bodoni

COSEL U.S.A. Inc.

FAX: 408-980-9757

COSEL U.S.A. INC., (Formerly U.S. Elco Inc.), 2930 Scott Blvd., Santa Clara, CA 95054, Tel: 408-980-5144; *Sls. Mgr.:* Bob Kitamura .... **D•1648-1650, 2098**

Local Distributors

CA	Santa Clara, Foresight	408-980-9700,714-833-2134
CO	Englewood, CDI	303-770-6214
FL	Ft. Lauderdale, CDI	1-800-558-2351
GA	Duluth, Stelmack Power	404-441-7927
GA	Norcross, Applied Power	1-800-445-8316
IL	Schaumberg, Mar Lyn	708-924-9111
IA	W. Des Moines, Allied	1-800-433-5700
KS	Lenexa, Allied	1-800-433-5700
LA	Metairie, Allied	1-800-433-5700
MA	Lowell, Total Power	508-453-7272
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MN	Minneapolis, Tortec	612-866-3662
MO	Earth City, Allied	1-800-433-5700
NE	Omaha, Allied	1-800-433-5700
NJ	Lodi, TRC	201-779-8282
OH	Cincinatti, Schuster	513-489-1400
PA	McKean, Advacom	814-476-7774
TX	Dallas, Allied	1-800-433-5700
UT	Salt Lake City, CDI	801-261-5244

COSMO CORPORATION, 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594, FAX: 216-861-0416; Empl.: 350; *Sls. Mgr.:* B. Gordon

COSMOS PLASTIC CO., 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594

COTO WABASH, A Kearney National Company, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686, FAX: 401-942-0920; Empl.: 300; *Sls. Mgr.:* J. Lynch(East); *Dist. Mgr.:* Chris Cardin ..... **B•1451-1453**

Local Sales Offices & Reps

AL	Owens Cross Rds., cmrCross Assocs.	205-883-5991
AZ	Phoenix, Spectrum Mktg. Assocs., Inc.	602-890-9000
CA	Newport Bch., Forbes Pacific Inc.	714-722-6174
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Sls.	303-480-9991
FL	Orlando, Standard Mktg.	407-856-4140
FL	Sunrise, Standard Mktg.	305-749-5557
FL	Tampa, Standard Mktg.	813-933-5833
IL	Arlington Hgts., M.J. Petersen & Assocs.	708-577-8200
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Midwest Tech. Sls. Inc.	319-393-5115
KS	Goddard, Midwest Tech. Sls. Inc.	316-794-8565
KS	Lenexa, Midwest Tech. Sls. Inc.	913-888-5100
MD	Columbia, Delta III Assoc., Inc.	301-730-4700
MA	Andover, Crawford Assocs.	508-470-2122
MN	Roseville, TLC	612-483-2226
MO	Earth City, Midwest Tech. Sls. Inc.	314-298-8787
NY	Clifton Pk., Net Sls.	518-371-6864
NY	Cortland, Net Sls.	607-756-6592
NY	Great Neck, MOS Mktg. Assocs.	516-487-3966
NY	Victor, Net Sls.	716-924-1844
NC	Charlotte, Godwin Assocs.	704-549-8500
NC	Raleigh, Godwin & Assoc.	919-878-8000
OR	Oregon City, Halbar Pacific	503-656-3714
PA	Trevose, Omega Elctrn. Sls.	215-244-4000
TX	Plano, Richmar Elctrns.	214-424-8388
TX	Round Rock, Richmar Elctrns.	512-255-2551
UT	Ogden, Spectrum Mktg. Assocs. Inc.	801-972-8552
WA	Redmond, Halbar Pacific	206-882-0990
Can	Pickering, Ont., Current Mktg.	416-428-3413
Can	Pointe Claire, Que., A. R. Gray Assocs.	514-694-6378

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Saratoga, Testco Inc.	408-253-1900
CA	Sunnyvale, Spirox	408-739-3334
CO	Denver, Spectrum Distrbn.	303-480-9991
FL	W. Melbourne, Astro Mktg.	407-727-8817
IL	Bedsville, Voyager Elect. Corp.	708-860-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove Village, Nu-Way Elect. Dist., Inc.	708-437-7120
MA	Methuen, Aved Elect. Inc.	508-688-3800
MN	Fridley, Voyager Elect. Corp.	612-571-7766
NJ	Oakland, Relay Specialties	201-337-1000
NY	Rochester, Masline Elect., Inc.	716-546-5373
PA	Philadelphia, SHAP Elect. Co.	215-969-3300
TX	Ft. Worth, Allied Elec.	817-595-3500
TX	Austin, Altair Co.	512-837-4970
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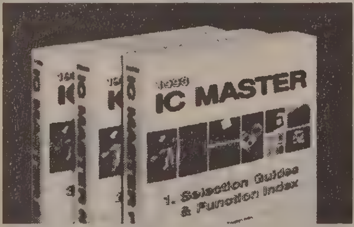

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COVID, INC., 1725 W. 17th St., Tempe, AZ 85281, Tel: 602-966-2221, FAX: 602-966-6728; Empl.: 40; *Sls. Mgr.:* Suzanne Jones

COVOX, INC., 675 Conger St., Eugene, OR 97402, Tel: 503-342-1271, FAX: 503-342-1283; Empl.: 30; *Sls. Mgr.:* Kevin Corson; *Dist. Mgr.:* Donna Corson

CPS, 15800 Upper Boones Ferry Rd., # 150, Lake Oswego, OR 97035, Tel: 503-684-8026, FAX: 503-684-8164; FSC No.: 31640; Empl.: 30; *Sls. Mgr.:* Clifford Gaw

CP TECHNOLOGY, INC., 21143 Christensen Drive, Cupertino, CA 95014, Tel: 408-996-8069, FAX: 408-986-8278; Empl.: 6

CRAFT DATA, INC., 27022 Cordero Lane, Mission Viejo, CA 92691, Tel: 714-582-8284, FAX: 714-248-2390; Empl.: 4

CRAIG SYSTEMS CORP., Eastern Technologies, Ltd., 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 508-388-5662, TWX: 710-347-0590, FAX: 508-388-0845; FSC No.: 81902; Empl.: 150; *Sls. Mgr.:* Roger Chouinard

CRAMCO INC., 80 Sinnott Rd., Scarborough, Ont., Can M1L 4M7, Tel: 416-757-2876, FAX: 416-757-5530; Empl.: 40; *Sls. Mgr.:* Leo Logiacco

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FAX: 414-377-4028

CRAMER COIL & TRANSFORMER CO., INC., 401 Progress Dr., Saukville, WI 53080, Tel: 414-268-2150, 414-375-5700; Empl.: 118; *Sls. Mgr.:* William G. Pickart ..... **A•2306-2308**

Local Sales Offices & Reps

IL	Chicago, Cramer Coil & Transformer Co., Inc.	312-907-0184
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
MI	Madison Hgts., D.E.M. Sls.	313-583-1500
MN	Minnetonka, Hanna Lind Ltd.	612-931-1242
MO	St. Charles, Buckman & Assocs.	314-947-4727
NC	Kernersville, Wallace Elctrns. Sls.	800-334-3518
OH	Centerville, Mid-Star Technlgs.	513-439-5700
WI	Saukville, Cramer Coil & Transformer Co., Inc.	414-375-5700
Can	Neapean, Ont., Ellam Assocs.	613-727-3892

CRAMER CO., 139 Mill Rock Road East, Old Saybrook, CT 06475-1261, Tel: 800-247-6784, FAX: 203-388-9831; Empl.: 210; *Dist. Mgr.:* E. Latourette

CRANE ELECTRONICS, INC., 4700 Smith Rd., Cincinnati, OH 45212, Tel: 800-676-7644, FAX: 513-631-5700; FSC No.: OAKZ5; Empl.: 25

CREARE INC., Etna Rd., P.O. Box 71, Hanover, NH 03755, Tel: 603-643-3800, FAX: 603-643-4657; FSC No.: 8A287; Empl.: 100

CREATIVE AUTOMATION CO., 11641 Pendleton St., Sun Valley, CA 91352, Tel: 818-767-6220, FAX: 818-767-0123; Empl.: 25; *Sls. Mgr.:* Royal Bush

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CRITERION INSTRS., LTD., 30 Progress Ave., Scarborough, Ont., CAN M1P4W8, Tel: 416-299-6666; Empl.: 16 ..... **D•1248-1249, 1651**

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IL	Chicago, Rock Sls. Inc.	708-351-9903
MI	Troy, Satullo Assocs. Inc.	313-585-4811
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OH	Cleveland, ABITEC Inc.	216-531-9122
TX	Lewisville, E.P.R.	214-436-4772
WI	Rock Sls. Inc.	708-351-9903
Can	Calgary, Al., Landel Controls	403-254-8900
Can	Montreal, Que., Projean Inst.	514-273-8331
Can	Richmond, B.C., John McMillan	604-273-1747
Can	Saskatchewan, Landel Controls	306-522-3399

CRL COMPONENTS, INC., Roxboro Group, Highway 20 West, Fort Dodge, IA 50501, Tel: 515-573-1300, FAX: 515-573-1342; FSC No.: 71590; Empl.: 500; *Dist. Mgr.:* Jim Wood

CR MAGNETICS, INC. (FORMERLY CURRENT RING CO., INC.), 308 Axminister Dr., Fenton, MO 63026, Tel: 314-343-8518, FAX: 314-343-5119; Empl.: 5 ..... **A•2309; B•1455, 1927**

Local Sales Offices & Reps

MO	Fenton, CR Magnetics, Inc.	314-343-8518

CROMPTON MODUTEC, 920 Candia Rd., Manchester, NH 03109, Tel: 603-669-5121, 800-METERS-1, FAX: 603-622-2690,603-641-2620; FSC No.: 53498; Empl.: 450

CROSS ELECTRONICS, 100 Commonwealth Dr., Warrendale, PA 15086, Tel: 412-776-1591, FAX: 412-776-1596; Empl.: 35; *Sls. Mgr.:* L. R. Craig

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FAX: 214-250-3865

CROUZET CORPORATION, 3237 Commander Dr., Carrollton, TX 75006-2506, Tel: 214-250-1647, 1-800-677-5311; Empl.: 80; *Sls. Mgr.:* Jack Wolbrink .. **B•1246-1247, 1456-1457, 1702-1703; C•1576-1577**

Local Sales Offices & Reps

AZ	Scottsdale, Jeff Miller	602-948-0751
CA	San Ramon, C. F. M. Sls.	510-735-3601
CT	Westbrook, John Brewer	203-399-7311
FL	New Port Richey, Kirk Sls.	813-846-8558
GA	Atlanta, Levine Lectronics	404-565-1556
IL	Schaumburg, Eric Pfister	708-885-5696
IA	W. Des Moines, HDI Ltd.	515-225-3777
MA	Burlington, Anacon Sls. Assoc.	617-272-9080
MN	St. Paul, Johnson Co.	612-429-2544
MS	Jackson, Doby Assocs.	501-981-1138
NY	Fairport, Tac Sls.	716-223-7610
NY	Nyack, S & Y Assocs.	914-358-9484
OH	Centerville, Omega Sls.	513-434-5507
OH	Gahanna, Jack Matthews	614-476-6441
OR	Portland, Control Dvcs. NW	503-659-3216
PA	Valley Forge, Providence Mktg.	215-935-3300
TX	Dallas, John Hill	214-250-1647
WA	Bellevue, Control Dvcs. NW	206-451-8552

Local Distributors

AZ	Phoenix, Southwestern Automation	602-276-7022
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Santa Monica, Master Distrs.	310-452-1229
FL	Orlando, Louis Pryor	407-295-3762
GA	Tucker, CID, Inc	404-491-3143
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, PEI Genesis	317-879-0700
MA	Norwell, Controls Plus	617-871-0078
MN	Minneapolis, Lakeland Engrg.	612-544-0321
MN	St. Paul, Powermation	612-645-0781
MO	St. Louis, Control Design Supp.	314-426-3150
NJ	Oakland, Relay Specialties	201-337-1000
NY	Buffalo, Genessee Indl. Elec.	716-873-9661
NC	Gastonia, J.M.T. Elctrn. Supp.	704-867-4401
OH	Cincinnati, Aetna Elec.	513-871-8338
OR	Milwaukee, 04 Controls	503-659-7891
PA	Willow Grove, C.A. Briggs Co.	215-784-9250
SC	Columbia, Resource Elctrns.	803-779-5332
TX	Ft. Worth, Swieco.	817-281-1811
TX	Nacogdoches, Elliott Elec.	409-569-7941
WA	Kent, Motors & Controls Corp.	206-872-8010
WI	Waukesha, Powermation	414-523-0600

CROVEN CRYSTALS, 500 Beech St., Whitby, ON, Canada L1N 5S5, Tel: 416-668-3324, FAX: 416-668-5003; FSC No.: 00809; Empl.: 150; *Sls. Mgr.:* R. McCormick .... **A•1412-1417**

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CA	San Mateo, Melvin Sls.	415-349-7445
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Ovieda, Conley & Assocs.	407-365-3283
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MA	Norwood, Naton Assocs.	617-762-3224
MN	Minneapolis, Dunlop Consultants	612-559-9693
NY	New Rochelle, Ascor Elctrns.	914-235-8838
OR	Tigard, Eltech Inc.	503-684-3458
PA	Ft. Washington, Beta Sls.	215-643-6650
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
VA	Charlottesville, PDQ Sls.	804-979-7085
WA	Bellevue, Eltech, Inc.	206-643-4330

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Local Sales Offices & Reps

CA	Pleasanton, Sierra Sls. Engrg.	510-484-2250
MA	Duxbury, Crydom Co.	617-837-9722
NJ	Red Bank, Crydom Co.	908-576-1576

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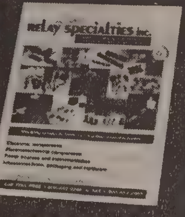

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CRYOMAGNETICS, INC., 1006 Alvin Weinberg Dr., Oak Ridge, TN 37830, Tel: 615-482-9551, FAX: 615-483-1253; *Sls. Mgr.:* D. Michael Coffey

CRYSTAL COMPONENTS USA, P.O. Box 1410, Cyrstal Lake, IL 60039-1410, Tel: 815-477-2052, FAX: 815-477-2052; Empl.: 5; *Sls. Mgr.:* Robert Kemp

CRYSTAL ENGINEERING CORP., 1119 Los Olivos, Los Osos, CA 93402, Tel: 805-528-2155, 800-444-1850, FAX: 805-528-3113; Empl.: 10; *Sls. Mgr.:* Wayne Hamari; *Dist. Mgr.:* Wayne Hamari

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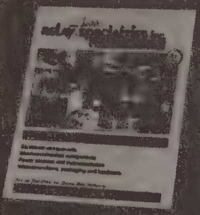

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CA	Arcadia, Van Gott & Assocs.	818-445-9728
FL	Margate, EPM Corp.	305-977-0331
FL	Melbourne, EPM Corp.	407-255-3733
FL	Orlando, EPM Corp.	407-425-6149
GA	Norcross, Electro Mech	404-447-6478
IL	Palatine, Technlg. Sls., Inc.	708-991-6600
IA	Cedar Rapids, Lowell-Kangas & Assoc.	319-362-9290
KS	Shawnee, Lowell-Kangas & Assoc.	913-631-3515
MA	Seekonk, Rudolph Mktg. Assocs.	508-399-6270
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NY	Franklin Sq., Cooper-Simon & Co., Inc.	516-489-0404
NC	Raleigh, Electro Mech	919-790-9300
OH	Dayton, North Central Mktg.	513-845-3575
OH	Lexington, North Central Mktg.	419-884-9804
OH	Lyndhurst, North Central Mktg.	216-442-2717
TX	Dallas, Exel Technlgs., Inc.	214-239-3935
WI	Milwaukee, Technlg. Sls., Inc.	414-964-5015

Local Distributors

FL	Largo, D & D Battery	813-587-9900
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GA	Doraville, Lighting Plastic Suppliers	404-448-9373
IL	Barrington, Alexander Tech. Sls., Inc.	708-381-7222
MA	Methuen, Generation Elctrns., Inc.	508-683-1177
TX	San Antonio, Altex Elctrns.	512-655-8882
TX	Spring, Jabro Southwest	713-367-9393

CSD INDUSTRIES, INC., dba C Enterprises, 310-110 Via Vera Cruz, San Marcos, CA 92069, Tel: 619-744-8182, 800-334-3815, FAX: 619-744-1659; Empl.: 28; *Dist. Mgr.:* Steve Yamasaki

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AZ	Paradise Valley, Techrep Arizona	602-991-6646
CA	San Jose, Comtech Mktg.	408-249-3330
FL	Longwood, SAM Rep., Inc.	407-869-9565
IL	Des Plaines, Esco Assocs.	312-298-5310
MD	Middletown, ST/Woolard	301-371-4500
MA	Canton, New England Elctrn. Sls.	617-828-4835
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Cazenovia, S. T. Woolard	315-655-8145
OH	Dayton, K. W. Elctrn. Sls.	513-890-2150
OR	Beaverton, Components West	503-642-9110
PA	Pittsburgh, KW Elctrn. Sls.	412-366-9396
SC	Six Mile, S.T. Woolard	803-868-4226
TX	Carrollton, Seaton Corp.	214-980-9860
WA	Redmond, Components West	206-885-5880
Can	Port Coquitlam, BC, Macom Agencies	604-942-1292

CSTS, 4015 E. Leaverton Ct., Anaheim, CA 92807-1610, Tel: 714-632-1300, FAX: 714-632-1937; Empl.: 14

C-TEK INC., 4 Railroad Ave., Wakefield, MA 01880, Tel: 617-246-1720, FAX: 617-246-2905; Empl.: 15

CTI ELECTRONICS, 110 Old South Ave., Stratford, CT 06497, Tel: 203-386-9779, FAX: 203-378-4986 .... **D•1086**

Local Sales Offices & Reps

CT	Stratford, CTI Elctrns.	203-386-9779
EXP	Ede, Netherlands, Inductive Controls Sys.	31-8380-76111

CTS®

FAX: 219-294-5718

CTS CORPORATION, 905 West Blvd. North, Elkhart, IN 46514, Tel: 219-293-7511; Empl.: 4350 ..... **A•1358-1377, 1908-1909; B•1704; D•1028, 1705**

Local Sales Offices & Reps

AL	Huntsville, R.O. Whitesell & Associates	205-883-5110,FAX:205-882-9626
AZ	Phoenix, Compass Mktg. & Sls., Inc.	602-996-0635, FAX:602-996-0586
AR	Hot Springs Vlg., Southern States Mktg., Inc.	501-922-0807,FAX:501-922-0807
CA	Auburn, Ewing-Foley, Inc.	916-885-6591, FAX:916-885-6594
CA	Calabasas, Centaur Corp.	818-591-1655, FAX:818-591-7479
CA	Irvine, Centaur Corp.	714-261-2123, FAX:714-261-2905
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525, FAX:415-941-5109
CA	San Diego, Centaur Corp.	619-278-4950, FAX:619-278-0649
CA	South Pasadena, CTS Corp.	213-682-1137, FAX:818-441-3058
CO	Denver, ELCOM, Inc.	303-337-2300, FAX:303-745-0462
CT	Brookfield, CTS Corp.	203-740-9755, FAX:203-740-9747
CT	Hamden, CompRep Assocs., Inc.	203-932-4403, FAX:203-932-4551
CT	Stamford, Unesco/Genex, Inc.	203-322-9308, FAX:203-329-8924
FL	Boca Raton, R.O. Whitesell & Assocs.	407-393-6139,FAX:407-393-6072
FL	Longwood, R.O. Whitesell & Assocs.	407-682-6662,FAX:407-682-7038
FL	Palm Harbor, R.O. Whitesell & Assocs.	813-787-0898,FAX:813-787-0987
GA	Norcross, R.O. Whitesell & Associates	404-449-9190,FAX:404-449-9197
IL	Northbrook, Dolin Sls. Co., Inc.	708-498-6770, FAX:708-498-4885
IN	Huntington, Elctrn. Reps., Inc.	219-356-3513, FAX:219-356-0337
IN	Indianapolis, Elctrn. Reps., Inc.	317-894-1414, FAX:317-894-1216
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127, FAX:317-456-1234
IA	Cedar Rapids, Seltec Sls. Corp.	319-364-7660, FAX:319-364-7906
KS	Olathe, Advanced Tech. Sls., Inc.	913-782-8702, FAX:913-782-8641
MD	Lutherville, DGR, Inc.	301-583-1360, FAX:301-825-5579
MA	Waltham, Unesco/Genex, Inc.	617-890-1535, FAX:617-890-7931
MA	Westwood, CompRep Assocs., Inc.	617-329-3454:FAX:617-329-6395
MI	Farmington Hills, J. L. Montgomery Assocs., Inc.	313-489-0099,FAX:313-489-0189
MN	Minneapolis, Robert W. Marshall Co., Inc.	612-929-0457,FAX:612-929-8307
MN	Minneapolis, S & R Comp. Sls., Inc.	612-559-3090, FAX:612-559-3153
MO	Bridgeton, Advanced Tech. Sls., Inc.	314-291-5003, FAX:314-291-7958
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-344-9990,FAX:505-345-4848
NY	E. Syracuse, Nycom, Inc.	315-437-8343, FAX:315-437-1208
NY	Rockville Centre, S-J Assocs., Inc	516-536-4242, FAX:516-536-9638
NC	Raleigh, Zucker Assocs., Inc.	919-782-8433, FAX:919-782-8476
OH	Dayton, Baehr, Greenleaf & Assocs., Inc.	513-439-0724,FAX:513-439-0387
OH	Westlake, Baehr, Greenleaf & Assocs., Inc.	216-892-1770,FAX:216-892-1771
OR	Tigard, Vantage Corp.	503-620-3280, FAX:503-684-0676
PA	Trevose, P.S.A. Inc.	215-245-0513, FAX:215-245-4817
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088,FAX:412-934-3990
TN	Knoxville, R.O. Whitesell & Associates	615-694-9476,FAX:615-691-9693
TX	Austin, Southern States Mktg., Inc.	512-835-5822, FAX:512-835-1404
TX	Houston, Southern States Mktg., Inc.	713-789-2426:FAX:713-789-3202
TX	Irving, CTS Corp.	214-444-2570, FAX:214-401-4091
TX	Richardson, Southern States Mktg., Inc.	214-238-7500,FAX:214-231-7662
UT	Murray, ELCOM, Inc.	801-262-2400, FAX:801-262-2583
WA	Bellevue, Vantage Corp.	206-455-3460, FAX:206-455-9419
WI	Glendale, Dolin Sls. Co., Inc.	414-482-1111, FAX:414-351-4142
PR	Caguas, CompRep Assocs., Inc.	809-746-6550, FAX:809-746-4800
Can	Calgary, Alb., r.n.Longman Sls., Inc.	403-228-8719, FAX:403-295-6324
Can	Kirkland, Que., r.n.Longman Sls., Inc.	514-694-3911, FAX:514-695-4414
Can	Mississauga. Ont., r.n.Longman Sls., Inc.	416-670-8100,FAX:416-670-1384
Can	Nepean, Ont., r.n.Longman Sls., Inc.	613-564-0100, FAX:613-596-9019

Value Added Distributors;Primarily Switch Products

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700, FAX:205-830-2565
AL	Huntsville, Marshall Inds.	205-881-9235, FAX:205-881-1490
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200, FAX:602-437-2348
AZ	Phoenix, Marshall Inds.	602-496-0290, FAX:602-893-9029
AZ	Tempe, Bell Inds.	602-966-3600, FAX:602-967-6584
CA	Agoura Hills, Bell Inds.	818-879-9494, FAX:818-991-7696
CA	Calabasas, Marshall Inds.	818-878-7000, FAX:818-880-6846
CA	Chatsworth, Hall-Mark Elctrns.	818-773-4500, FAX:818-773-4555
CA	Cypress, Bell Inds.	714-895-7801, FAX:714-891-4570
CA	Irvine, Capstone Elctrns.	714-283-8185, FAX:714-283-8191
CA	Irvine, Hall-Mark Elctrns.	714-727-6000, FAX:714-727-6066
CA	Irvine, Integrated Elctrns.	714-753-0127, FAX:714-753-0831
CA	Irvine, Marshall Inds.	714-660-0951, FAX:714-581-5255
CA	Milpitas, Marshall Inds.	408-942-4600, FAX:408-262-1224
CA	Rancho Cordova, Marshall Inds.	916-635-9700, FAX:916-635-6044
CA	Rocklin, Bell Inds.	916-652-0418, FAX:916-652-0403
CA	Rocklin, Hall-Mark Elctrns.	916-624-9781, FAX:916-961-0922
CA	Sacramento, Integrated Elctrns.	916-363-6030, FAX:916-362-6926
CA	San Diego, Bell Inds.	619-268-1277, FAX:619-492-9826
CA	San Diego, Hall-Mark Elctrns.	619-268-1201, FAX:619-268-0209
CA	San Diego, Marshall Inds.	619-627-4158, FAX:619-627-4163
CA	San Jose, Capstone Elctrns.	408-453-9804, FAX:408-453-9819
CA	San Jose, Hall-Mark Elctrns.	408-432-4000, FAX:408-432-4044
CA	San Jose, Rose Elctrns.	408-943-0200, FAX:408-943-0360
CA	Sunnyvale, Bell Inds.	408-734-8570, FAX:408-734-8875
CA	Sunnyvale, PSC Elctrns.	408-737-1333, FAX:408-737-0502
CA	Yorba Linda, Corona Elctrns.	714-283-8185, FAX:714-283-8191
CO	Denver, Bell Inds.	303-691-2460, FAX:303-691-9036
CO	Denver, Integrated Elctrns.	303-292-6121, FAX:303-297-2053
CO	Englewood, Hall-Mark Elctrns.	303-790-1662, FAX:303-790-4991
CO	Littleton, Indelco Elctrns.	303-795-3431, FAX:303-795-8298
CO	Thornton, Marshall Inds.	303-451-8444, FAX:303-457-2899
CT	Cheshire, Hall-Mark Elctrns.	203-271-2844, FAX:203-269-1704
CT	Wallingford, Bell Inds.	203-269-6801, FAX:203-269-6527
CT	Wallingford, Greene-Shaw Elctrns.	203-265-3333, FAX:203-265-3583
CT	Wallingford, Marshall Inds.	203-265-3822, FAX:203-284-9285
FL	Altamonte Springs, Bell Inds.	407-339-0078, FAX:407-339-0139
FL	Altamonte Springs, Marshall Inds.	800-226-4486, FAX:407-767-8676
FL	Altamonte Springs, Vantage Comps.	407-682-1199,FAX:407-682-1286
FL	Deerfield, Vantage Comps.	305-429-1001, FAX:305-481-3586
FL	Ft. Lauderdale, Component Assocs., Inc.	305-733-4100,FAX:305-733-0384
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880, FAX:305-977-4887

FL	Largo, Hall-Mark Elctrns.	813-541-7440, FAX:813-544-4394
FL	Pompano Bch., Hall-Mark Elctrns.	305-971-9280, FAX:305-971-9339
FL	St. Petersburg, Marshall Inds.	813-573-1399, FAX:813-573-0069
FL	Woodale, Hall-Mark Elctrns.	708-860-3800, FAX:708-860-0239
GA	Duluth, Hall-Mark Elctrns.	404-623-4400, FAX:404-476-8806
GA	Norcross, Bell Inds.	800-525-6666, FAX:407-339-0139
GA	Norcross, Marshall Inds.	404-923-5750, FAX:404-923-2743
IL	Bensenville, Voyager Elctrns. Corp.	708-860-1300, FAX:708-860-1573
IL	Elk Grove Vlg., Bell Inds.	708-640-1910, FAX:708-640-0474
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040, FAX:312-843-2320
IL	Itasca, Capstone Elctrns.	708-250-0300, FAX:708-250-0183
IL	Schaumburg, Marshall Inds.	312-490-0155, FAX:312-490-0569
IN	Indianapolis, Bell Inds.	317-875-8200, FAX:317-875-8219
IN	Indianapolis, Hall-Mark Elctrns.	317-872-8875, FAX:317-872-7165
IN	Indianapolis, Marshall Inds.	317-297-0483, FAX:317-297-2787
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747, FAX:913-888-0523
KS	Lenexa, Marshall Inds.	913-492-3121, FAX:913-492-6205
MD	Burtonville, United States Elctrns., Inc.	301-384-3300,FAX:301-384-1537
MD	Columbia, Hall-Mark Elctrns.	410-290-5100, FAX:410-290-8006
MD	Columbia, Hall-Mark Elctrns.	410-988-9800, FAX:410-381-2036
MD	Columbia, Vantage Comps., Inc.	410-720-5100, FAX:410-381-2172
MD	Silver Springs, Marshall Inds.	301-622-1118, FAX:301-622-0451
MA	Andover, Bell Inds.	508-474-8880, FAX:508-474-8902
MA	Andover, Vantage Comps.	508-687-3900, FAX:508-687-4116
MA	Billerica, Hall-Mark Elctrns.	508-667-0902, FAX:508-667-4129
MA	Newton, Green-Shaw Elctrns.	617-969-8900, FAX:617-969-4712
MA	Tewksbury, Armor Elctrns.	508-640-1499, FAX:508-640-1570
MA	Wilmington, Capstone Elctrns.	508-657-5874, FAX:508-988-9282
MA	Wilmington, Marshall Inds.	508-658-0810, FAX:508-658-7608
MI	Livonia, Marshall Inds.	313-525-5850, FAX:313-525-5855
MI	Plymouth, Hall-Mark Elctrns.	313-416-5800, FAX:313-416-5811
MN	Bell Inds. (Nationwide)	800-289-2355
MN	Capstone Elctrns. (Nationwide)	800-388-2277
MN	Bloomington, Hall-Mark Elctrns.	612-881-2600, FAX:612-881-9461
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766, FAX:612-571-9519
MN	Plymouth, Marshall Inds.	612-559-2211, FAX:612-559-8321
MN	Thief River Falls, Digi-Key Corp. (Nationwide)	800-344-4539
MO	Bridgeton, Marshall Inds.	314-291-4650, FAX:314-291-5391
MO	Earth City, Hall-Mark Elctrns.	314-291-5350, FAX:314-291-0362
NJ	Clifton, Vantage Comps., Inc.	201-777-4100, FAX:201-777-6194
NJ	Fairfield, Bell Inds.	201-227-6060, FAX:201-227-2626
NJ	Fairfield, Marshall Inds.	201-882-0320, FAX:201-882-0095
NJ	Marlton, Capstone Elctrns.	609-569-7500, FAX:609-988-1684
NJ	Moorestown, Hall-Mark Elctrns.	609-235-1900, FAX:609-235-3381
NJ	Mt. Laurel, Marshall Inds.	609-234-9100, FAX:609-778-1819
NJ	Parsippany, Hall-Mark ELctrns.	201-515-3000, FAX:201-515-4475
NM	Albuquerque, Bell Inds.	505-292-2700, FAX:505-275-2819
NY	Buffalo, Summit Distrs.	716-887-2800, FAX:716-887-2866
NY	Endicott, Marshall Inds.	607-785-2345, FAX:607-785-5546
NY	Fairport, Hall-Mark Elctrns.	716-425-3300, FAX:716-425-7195
NY	Rochester, Marshall Inds.	716-235-7620, FAX:716-235-0052
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600, FAX:516-737-0838
NY	Smithtown, Vantage Comps., Inc.	516-543-2000, FAX:516-543-2030
NC	Raleigh, Capstone Elctrns.	919-954-0600, FAX:919-954-9445
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712, FAX:919-878-8729
NC	Raleigh, Marshall Inds.	919-878-9882, FAX:919-872-2431
OH	Columbus, Hall-Mark Elctrns.	614-888-3313, FAX:614-888-0767
OH	Dayton, Bell Inds.	513-434-8231, FAX:513-434-8103
OH	Dayton, Bell Inds.	513-435-5922, FAX:513-435-3122
OH	Dayton, Marshall Inds.	513-898-4480, FAX:513-898-9363
OH	Solon, Hall-Mark Elctrns.	216-498-1100, FAX:216-248-4801
OH	Solon, Marshall Inds.	216-248-1788, FAX:216-248-2312
OK	Tulsa, Hall-Mark Elctrns.	918-254-6110
OR	Beaverton, ALMAC/Arrow	503-629-8090, FAX:503-645-0611
OR	Beaverton, Bell Inds.	800-525-6666, FAX:503-520-1948
OR	Beaverton, Integrated Elctrns.	503-641-1690, FAX:503-646-3737
OR	Beaverton, Marshall Inds.	503-644-5050, FAX:503-646-8256
PA	Philadelphia, PEI/Genesis	215-673-0400, FAX:215-553-8022

416-624-5572

CTS CORP., AUTOMOTIVE PRODUCTS, 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575, FAX: 219-295-3580 .... **B•1705**

CTS CORP., CONNECTOR PRODUCTS, 9210 Science Center Dr., New Hope, MN 55428, Tel: 612-533-3533, FAX: 612-533-3037; FSC No.: 16512; Empl.: 300; *Sls. Mgr.:* Steve Otto

CTS CORP., ELECTROCOMPONENTS, 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575, FAX: 219-295-3580; Empl.: 110 ...... **B•1704-1705; D•1028**

Refer to CTS Corp., Elkhart, IN for sales offices and representative listing.

CTS CORP., FREQUENCY CONTROLS, 400 Reimann Ave., Sandwich, IL 60548, Tel: 815-786-8411, TWX: 910-642-0860, FAX: 815-786-9743; Empl.: 450 .... **A•1358-1377**

Refer to CTS Corp., Elkhart, IN, for sales offices & representative listings.

CTS CORP, Microelectronics, 1201 Cumberland Ave., W. Lafayette, IN 47906, Tel: 317-463-2565, TWX: 810-342-1882, FAX: 317-497-5399; Empl.: 505; *Sls. Mgr.:* Dick Kramer

CTS CORP., RESISTOR NETWORKS, 406 Parr Rd., Berne, IN 46711, Tel: 219-589-3111, FAX: 219-589-3243; Empl.: 650; *Sls. Mgr.:* Jim Kolkowski; *Dist. Mgr.:* Cliff Stults .... **A•1908-1909**

CTS OF CANADA, LTD., 80 Thomas St., Streetsville, Ontario, Can. L5M 1Y9, Tel: 416-826-1141, FAX: 416-858-9058; Empl.: 220

CUBIT, Div. of Proteus Industries. Inc., 340 Pioneer Way, Mountain View, CA 94041, Tel: 415-962-8237, FAX: 415-965-9355; FSC No.: 62443; Empl.: 37; *Sls. Mgr.:* Jon Heiner

CUESTA SYSTEMS CORPORATION, 3440 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-4160, 800-332-3440, TELEX: 4949381 CUESTA, FAX: 805-546-0834; *Sls. Mgr.:* Dee Kruger

CUI STACK INC., 9640 S.W. Sunshine Ct., Beaverton, OR 97005, Tel: 503-643-4899, FAX: 503-643-6129; Empl.: 11; *Sls. Mgr.:* Jim Seiler; *Dist. Mgr.:* T. Dougan/W. Glessner .... **B•1248, 1706; C•1303; D•1029, 1653**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
CO	Franktown, MRC, Inc.	303-660-8750
MA	Topsfield, Liberty Electro Mktg.	508-887-6655
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
NJ	Flanders, Guido Assocs.	201-347-4643
NJ	Moorestown, Tai Corp.	609-778-5353
NC	Raleigh, B.T. Funderburk	919-846-2373
OH	Lexington, North Central Mktg.	419-884-9804
TX	Richardson, J.D. Gram & Assoc.	214-699-9976

Local Distributors

CA	Canoga Park, RAG Elctrns.	818-998-6500
CA	Milpitas, R & D Elctrn. Parts	408-262-7144
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
NJ	Newfoundland, Hosica Labs.	201-697-6111
NY	Great Neck, The Instr. Mart	516-487-7430
OR	Beaverton, Norvac Elctrns.	503-644-1052

CUNO, INC., Process Filtration Products, 400 Research Pkwy., Meriden, CT 06450, Tel: 203-237-5541; Empl.: 700; *Sls. Mgr.:* Alan Ponchick

CURRENT COMPONENTS, INC., 8600 Myersville Rd., Middleton, MD 21769, Tel: 301-473-5333, FAX: 301-371-7353; *Sls. Mgr.:* John Hackler

CURRENT TECHNOLOGY, INC., 101 W. Buckingham Rd., Richardson, TX 75081-4802, Tel: 214-238-5300, FAX: 214-238-0911; *Sls. Mgr.:* Steve Larson, VP Sls. & Mktg.

CURTIS INDUSTRIES, PO Box 343925, Milwaukee, WI 53234-3925, Tel: 414-649-4200, FAX: 414-649-4279; FSC No.: 73631; Empl.: 110; *Sls. Mgr.:* Al Hungsberg; *Dist. Mgr.:* Al Hungsberg

CURTIS

FAX: 914-666-2188

CURTIS INSTRUMENTS, INC., 200 Kisco Ave., Mt. Kisco, NY 10549, Tel: 914-666-2971, TWX: 710-571-2163; FSC No.: 18530; Empl.: 400; *Sls. Mgr.:* Michael Miller .... **D•1158**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, TecRep Mktg.	602-991-6646
CA	Santa Clara, NorCal RepCo	408-988-1643
CA	Seal Beach, Texel Engrg.	310-596-9411
CO	Golden, J.F. Hurlbut Co.	303-279-7796
FL	Longwood, NSL Assocs.	407-629-5226
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Chicago, Bierhaus Sls.	312-751-8088
KS	Overland Park, Acorn Elctrns.	913-649-6402
MD	Baltimore, Advanced Tech. Sls.	410-323-3140
MA	Brookline, Harman Assocs.	617-232-6687
MA	E. Longmeadow, Harman Assoc.	413-733-1425
MI	Ann Arbor, T.E. Murphy Co.	313-995-4082
MN	Edina, S.J. Collins & Assoc.	612-933-7661
MO	St. Louis, Acorn Elctrns.	314-421-1751
NH	Hudson, Harman Assoc.	603-882-0025
NY	Manhasset, WinCor Elctrn. Sls. Corp.	516-627-9474
NY	Manlius, Smith Tech. Sls.	315-682-1777
NC	Raleigh, L & D Inc.	919-876-5301
OH	Arcanum, T.E. Murphy Co.	513-692-8713
OH	Piqua, T.E. Murphy Co.	513-778-0247
OR	Portland, Evergreen Mktg.	503-598-7667
PA	Newtown Square, W. Reeves Assocs.	215-356-7500
TX	Carrollton, Lektron	214-416-4585
WA	Edmonds, Evergreen Mktg.	206-485-8063
WI	Milwaukee, Bierhaus Sls.	414-963-0318
Can	Mississauga, Patlon Aircraft	416-624-5572

CUSTOM BOBBIN WINDINGS, A & K Corporation, P.O. Box 2369, Zanesville, OH 43702-2369, Tel: 614-452-6973, FAX: 614-452-4156; Empl.: 16

CUSTOM CABLE CORP., 242 Butler St., Westbury, NY 11590, Tel: 516-334-3600, TELEX: 269301, FAX: 516-334-3989; Empl.: 20; *Sls. Mgr.:* J. Michelman; *Dist. Mgr.:* D. Pollack

CUSTOM COILS INC., P.O. Box 348, Alcester, SD 57001-0348, Tel: 605-934-2460, FAX: 605-934-2440; FSC No.: 34808; Empl.: 75; *Sls. Mgr.:* Randy Larson ..... **A•2311**

Local Sales Offices & Reps

CA	Irvine, CalRep, Inc.	714-509-7707
CA	Santa Clara, Rodgers Assocs.	408-984-8110
CO	Arvada, Krebill Comp. Sls.	303-940-7420
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
IN	Indianapolis, T.P.S. Assocs.	317-841-3046
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Kansas City, Lorenz Sales, Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MI	Holland, T.P.S. Assocs.	616-399-4665
MN	Edina, M F I	612-832-9017

MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660

CUSTOM COMPUTER CABLE, INC., 7171 Shady Oak Rd., Eden Prairie, MN 55344, Tel: 612-941-5651, 1-800-343-5553, FAX: 612-941-2865; Empl.: 40; *Sls. Mgr.:* Sam McDonald

CUSTOM CONNECTOR, 1738 E. 30th St., Cleveland, OH 44114, Tel: 216-241-1679, FAX: 216-241-1734; Empl.: 24; *Sls. Mgr.:* Larry Weider

CUSTOM CONTROL SENSORS, INC., 21111 Plummer Street, Chatsworth, CA 91313-2516, Tel: 818-341-4610, FAX: 818-709-0426; Empl.: 350; *Sls. Mgr.:* Larry Lewis

CUSTOM ELECTRONICS, Browne St., Oneonta, NY 13820, Tel: 607-432-3880, FAX: 607-432-3913; FSC No.: 23280; Empl.: 90; *Sls. Mgr.:* D. Hathaway

CUSTOM LINEAR INC., 617-E. Arques Ave., Sunnyvale, CA 94086-3832, Tel: 408-749-9933, FAX: 408-736-4720; Empl.: 15; *Sls. Mgr.:* Earl Wentworth

CUSTOM LOGIC, P.O. Box 3940, Crestline, CA 92325, Tel: 909-338-4059, FAX: 909-338-4450

CUSTOM MICRO SYSTEMS, INC., P. O. Box 9472, Livonia, MI 48151, Tel: 313-559-5397

FAX: 516-467-5066

CUSTOM POWER SYSTEMS, 33 Comac Loop, Ronkonkoma, NY 11779-9998, Tel: 516-467-5328; Empl.: 30 .... **D•2082**

Local Sales Offices & Reps

CA	Agoura Hills, Powerdyne	818-991-0632
CA	San Jose, NES	408-293-2600
FL	Oviedo, Lighthouse Mktg.	407-366-0073
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
NJ	Clementon, Systech Assocs.	609-784-8300
NY	Smithtown, J L Sls.	516-864-1701
TX	Dallas, Eatman Engrg.	214-771-1903

CUSTOM SCI. INSTRS., Atlas Electric Devices Co., 13 Wing Dr., Cedar Knolls, NJ 07927, Tel: 201-538-8500, FAX: 201-984-6793; Empl.: 35; *Sls. Mgr.:* Henry Piekarski

CUSTOM SERVO MOTORS, P.O. Box 443, New Ulm, MN 56073, Tel: 507-354-1616, FAX: 507-354-1611; *Sls. Mgr.:* Pat McLaughlin, Blake Benson

CUT CRAFT, INC., 1501 Northpark Drive, Ft. Worth, TX 76102, Tel: 817-332-6151, FAX: 817-332-3304; Empl.: 90; *Sls. Mgr.:* Fred A. Antonini .... **C•1662, 1684**

CUTLER-HAMMER, INC., SHALLCROSS RESISTOR PRODS., See RCL Shallcross, Inc.

THE CUTTING EDGE, Controls Unlimited Inc., 4823 North Ridge Rd., Perry, OH 44081, Tel: 1-800-962-2376, FAX: 216-259-5015; Empl.: 4; *Sls. Mgr.:* Paul Adams

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1026 6th. AVENUE
OAKLAND, CA 94606

CVC PRODUCTS, INC., 525 Lee Rd., P.O. Box 1886, Rochester, NY 14603, Tel: 716-458-2550, TELEX: 265240, TWX: 4947142, FAX: 716-458-0424; Empl.: 105; *Sls. Mgr.:* Christopher J. Mann

CVDS INC., 6900 Trans Canada Hwy., Pte. Claire,Que., Canada H9R 1C2, Tel: 514-694-9320, FAX: 514-694-0786; Empl.: 100; *Sls. Mgr.:* Gerry Sullivan, VP Sls. & Mktg.

FAX: 215-355-1088

CW INDUSTRIES, 130 James Way, Southhampton, PA 18966, Tel: 215-355-7080; FSC No.: 79727; Empl.: 450; *Sls. Mgr.:* John C. Neilson, VP Sls. & Mktg.; *Dist. Mgr.:* John C. Neilson, VP Sls. & Mktg. .... **B•1707; C•1304**

Local Sales Offices & Reps

AL	Madison, Lamons Sls.	205-461-7871
AZ	Phoenix, Mercury Eng. Sls.	602-265-0344
AR	Little Rock, Erickson Sls.	501-455-0618
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CA	Napa, Stewart-Fullerton	707-258-1160
CO	Englewood, Purdy Co. Assoc.	303-790-2211
CT	Guilford, Tynik, Inc.	203-453-1613
FL	Oviedo, Conley & Assocs.	407-365-3283
FL	Tampa, Standard Mktg.	813-933-5833
GA	Norcross, Lamons Sls.	404-242-2610
IL	Des Plaines, G. Mcl. Cole Co.	708-827-6040
IN	Greenfield, France Entprs.	317-462-6098
IN	Greenwood, Liberty Sls.	317-888-8396
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Taunton, Focus Elctrn. Sls.	508-824-3840
MI	Holland, Mackinaw Sls, Inc.	616-399-4665
MN	Minneapolis, Robt. Marshall Co.	612-929-0457
MO	Kansas City, Ruffolo & Assocs.	816-471-5701
NJ	Middletown, Elctrn. Mktg. Assoc.	908-615-9484
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Akron, Augnat Assocs.	216-666-2819
OR	Tigard, Eltech Inc.	503-684-3458
PA	Hatboro, A Q S	215-674-3562
TN	Greeneville, Lamons Sls. Co.	615-639-8711
TX	Dallas, Erickson Sls. Inc.	214-739-5833
WA	Bellevue, Eltech	206-643-4330
Can	Etobicoke, True North Tech. Ltd.	416-744-2233
Can	Mississauga, Ont., True North Tech., Ltd.	416-677-9788

Local Distributors

CA	Canoga Park, Acort Inds., Inc.	818-700-2991
CA	Fountain Valley, Components Ctr.	714-979-0437
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Santa Ana, BDS Elctrns., Inc.	714-662-1050
CA	Santa Ana, El-Com/Cabletek	714-432-6630
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Sunnyvale, Bell Inds.	408-745-0400
CO	Arvada, Denver Wintronics	303-431-7161
DE	Wilimington, Wholesale Elctrns., Inc.	302-652-3222
FL	Stuart, Microwave Comps., Inc.	407-286-4455
IL	Crystal Lake, Sub-Sem Inc.	815-459-4139
IL	Wheeling, Hawk Elctrns., Inc.	708-459-4030
IN	Indianapolis, Bell Inds.	317-875-8202
MD	Beltsville, Petricko Sls., Inc.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Norwood, Emtel Elctrns.	617-769-9500
MI	St. Clair Shores, Spemco	313-771-2700
MN	New Brighton, Chris Elctrns.	612-631-2647
MN	Thief River Falls, Digi-Key Corp.	800-346-5144
NJ	Roselle, Lectron Inds.	201-245-5858
NJ	Union, Lectron Inds.	908-687-2626
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Bohemia, Car-Lac Elctrns.	800-645-1192
NY	Farmingdale, Pride Elctrns.	516-293-4020
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Englewood, Argent Inds., Inc.	513-836-8633
PA	Bristol, AIM Elctrns.	215-785-3500
PA	Levittown, Aim Elctrns.	215-946-3900

CYBERPAK CO., 1413 Sherman Rd., Unit 110, Romeoville, IL 60441, Tel: 708-972-0707, FAX: 708-972-0713; Empl.: 5; *Sls. Mgr.:* R. Weinbrenner

CYBER SYS., INC., 2031 E. Cerritos Ave., Anaheim, CA 92806, Tel: 714-502-6950, FAX: 714-563-7527; Empl.: 15

CYBORTRONICS INC., 17 Hammond, Ste. 409, Irvine, CA 92718, Tel: 714-855-2814, FAX: 714-855-0278; *Sls. Mgr.:* Eric Luebben

CYBRID INCORPORATED, 10 Woodcrest Drive, Woodcliff Lake, NJ 07675, Tel: 201-307-0426, FAX: 201-391-7112; Empl.: 9

CYCLO-TRONICS, INC., 1345 N. Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-0800, FAX: 708-526-0803; Empl.: 10

THE CYLIX CORPORATION, 2637 Townsgate Rd., Ste. 200, Westlake Vl., CA 91361, Tel: 805-379-3155, FAX: 805-379-4551; FSC No.: 59; Empl.: 15; *Sls. Mgr.:* Peter Norman; *Dist. Mgr.:* Peter Norman

CYPRESS MAGNETICS, INC., 8753 Industrial Lane, Rancho Cucamonga, CA 91730, Tel: 909-987-3570, FAX: 909-980-2009; FSC No.: 59791; Empl.: 15; *Sls. Mgr.:* Robert C. Greenwood

CYPRESS SEMICONDUCTOR CORP., 3901 North First Street, San Jose, CA 95134, Tel: 408-943-2600, TELEX: 821032 CYPRESS SNJ UD, TWX: 910-997-0753, FAX: 408-943-2741

FAX: 716-381-0475

CYTEC CORP., 2555 Baird Road, Penfield, NY 14526, Tel: 716-381-4740, 800-346-3117; Empl.: 20; *Sls. Mgr.:* Harry Turner .... **D•1250**

DABURN ELECTRONICS & CABLE CORP., 225 Pegasus Ave., Northvale, NJ 07647, Tel: 201-768-5400, FAX: 201-768-9642; FSC No.: 25706 .... **C•1740-1746**

Local Sales Offices & Reps

AZ	Chandler, Harco	602-838-7186
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	Newport Beach, SPA Elctrns.	714-863-1193
CO	Denver, Mountain Reps	303-333-7745
FL	Tampa, SRT Mktg.	813-884-4805
IN	Carmel, STB & Assocs.	317-844-9227
MD	Bel Air, Freedman Malta Assocs.	301-879-3848
MA	No. Scituate, W. A. Hendrickson	617-545-0652
MN	Minneapolis, R. K. Sls.	612-571-1001
NY	E. Syracuse, Liberty Elec.	315-437-8100
NY	Plainview, Robt. Smith Assocs.	516-681-3155
NC	Concord, Muncy Sls. Assocs.	800-762-1271
PA	King of Prussia, Freedman-Malta	215-337-9211
PA	Pittsburgh, Catalyst Sls.	412-826-3434
WA	Edmonds, ACDC	206-745-5445
WI	Menomonee Falls, Voss-Dent Assocs.	414-781-0555
EXP	Rehovot, Isreal, M.G.R.	972-8411719
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

Local Distributors

CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	San Diego, Shanks & Wright	619-239-0176
CT	Danbury, Pilgram	203-792-7271
CT	West Hartford, Signal Ctr.	203-233-8551
FL	Altamonte, Royce	305-869-4700
FL	Miami, Small Parts	305-751-0856
GA	Atlanta, ACK Radio Supp.	404-351-6340
IA	Marion, Brenneman & Assoc.	319-377-6394
LA	Harahan, Elctrn. Parts & Supp.	504-734-0641
MD	Gaithersburg, M S Elctrns.	301-921-0200
MA	Carlisle, Davis Assoc.	617-434-6121
MA	Needham, YDI Electronics	617-449-1005
MA	Woburn, Pacer	617-935-8330
MN	New Brighton, Chris	612-631-2647
NJ	Bayville, Berkley Indl.	908-341-9366
NJ	Cranford, GSI Elctrns.	908-272-6400
NJ	Kenilworth, Federated Purchaser	908-272-0505
NY	Albany, E. E. Taylor	518-438-7811
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Hauppauge, Broadline	516-231-4100
NY	Rochester, Simcona	716-328-3230
PA	Philadelphia, AC Radio	215-462-9379
RI	Westerly, Ocean State EL	401-596-3080
WA	Seattle, Westlake Elctrns.	206-622-6600
Can	Markham, Ont., Arma	416-475-2024

DADEN ASSOCIATES, 1001 Calle Amanecer, San Clemente, CA 92673, Tel: 714-366-1522, FAX: 714-366-9600; FSC No.: 57032; Empl.: 49; *Sls. Mgr.:* Mark Fournier

DAGE-MTI, 701-N. Roeske Ave., Michigan City, IN 46360, Tel: 219-872-5514, FAX: 219-872-5559; Empl.: 51; *Sls. Mgr.:* Paul Thomas

DAGE PRECISION INDUSTRIES, INC., 46701 Fremont Blvd., Fremont, CA 94538, Tel: 510-683-3930, FAX: 510-683-3935; Empl.: 7; *Sls. Mgr.:* Bonnie Nichols

DAICO INDUSTRIES, INC., 2453 East Del Amo Blvd., Rancho Dominguez, CA 90220, Tel: 310-631-1143, FAX: 310-631-8078; FSC No.: 28983; Empl.: 130; *Sls. Mgr.:* Kevin Townsend; *Dist. Mgr.:* Diane Felando

DAIDO PRECISION ENGINEERED PRODUCTS/, Sumtak Electronics, 615 Pierce St., Somerset, NJ 08875, Tel: 908-805-1900, FAX: 908-805-0122; *Sls. Mgr.:* Phillip Giannini, Nat. Sls. Mgr.

DAITRON, INC., 7150 S.W. Hampton, Suite 130, Tigard, OR 97223, Tel: 503-620-2879, TELEX: 910-240-4863, FAX: 503-620-2942; Empl.: 13; *Sls. Mgr.:* Harry Iino; *Dist. Mgr.:* Karen Sempert

DALE ELECTRONICS, INC., Columbus Div., 1122 23rd Street, Columbus, NE 68601-3647, Tel: 402-563-6506, FAX: 402-563-6418; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Greg Mefford; *Dist. Mgr.:* Jon Trabert ..... **A•1225-1233, 1379-1381, 1910-1931, 2072-2077, 2312-2313; B•1024-1026, 1870-1871; C•1306-1308**

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701-2242, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Mike Burns; *Dist. Mgr.:* Jon Trabert ...... **A•1910-1915, 1917-1924**

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282-1883, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jon Trabert .... **A•1379-1381, 2072-2077**

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* Mike Husman; *Dist. Mgr.:* Jon Trabert .. **A•1225-1230, 1232-1233, 2312-2313; C•1306-1308**

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DALLAS SEMICONDUCTOR, 4401 South Beltwood Pkwy., Dallas, TX 75244, Tel: 214-450-0400, FAX: 214-450-0470; Empl.: 700; *Sls. Mgr.:* Jack Mattis .... **A•1525-1527**

Local Sales Offices & Reps

AL	Huntsville, Glen White & Assocs.	205-882-6751
AZ	Scottsdale, Haas & Assocs.	602-488-3662
CA	San Diego, Harvey King, Inc.	619-695-9300
CA	Santa Clara, Phase II	408-980-0414
CA	Thousand Oaks, S.C. Cubed	805-461-4675
CA	Tustin, S.C. Cubed	714-731-9206
CO	Wheat Ridge, Waugaman Assoc.	303-423-1020
CT	Wallingford, Technology Sls. Inc.	203-269-8853
FL	Altamonte Springs, Semitronic Assoc.	407-831-8233
FL	Clearwater, Semitronic Assoc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assoc., Inc.	305-731-2484
GA	Norcross, Glen White & Assocs.	404-441-1447
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, Elctrn. Sls. & Eng.	317-849-4260
IA	Cedar Rapids, Cahill, Schmitz & Howe	319-377-8219
KS	Overland Park, Gibb Technlg. Sls.	913-451-6785
MA	Woburn, Mill-Bern Assocs.	617-932-3311
MI	Livonia, Geisting & Assocs.	313-478-8106
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Chesterfield, Gibb Technlg. Sls.	314-530-0495
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NY	Fairport, Technlg. Sls.	716-223-7500
NY	Rockville Centre, S-J Assocs.	516-536-4242
NC	Huntersville, Glen & White Assoc.	704-875-3777
NC	Raleigh, H & A Sls.	919-848-1931
OH	Cincinnati, Geisting & Assocs.	513-385-1105
OH	Cleveland, Geisting & Assoc.	216-261-9705
OH	Columbus, Geisting & Assoc.	614-459-4800
OK	Tulsa, West Assocs.	918-665-3465
OK	Tusla, West Assocs.	918-665-3465
OR	Beaverton, Western Tech. Sls.	503-644-8860
PA	Pittsburgh, Geisting & Assoc.	412-828-3553
TN	Gray, Glen White & Assoc.	615-477-8850
TX	Austin, West Assoc.	512-343-1199
TX	Houston, West Assocs.	713-621-5983
TX	Richardson, West Assoc.	214-680-2800
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Falls Church, S-J Chesapeake	703-533-2233
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Brookfield, Sumer, Inc.	414-784-6641
EXP	Hato Rey, PR, Semitronic Assoc.	809-766-0700
Can	Burnaby, B.C., Davetek Mktg.	604-430-3680
Can	Ottowa, Dynasty	613-596-9800
Can	Pointe Claire, Dynasty	514-695-7353

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200
CA	Irvine, Insight Elctrns.	714-727-2111
CO	Wheat Ridge, Added Value Elect. Dist.	303-422-1701
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Lake Mary, Milgray-Elctrns.	407-321-2555
GA	Duluth, Hall-Mark Elctrns.	404-623-4400
IL	Palatine, Milgray Elctrns.	708-202-1900
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
MA	Wilmington, Milgray Elctrns.	508-657-5900
MI	Livonia, Hall-Mark Elctrns.	313-462-1205
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OK	Tusla, Sterling Elctrns.	918-663-2410
OR	Beaverton, Anthem Elctrns.	503-643-1114
TX	Richardson, Anthem Elctrns.	214-238-7100
UT	Salt Lake City, Anthem Elctrns.	801-973-8555
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Almac Elctrns.	206-643-9992
Can	Ville St. Laurent, Que., ITT Multicomponents	514-335-7697

DALSA INC., 605 McMurray Road, Waterloo, Ont., Canada N2V 2E9, Tel: 519-886-6000, FAX: 519-886-8023; *Sls. Mgr.:* Ralph Beier

DAMAC PRODUCTS, INC., 10410-1 Pioneer Blvd., Santa Fe Springs, CA 90670, Tel: 310-946-0881, FAX: 310-946-2631; Empl.: 30; *Sls. Mgr.:* Melodie Eberhart

DANAHER CONTROLS, 1675 N. Delany Rd., Gurnee, IL 60031-1282, Tel: 708-662-2666; Empl.: 300; *Sls. Mgr.:* R. Lowry; *Dist. Mgr.:* S. Rosenthal

DANCER COMMUNICATIONS, INC., 649 South Ave., Bldg. 8, Secane, PA 19018, Tel: 215-543-8066, FAX: 215-543-2151; *Sls. Mgr.:* Joanne Gilligan

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Dan Hall .... **D•1654-1655**

Local Sales Offices & Reps

CA	Pasadena, Electro Mecha. Instrs.	818-795-7193

D & L ELECTRONICS, Box 1236 540 Valley View Rd., Langhorne, PA 19047, Tel: 800-942-3631, FAX: 215-757-7391

D & P MFG. INC., 32 Hamilton St., Chalfont, PA 18914, Tel: 215-997-1200, FAX: 215-997-2380; Empl.: 7; *Sls. Mgr.:* Eugene Rane

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 526 Thorpe Rd., Orlando, FL 32824, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Gary Moore; *Dist. Mgr.:* Don Malinovsky .... **C•1700**

Local Sales Offices & Reps

CA	El Toro, DMC Western Reg.	407-855-6161

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 11952 Challenger Court, Moorpark, CA 93021, Tel: 1-805-529-3788, FAX: 805-529-3837; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 205; *Sls. Mgr.:* Bob Long

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DA/PRO RUBBER, INC., 601 N. Poplar, Broken Arrow, OK 74012, Tel: 918-258-9386, FAX: 918-258-3286; Empl.: 260; *Sls. Mgr.:* Walter F. Sanders; *Dist. Mgr.:* Walter F. Sanders

DARE ELECTRONICS, INC., 3245 S. County Rd., 25A, Troy, OH 45373, Tel: 513-335-0031; FSC No.: 55901; Empl.: 20; *Sls. Mgr.:* Paul J. Gilmore

DARRAH ELECTRIC COMPANY, 5914 Merrill Ave., Cleveland, OH 44102, Tel: 216-631-0912, FAX: 216-631-0440; Empl.: 24; *Sls. Mgr.:* David J. Darrah; *Dist. Mgr.:* David J. Darrah

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, FAX: 619-578-9215; FSC No.: 55792; Empl.: 40; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, FAX: 714-978-2514; FSC No.: 56259; Empl.: 19; *Sls. Mgr.:* Clyde Davis

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32549, Tel: 904-244-6121, FAX: 904-244-6344; FSC No.: 32365; Empl.: 50

DATACON, INC., Interconnect Sub-Systems, 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, FAX: 617-273-4809; Empl.: 170; *Dist. Mgr.:* Lonise M. Silva

DATACUBE, INC., 300 Rosewood Drive, Danvers, MA 01923, Tel: 508-777-4200, FAX: 508-777-3117; Empl.: 130; *Sls. Mgr.:* David Lerner

FAX: 201-773-9672

DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ...... **A•1528-1544**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, Tech Sls., Inc.	602-246-1614
AR	R-Squared	713-820-3210
CA	Mountain View, Weseloh/Swanson & Assocs.	415-961-0565
CA	Yorba Linda, Target Elctrns.	714-692-1630
DE	Jack McCoy Assocs.	215-363-0350
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IN	Electro Mktg.	513-890-8322
KY	Electro Mktg.	513-890-8322
LA	R-Squared	713-820-3210
ME	Dynamic Sls., Inc.	617-272-5676
MA	Burlington, Dynamic Sls., Inc.	617-272-5676
MI	Livonia, Electro Mktg.	313-421-7590
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
NH	Dynamic Sls., Inc.	617-272-5676
NJ	Medford, Jack McCoy Assocs.	609-953-0770
NY	Pittsford, James E. Zimmmerman Sls.	716-381-3186
NC	Raleigh, Hughes Assocs., Inc.	919-467-7029
OH	Dayton, Electro Mktg.	513-890-8322
OK	R-Squared	713-820-3210
PA	Downingtown, Jack McCoy, Inc.	215-363-0350
PA	Pittsburgh, Electro Mktg.	412-492-0688
RI	Dynamic Sls., Inc.	617-272-5676
SC	Hughes Assocs., Inc.	919-467-7029
TN	Morristown, Hughes Assocs., Inc.	615-587-2433
TX	Houston, R-Squared	713-820-3210
VT	Dynamic Sls., Inc.	617-272-5676
Can	Ont., Source Elctrns.	416-676-0830

Local Distributors

CA	Sunnyvale, Target Elctrns.	408-733-0384
TX	Carrollton, Omni Pro	214-713-9000

DATA DEVICE CORP., See ILC Data Device Corp.

Data Display Products

FAX: 310-640-7639

DATA DISPLAY PRODUCTS, 445 So. Douglas St., El Segundo, CA 90245-4630, Tel: 310-640-0442, 800-421-6815; FSC No.: 15513; Empl.: 40; *Sls. Mgr.:* Anthony Toniolo; *Dist. Mgr.:* Anthony Toniolo ..... **B•1136-1139**

Local Sales Offices & Reps

AL	Madison, Southern Elctrn. Reps.	205-461-8925
CA	Arcadia, HMC	818-447-0958
CA	Cupertino, Codella Mktg.	408-248-3890
CO	Broomfield, Summitwest Mktg.	303-460-9600
IL	Lemont, Trend-Tronics	708-972-1166
MA	Randolf, Hatch Assocs.	617-963-3306
MN	Minneapolis, Amtek Mktg.	612-561-5371
NJ	Flanders, K & R Engrg.	201-584-5235
OR	Beaverton, WJ Sls.	503-626-3759
PA	Allison Park, KW Elect. Sls	412-492-0777
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Freeport, Marathon Assoc.	409-233-7026

Local Distributors

CA	Arcadia, Parco	818-447-0958,800-423-4892
CA	Santa Clara, Bell Elctrn. Supp.	408-727-2355
CO	Denver, Hardware Specialty	303-371-8553
IL	Lemont, Trend-Tronics	708-972-1166, 800-323-1697
MD	Burtonsville, U.S. Elctrns.	301-384-3300
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Methuen, Aved Elctrns.	508-688-3800
NJ	E. Hanover, State Elctrns.	201-887-2550
NJ	Flanders, VKR Svcs.	201-584-5393,800-631-9362
NJ	Rockaway, Tonar Inds.	201-586-9000,800-654-6246
NY	Hauppauge, Vargas	516-273-1111,800-645-1402
NC	Charlotte, EMC	704-394-6195
OH	Cleveland, EMC	216-442-3441
OH	Columbus, EMC	614-299-4161
OH	Dayton, EMC	513-439-4711
OH	Englewood, Argent Inds.	513-836-8633
PA	Philadelphia, Shap Elctrns.	215-969-3300, 800-441-0375
PA	York, ECI	717-846-5334
Can	Burnaby, B.C., Intek Elctrns.	604-294-8100, FAX:604-294-6335
Can	Calgary, Alb., Cardinal Ind. Elctrns.	403-259-6817, FAX:403-259-8699
Can	Edmonton, Alb., Cardinal Ind. Elctrns.	403-483-6266,FAX:403-484-8926
Can	Markham, Ont., Carsten Elctrns.	416-477-9898, FAX:416-477-7474
Can	Pt. Claire, Que., Coba Elctrns.	514-694-1335, FAX:514-694-1337
Can	Rexdale, Ont., Valtrie Mktg.	416-798-2555, FAX:416-798-2560

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063-3206, Tel: 305-971-0400; *Sls. Mgr.:* Mario M. Martinez

DATA ENVIRONMENT, INC., Box 91511, Portland, OR 97291, Tel: 503-531-0765

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 800-332-3282, TELEX: 200081, FAX: 508-263-0630; Empl.: 300; *Sls. Mgr.:* Ernest C. Lutfy .... **B•1928-1930**

Local Sales Offices & Reps

AL	Fairhope, FLW Southeast	205-990-8989
AL	Huntsville, FLW Southeast, Inc.	205-536-6207
AZ	Phoenix, Trembly	602-431-9417
CA	Laguna Hills, Elotek Sys., Inc.	714-830-4856
CA	Santa Clara, Johnson Assoc.	408-984-4626
CO	Highlands Ranch, Valcomp Elctrns., Inc.	303-791-0330
FL	Orlando, FLW Southeast, Inc.	407-894-9671
GA	Marietta, FLW Southeast, Inc.	404-424-1731
IL	Bridgeview, Finn & Conway, Inc.	708-599-0103
IN	Indianapolis, C.M. Buck & Assoc. Inc.	317-293-5704
IA	Cedar Rapids, Delltron Co.	319-393-0075
MD	Columbia, Delta III Assocs., Inc.	410-730-4700
MA	Acton, Data Instrs., Inc.	617-264-9550
MI	Rochester Hills, Geotronix, Inc.	313-373-4334
MN	Minnetonka, Finn & Conway Inc.	612-593-1273
MO	Kansas City, Delltron Co.	816-436-6445
MO	Manchester, Midwest Control Prods.	314-394-8040
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Albany, Expert Indl. Sys., Inc.	518-869-3355
NY	N. Tonawanda, Expert Indl. Sys., Inc.	716-694-3935
NY	Rochester, Expert Indl. Sys., Inc.	716-323-1305
NY	Syracuse, Expert Indl. Sys., Inc.	315-455-2469
NC	Charlotte, Emco, Inc.	704-372-8281
OH	Richfield, Geotronix, Inc.	216-659-6100
OH	Trotwood, Geotronix Inc.	513-854-5939
OK	Oklahoma City, Bauman Instr. Corp.	405-631-8080
OK	Tulsa, Bauman Instr. Corp.	918-492-8086
PA	Allison Park, Geotronix, Inc.	412-487-1770
PA	Richboro, Technical Dvcs. Inc.	215-953-1595
TX	Grand Prairie, Collinsystems, Corp.	214-647-3569
TX	Houston, Collinsystems, Corp.	713-464-9460
WA	Redmond, S.E.A. Sls.	206-883-4999
WA	Vancouver, S.E.A. Sls.	206-573-5161
WI	Brookfield, Finn & Conway Inc.	414-784-3300
Can	Richmond, BC, Maxwell Morton Assocs.	604-273-1337
Can	Woodbridge, Ont., Technel Engrg. Inc.	416-851-4244

Local Distributors

CA	Glendale, A. Biederman, Inc.	818-246-8431
CA	Milpitas, A. Biederman, Inc.	408-435-0209
CO	Lafayette, Big Horn Instrmn.	303-665-4054
CT	Meriden, Meriden Cooper	203-237-8448
GA	Norcross, AA Elec. Inc.	404-449-8670
IN	Indianapolis, C & E Sls., Inc.	317-844-9799
MA	Billerica, Tanyx Meas. Inc.	508-671-0183
MI	Taylor, North Cen. Engrg., Inc.	313-942-0900
MN	Minneapolis, Process Measurement Co.	612-544-4035
MN	St. Paul, Power/mation	612-645-0781
MO	St. Louis, ISL Corp.	314-423-3141
NJ	Newark, Norman Bragar Co., Inc.	201-344-1100
NY	Amherst, KOM Lamb Inc.	716-691-6400
NC	Charlotte, EMCO	704-372-8281
OH	Cincinnati, C & E Sls. Inc.	513-241-1069
OH	Twinsburg, The Stanley M. Proctor Co.	216-425-7814
OR	Portland, Branom Instr.	503-283-2555
PA	Bensalem, Airline Hydraulics	215-638-4700
TX	Dallas, Butler and Land	214-343-8800
TX	Sugar Land, Alpha Process Sls.	713-240-4505
UT	Salt Lake City, Rust Automation Equip.	801-486-9865
WA	Seattle, Branom Instr.	206-762-6050
WI	Waukesha, Power/mation	414-542-2868
Can	Don Mills, Ont., Intertechnology, Inc.	416-445-5500

DATAK CORP., An LKG Company, 2240 15th St., Rockford, IL 61104, Tel: 815-229-7773, 1-800-645-2262, FAX: 815-229-7785; *Sls. Mgr.:* Wayne Timpe .... **C•1677**

Local Sales Offices & Reps

AL	Alabaster, Rohr-Wanger-Roberts	205-879-7361
AZ	Mesa, Yocum Mktg.	602-834-3334
CA	Gardena, Bidwell-Schwartz Assoc.	213-770-0300
CA	Irvine, English Damco Sls.	714-753-1950
CA	So. San Francisco, Carelli-Ema, Inc.	415-873-2524
CT	Lebanon, Adams McGregor Sales	203-537-5737
FL	Altamonte Springs, DHR Mktg.	407-331-1199
FL	Pompano Bch., DHR Mktg.	305-972-9157
GA	Norcross, Rohr-Wanger-Roberts	404-463-9349
IL	Addison, Elctrn. Specs.	708-250-9080
IA	Cedar Rapids, Mink Assocs.	319-393-0373
KS	Overland Park, M.I.N.K. Associates	913-341-8309
MD	Silver Spring, Mid-Atlantic Sls.	301-593-7749
MN	Minneapolis, Kodo Assocs., Inc.	612-881-1255
MO	Bridgeton, M.I.N.K. Assocs.	314-291-5454
OH	Akron, Buckeye Mktg. Grp.	216-836-7875
OR	Portland, Jos. V. Belusko	503-222-4279
PA	Philadelphia, Instrmn. Specialties	215-742-0898
PA	Pittsburgh, Buckeye Mktg. Grp.	412-655-1519
RI	Coventry, Adams McGregor	401-726-1300
SC	Rock Hill, Rohr-Wanger-Roberts	803-324-5111
TX	Rowlett, Campion Sls. Co., Inc.	214-475-8313
VA	Charlottesville, Mid Atlantic Sales	804-973-8099
WI	Waterford, Elctrn. Specs.	414-662-2859
Can	Montreal, Cantronics Ltd./Cantronics Intl. Ltd.	514-848-7132
Can	Scarborough, Ont., Cantronics Ltd./Cantronics Intl. Ltd.	416-297-8668,FAX:416-297-0107

Local Distributors

AL	Birmingham, ACK Radio Supply Co.	205-322-0588
AZ	Phoenix, Dalis Elctrns.	602-275-2885
AZ	Phoenix, Tri-Tek, Inc.	602-371-0860
AZ	Scottsdale, D.C. Elctrns.	602-945-7736
CA	Belmont, Jameco	415-592-6718
CA	Berkeley, Al Lasher's Elctrns.	510-843-5915
CA	Canoga Pk., Sandys Elctrns.	818-346-8353
CA	Concord, Pacific Valley Elctrns.	510-682-4700
CA	Costa Mesa, Marvac-Dow Elctrns.	714-650-2001
CA	Fremont, Easy Tech.	510-770-2300
CA	Fresno, Sparky Elctrns.	209-227-2986
CA	Fullerton, Orvac Elctrns.	714-871-1020
CA	Hollywood, Pacific Radio Exchg.	213-462-1393
CA	Manhattan Bch., Fry's Elctrns.	310-364-3789
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Mountain View, Haltek Elctrns.	415-969-0510
CA	No. Hollywood, Sandy's Elctrns.	818-983-2550
CA	Redwood City, HDB Elctrns.	415-368-1388
CA	San Diego, Gateway Elctrns.	619-279-6802
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CA	Thousand Oaks, Pace Elctrns.	805-497-7515
CA	Van Nuys, All Elctrns.	818-333-8009
CO	Colorado Springs, Centennial Elctrns.	719-633-4666
CT	Greenwich, Wise Comps.	203-531-4880
DE	New Castle, Electronics Exch.	302-322-5401
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Atlanta, Ack Radio Supply	404-351-6340
GA	Macon, Fouraker Elctrns.	912-746-4325
GA	Norcross, Austin Elctrns.	404-449-8697
ID	Boise, Kimball Elctrns.	208-232-2201
IL	Berwyn, B-B & W, Inc.	312-749-1710
IL	Mt. Prospect, Tri-State Elec.	312-255-0600
IL	Niles, Joseph Elec.	312-297-4200
IL	Peoria, Klaus Radio	309-691-4840
IL	S. Holland, Union Elctrns.	708-333-4100
IN	Ft. Wayne, Warren Radio	219-426-5344
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KY	Louisville, Peerless Elec.	502-637-7674
LA	Lafayette, Ralph's	318-233-0105
MD	Aberdeen, Harco Elctrns.	301-838-7990
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Gaithersburg, Capitol Radio Whlsrs.	301-881-2270
MA	Lynn, Land Elctrns. Supp.	617-592-2220
MA	Needham, You-Do-It Elctrns.	617-449-1005
MA	Norwood, Gerber Elec.	617-769-6000
MI	Flint, Shand Elctrns.	313-743-8940
MI	Livonia, Norwest Elctrns.	313-261-4551
MN	Minneapolis, AEI/Acme Elctrn Parts.	612-338-4754
MO	Kansas City, Elctrn. Supp.	816-931-0250
MO	St. Louis, Gateway Elec.	314-427-6116
MO	St. Louis, Van Sickle	314-621-5000
MT	Bozeman, Elctrn. Svc. & Distr.	406-587-4466
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NV	Las Vegas, Sandy's Elctrns.	702-383-8353
NV	Reno, Elect. Distr. Co.	702-323-2766
NJ	Denville, Lashen Elctrns.	201-627-3783
NJ	Greenbrook, Greenbrook Elctrns.	201-968-3500
NJ	Kenilworth, Federated Purchasers, Inc.	201-272-0505
NM	La Cruces, Elctrn. Parts Co.	505-523-4578
NY	Buffalo, Summit Distr.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Plainview, Kelvin Elctrns.	516-349-7620
NY	Rochester, Summit Elec.	716-334-8110
NC	Greensboro, Guilford Elctrns. Supp.	919-275-1385
OH	Warren, REM Elctrns. Supply	216-373-1300
OK	Oklahoma City, Radio Supp.	405-232-6127
OR	Portland, Radar Elec.	503-232-3404
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Philadelphia, A.C. Radio	215-462-9379
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Pawtucket, Jabbour Electronic Supply	401-728-4600
RI	Providence, W. Dandreta & Co.	401-861-2800
RI	Westerly, Ocean State Elctrns.	401-596-3080
SC	Charleston, Wholesale Inds. Elctrns.	803-722-2634
TN	Memphis, W & W Distbg.	901-527-4627
TX	Houston, Elctrn. Parts Outlet	713-784-0140
TX	Richardson, Off The Shelf Comps.	214-238-0808
TX	Stafford, C.E.C. Elctrn. Parts	713-498-5573
UT	Salt Lake City, Kimball Elec.	801-328-2075
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Annadale, Arcade Elctrns.	703-256-4610
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	Wausau, Electronics Inc.	715-845-4671
NH	Newton, Adams-McGregor	603-382-3669

DATAKEY, INC., 407 W. Travelers Trail, Burnsville, MN 55337, Tel: 612-890-6850, FAX: 612-890-2726; FSC No.: 7025; Empl.: 50; *Sls. Mgr.:* Jerry Cox

DATALUX CORP., 155 Aviation Dr., Winchester, VA 22602, Tel: 703-662-1500, FAX: 703-662-1682; Empl.: 25; *Sls. Mgr.:* R.H. Twyford

DATA MEGA INC., Mega Data, 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6501, FAX: 708-860-3672

DATA POWER, See Beaver Labs

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464; Empl.: 35; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91367-2499, Tel: 818-888-4014, TELEX: 67-4734, FAX: 818-887-4789; Empl.: 3500; *Sls. Mgr.:* Paul Depa; *Dist. Mgr.:* John Thorse

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-7801; FSC No.: 96238; Empl.: 200; *Sls. Mgr.:* Robert Griffith

DATAQ INSTRUMENTS, INC., 150 Springside Dr., Ste. B220, Akron, OH 44333, Tel: 216-668-1444, TELEX: 6502817028, FAX: 216-666-5434

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 150; *Sls. Mgr.:* Carl Anderson, Sls. V.P.

DATA RAY

FAX: 303-451-1143

DATA RAY CORP., 12300 Pecos, Westminster, CO 80234, Tel: 1-800-926-5556, 303-451-1300; Empl.: 100; *Sls. Mgr.:* A. Woodley ...... **B•1028-1031**

Local Sales Offices & Reps

CA	Seal Bch., Texel	213-596-9411

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, 800-344-9684, FAX: 203-431-4657; Empl.: 70; *Sls. Mgr.:* T. Busch

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 55; *Sls. Mgr.:* L. Rizzo ...... **B•1931**

Local Sales Offices & Reps

AK	El Dorado, Indl. Controls Assoc.	501-862-5978
CA	Anaheim, Direct Drives & Controls	714-993-3412
CO	Denver, Motion Tek	303-333-6050
IL	Geneva, The Fromm Co.	708-208-6100
MI	Troy, Kinetic Technlgs.	313-828-9700
NJ	Maywood, Concept 250 Inc.	201-488-7343
NY	Sidney, A.J.S. Controls	607-563-8978
OH	Cincinnati, G.R. Fehr Co., Inc.	513-772-5700
PA	Wexford, Intek Sys.	412-935-4717
UT	Salt Lake City, Motion Tek, Inc.	801-268-9815

Local Distributors

NY	Sidney, AJS Controls	607-563-8978

DATATRAN CORP., 355 Yuma St., Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 270; *Sls. Mgr.:* Pam Nelson; *Dist. Mgr.:* Lori Dustin

FAX: 909-928-7701

DATATRONICS, INC., 28151 Highway 74, Romoland, CA 92585, Tel: 909-928-7700; FSC No.: 0F5M2 .... **A•2314**

For all states not listed, please contact factory in Romoland, CA 909-928-7700.

Local Sales Offices & Reps

AL	Huntsville, Bolton Assoc.	205-880-1164
CA	Riverside, Dalbeck-Vought, Inc.	909-243-1170
CA	San Jose, Fischer Assoc.	408-733-7350
CO	Denver, Megatronix	303-730-6262
FL	St. Petersburg, Bolton Assocs.	813-864-2294
GA	Dunwoody, Bolton Assoc.	404-671-9827
IL	Elgin, Selective Sls.	708-697-3757
IL	Park Ridge, Synmark Sls.,Inc.	312-390-9696
IN	Ft. Wayne, Gen.II Mktg.,Inc.	219-436-4485
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Dy-Tronix	913-339-6333
KY	Louisville, Gen II Mktg.	502-491-5250
MA	Woburn, Radian Assocs.,Inc.	617-933-7386
MI	Kalamazoo, Midwestern Sls.	616-372-6133
MI	Troy, C.B. Jensen & Assocs.	313-643-0506
MN	Minneapolis, Tech. Solutions	612-785-9303
MO	Bridgeton, Dy-Tronix	314-291-3861
NJ	Kenilworth, Ventronics, Inc.	908-272-9262
OH	Columbus, N. Central Mktg.	419-884-9804
OR	Lake Oswego, Abacus Sls.	503-777-8111
SC	Greenwood, Bolton Assoc.	803-223-4018
TX	Plano, Vielock Assoc.	214-881-1940
UT	Bountiful, Anderson Assoc.	801-292-8991
WI	East, Selective Sls.	414-367-1133
Can	Quebec, Componetics	514-331-9930

Local Distributors

OH	N. Central Mktg.	419-884-9804
WI	Selective Sls.	414-367-1133

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATAWARE ELECTRONICS INC., 8227 44th Ave. West H, Mukilteo, WA 98275, Tel: 206-742-5000, FAX: 206-742-8900; Empl.: 50-100; *Sls. Mgr.:* William Bovermann

DATAWRAP, INC., 37 Water St., Wakefield, MA 01880, Tel: 617-246-5757, FAX: 617-246-5758; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410, FAX: 215-322-9730; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

DATEL®

INNOVATION and EXCELLENCE

FAX: 508-339-6356

DATEL, INC., 11 Cabot Blvd., Mansfield, MA 02048-1194, Tel: 508-339-3000; Empl.: 550; *Sls. Mgr.:* L. Jacobsen ...... **D•1184-1185, 1340-1343, 2099-2103**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs. Inc.	205-533-9108
AZ	Phoenix, Tech. Sls.	602-246-1614
CA	San Diego, Bestronics of San Diego	619-693-1111
CA	Santa Clara, W. J. Electrns.	408-982-9222
CO	Denver, Elcom, Inc.	303-337-2300
CA	La Mirada, Select Elctrns.	213-921-5159
FL	Largo, Q-Rep	813-397-8431
GA	Norcross, Hughes Assocs. Inc.	404-662-1587
IL	Inverness, Carvel Engrg. & Sls.	708-934-9600
IN	Indianapolis, Wilson Tech. Sales	317-872-2513
IA	Cedar Rapids, Midtec Assocs.	319-395-0028
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Burtonsville, Chesapeake Technlg., Inc.	301-236-0530
MI	W. Bloomfield, Infinity, Inc.	313-932-1179
MN	Minneapolis, George Russell & Assocs.	612-854-1166
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Haddenfield, G. L. Williams Assocs.	609-428-6060
NM	Albuquerque, Delta Elctrn. Sls.	505-271-3276
NY	Clark Mills, KLM-Garner	315-853-6126
NY	Elmont, Crane & Egert	516-872-0800
NC	Cary, Hughes Assocs., Inc.	919-467-7029
TN	Knoxville, Hughes Assocs, Inc.	615-558-0283
TX	Arlington, ION Assocs.	817-695-8000
TX	Austin, ION Assocs.	512-794-9006
TX	Houston, ION Assocs.	713-537-7717
UT	Murray, Elcom, Inc.	801-262-2400
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	206-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
WI	New Berlin, Carvel Engrg. & Sls.	414-784-7007
Can	Mississauga, Ont., Tracan Elctrns.	416-625-7752
Can	Montreal, Que., Tracan Elctrns.	514-955-8096
Can	Nepean, Ont., Tracan Elctrns.	613-596-9760
Can	Vancouver, B.C., Advanced Power Comps.	604-436-0522

DATRICON, Scientific Technologies, Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 510-471-9717, FAX: 510-471-9752; Empl.: 42

DATRON SYSTEMS DIVISION, 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787, FAX: 805-526-0885; FSC No.: 32255; Empl.: 119; *Sls. Mgr.:* John Ricardi

DATUM TIMING, Datum Inc., 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, ESYLNK: 714-533-6345; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann ...... **D•1116, 1186-1189**

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Local Sales Offices & Reps

CA	BANCOMM	408-578-4161
AL	Huntsville, Southern Mktg. Assoss. Ltd.	205-534-6020
AK	Anchorage, Dryden Instrmn	907-344-4995
CA	Anaheim, Datum	714-533-6333
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Littleton, Vic Meyers Assocs. Inc.	303-730-7313
CT	Mt. Carmel, Scientific Dvcs.- Connecticut	203-248-9361
FL	Longwood, Southern Mktg. Assocs. Ltd.	407-682-7317
FL	Satellite, Southern Mktg. Assocs. Ltd.	407-777-3587
GA	Alpharetta, Southern Mktg. Assocs. Ltd.	404-664-9797
IL	Des Plaines, Marsland Assocs.	708-298-2620
IN	Brownsburg, Marsland Assocs.	317-852-8688
IA	Marion, Marsland	319-373-0566
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Columbia, Creative Mktg. Assocs.	301-880-4161
MA	Waltham, Scientific Devices-New England	617-890-2252
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs., Inc.	908-964-6200
NM	Albuquerque, Vic Meyers Assocs. Inc.	505-884-6878
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
OH	Dublin, Micro Sls. Corp.	614-792-9117
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-579-2995
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WA	Seattle, Comptronics	206-784-9713
WI	New Berlin, Marsland Assocs.	414-786-6611

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, FAX: 805-688-3306; Empl.: 6; *Sls. Mgr.:* Dean Davidge

DAVIES MOLDING CO., 350 E. Kehoe Blvd., Carol Stream, IL 60188, Tel: 708-510-8188, FAX: 708-510-9944; FSC No.: 72512; Empl.: 130; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

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INSTRUMENTS

FAX: 410-358-0252

DAVIS INSTRUMENT MFG. CO., INC., 4701 Mt. Hope Drive, Baltimore, MD 21215, Tel: 800-368-2516 ...... **D•1251**

DAYCO PRODUCTS, INC., P.O. Box 1004, Dayton, OH 45401-1004, Tel: 513-226-5926, TELEX: 288219, TWX: 810-459-1822; Empl.: 6000

DAYTRONIC CORP., BTR Grp., 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, FAX: 513-866-3327; Empl.: 125; *Sls. Mgr.:* Ronald J. Toke

DAZIX, Intergraph, One Madison Industrial Park, Huntsville, AL 35894, Tel: 1-800-239-4111, 205-730-2000, FAX: 205-730-8344

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 407-727-0660; Empl.: 337

DCI

FAX: 913-782-5766

DCI INC., 14812 W. 117th Street, Olathe, KS 66062, Tel: 913-782-5672; FSC No.: 58677; Empl.: 40; *Sls. Mgr.:* Larry Shelton ...... **B•1032; D•1344**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	Lomita, Techrep Comps.	310-539-9070
CA	San Diego, Techrep - San Diego	714-361-7727
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
FL	Sarasota, REP USA	813-923-2897
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Deerfield, Jebco Sls. Ltd.	708-945-2102
IN	Ft. Wayne, M/S Sls. & Assoc.	219-463-3023
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix	316-838-0884
MA	Pembroke, R.G. Assocs., Inc.	617-293-5233
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170
MO	St. Louis, Dy-Tronix	314-291-4777
MA	Lowell, R.G. Assocs., Inc.	508-458-9802
NY	Pittsford, L-Tron	716-383-0050
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303

NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, H H & Assocs.	214-247-8308
TX	Houston, Talon Tech. Sls.	713-999-8588
VA	Alexandria, Dandelion-sk	703-722-4316
WA	Seattle, Brett Assocs., Inc.	206-328-6900
WA	Roy, Accu-Tec	206-843-9143

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AZ	Phoenix, J.Smith & Assoc.	602-267-0981
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
CT	Tolland, R.G. Assoc.	203-875-4201
FL	Sarasota, REP USA	813-923-2897
MO	Raytown, Vertec Assocs., Inc.	816-737-0377
MI	Clarkston, Aztech Sys., Inc.	313-325-0941
MN	Minneapolis, Instrmn. Resources	612-537-2434
NJ	Manchester, Vertec	314-394-6242
NV	Las Vegas, Jim Smith & Assocs., Inc.	702-798-5053
NM	Albuquerque, Jim Smith & Assocs., Inc.	505-345-6501
NC	Charlotte, Zelco Assocs., Inc.	704-541-6122
OH	Cleveland, Aztech Sys., Inc.	216-671-1200
Can	Montreal, Que., Morrison & Force Dvcs.	514-737-0072
FL	Longwood, CBC Elctrns.	407-831-5380
IL	Elmhurst, Utronix Sls. Inc.	312-834-1100
MI	Clarkston, Aztech Sys., Inc.	313-325-0941
NJ	Cherry Hill, Analectro, Inc.	800-247-3581
OH	Cleveland, Aztech Sys., Inc.	216-671-1200
RI	Warwick, Ertronics, Inc.	401-732-3567
TX	Dallas, Kay Todd Assocs.	214-458-8833
Can	St.Laurent, Que., Componetics	514-331-9930

DCT INSTRUMENTS, 1165 Chambers Road, Columbus, OH 43212, Tel: 1-800-328-1028, FAX: 614-481-7701; *Sls. Mgr.:* Joe Snell

DDI INC., 5 Dodge St., Ste. 310, Beverly, MA 01915-1703, Tel: 508-927-7976, FAX: 508-921-6388; Empl.: 4; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

DDK ELECTRONICS, INC., 401 Bentley Street, Markham, Ont., Canada L3R 9T2, Tel: 416-470-1346, FAX: 416-470-1479; Empl.: 25; *Sls. Mgr.:* Bill Anderson

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DE ANZA MFG. SVCS. INC., 1271 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-734-2020, FAX: 408-734-2580; FSC No.: 5935 & 5965; Empl.: 100; *Sls. Mgr.:* Michael A. Takahara

DEARBORN WIRE & CABLE, L.P., 250 W. Carpenter, Wheeling, IL 60090, Tel: 708-459-1000, 800-323-0198, FAX: 708-459-0170; FSC No.: 28105; Empl.: 135; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Scott Gauger

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 1-310-397-9668; Empl.: 7

DEGUSSA CORP., Temperature Sensing Products, 104 New Era Drive, So. Plainfield, NJ 07080, TELEX: 4754247, FAX: 908-757-8561; FSC No.: 630673043; *Sls. Mgr.:* Ron Fichter

DEI, 230 N. Market Pl., Escondido, CA 92029, Tel: 619-743-8344, FAX: 619-743-5297; Empl.: 30; *Sls. Mgr.:* Matt Pedote

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Local Distributors

AL	Huntsville, Century Fastener	205-883-5344
AZ	Tempe, Ziptape ID Sys.	602-967-8888
CA	Huntington, HW Eckhardt Corp.	714-375-4926
CA	Riverside, Elctrn. Supply	714-683-7300
CA	San Fernando, Aleph Intl.	818-365-9856
CA	Santa Clare, The Wachtel Co.	408-982-0962
CO	Denver, Hardware Specs.	303-371-8553
CT	Milford, Plastic & Metal Comp.	203-877-2723
DE	Wilmington, Wholesale Elctrns.	302-652-3222
FL	Tampa, Century Fastener	813-886-5770
GA	Lawrenceville, Century Fastener	404-513-1620
GA	Suwanne, Arden Fastener	404-945-3105
IL	Addison, L-Comp	708-628-1400
IL	Bensenville, Vertex Computer Cable	708-766-7979
IL	Hillside, Zellerbach	708-448-8200
IN	Bloomington, Stansifer Radio Co., Inc.	812-336-6339
IN	Indianapolis, Wire Supplies, Inc.	317-786-4485
ME	Bangor, ICC North	207-942-2600
MD	Hanover, Vertex Computer Cable	301-796-5000
MA	Marlborough, Hardware Specs.	508-481-8622
MA	Woburn, Pacer Elctrns.	617-935-8330
MI	Muskegon, All Phase Elec.	616-733-3171
MN	Faribault, KGP Telecomm.	507-334-2269
MN	St. Paul, Arden Fasteners	612-483-6681
MO	St. Louis, L-Comp	314-291-6200
NV	Las Vegas, Kiesub	702-733-3888
NJ	Kenilworth, Federated Purch.	201-272-0505
NJ	Northvale, Glasgal Comm.	201-768-8082
NY	Farmingdale, Vertex Computer Cable	516-293-9880
NY	Holtsville, Tower Fastener Co.	516-289-8800
NY	Long Island City, Hardware Specs.	718-361-9393
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Century Fastener	704-554-0444
NC	Charlotte, Texas Intl.	704-588-0004
NC	Raleigh, Century Fastener	919-787-1800
ND	Fargo, Border Sls.	701-239-2379
OH	Brookpark, Calvert Wire & Cable	216-433-7600
OH	Dayton, Vertex Wire & Cable	513-223-5333
PA	Philadelphia, PEI/Genesis	215-673-0400
SC	W. Columbia, Century Fastener	803-791-1800
TN	La Vergne, Arden Fastener	615-641-6661
TX	Dallas, Texas Intl.	512-366-3648
TX	Dallas, Wolford Elctrns.	713-331-2255
VA	Arlington, Arlington Elctrns.	703-524-2412
VA	Virginia Beach, Norfolk Wire & Elctrns.	804-499-1100
WA	Seattle, Radar Elctrn. Co., Inc.	206-282-2511
WI	New Berlin, Cable Comps., Inc.	414-785-1060
Can	Toronto, Cords Canada Ltd.	416-787-1114

DELBERT BLINN CO., INC., Box 2007, Pomona, CA 91769, Tel: 909-629-3900, FAX: 909-622-6218; Empl.: 6

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FAX: 914-699-4005

DEL ELECTRONICS CORP., One Commerce Park, Valhalla, NY 10595, Tel: 914-686-3600; FSC No.: 01378; Empl.: 95 …… **A•1157-1158, 1601, 1676, 2315, 2532; D•1656-1659**

Local Sales Offices & Reps

CA	Alambra (So. CA), James Gerry Co.	213-283-7694
CA	Gilroy, Armstrong & Assocs.	408-848-3221
CT	Redding, PCS	203-938-7013
MD	Kensington, Koebert Assoc.	301-493-8924
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
NM	Albuquerque, Quality Technlg.	505-899-4565
PA	Glenside, Koebert Assoc.	215-887-2310

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052-0449, Tel: 716-652-3600, FAX: 716-652-4814; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen …… **A•1186-1189**

Local Sales Offices & Reps

AL	Decatur, El Tech	205-353-7899
AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Chatsworth, First Rep. of S. CA	818-718-6155
CA	Milpitas, Advanced Technlg. Sls.	408-946-4111
CO	Parker, TMA	303-841-3435
FL	Orlando, CDM	407-240-3903
GA	Roswell, JWL Assoc.	404-518-8500
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Fort Wayne, Liberty Sls.	317-888-8396
IN	New Albany, Liberty Sls.	317-888-8396
IA	Cedar Rapids, C. Horn & Asst.	319-393-8703
KS	Parker, S. W. Wollard	913-898-6552
MD	Lutherville, D. A. Dougherty Sls. Co.	301-321-7890
MA	Sterling, Compatible Comps.	508-422-3327
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Morrestown, TAI	609-778-5353
NJ	Ridgewood, Ballou	201-444-6990
NY	Manhassett, Ballou, Inc.	516-627-1151
NY	Mendon, Tech-Mark	716-624-3840
NY	Utica, Tech-Mark	315-733-0575
NC	Charlotte, JWL Assoc.	704-541-5750
OH	Mason, S-Tek	513-398-5843
TX	Irving, Kite Elctrn. Sls. Co.	214-986-0321
Can	Mississauga, J. G. Weiss Co. Ltd.	416-673-0011
Can	Nepean, J. G. Weiss Co. Ltd.	613-825-0545
Can	St. Laurent, J. G. Weiss Co. Ltd.	514-337-5022
Can	Vancouver, J. G. Weiss Co. Ltd.	604-873-1112
Can	Winnipeg, J. G. Weiss Co. Ltd.	204-783-4387

Local Distributors

CA	Fountain Valley, Ecliptek	714-963-4009
CA	Garden Grove, National Elctrns.	714-892-7749
CA	Irvine, ITT Multicomponents	714-727-4001
CA	San Diego, Neumann	619-695-3005
CA	Santa Clara, Trinity Elctrns.	408-980-9014
CA	Stanton, Inductive Comps.	716-828-3420
FL	Ft. Lauderdale, Bros. Elec. of FL	800-342-6700
MD	Savage, Pyttronics Ind.	301-792-0708
MA	Sterling, Compatible Comps.	617-422-6762
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fairfield, Micross Comps.	201-227-8007
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Farmingdale, Milgray/New York	800-645-4729
NY	Plainview, ACI Elctrns.	516-293-6630
PA	Norristown, Century Elctrn. Comp.	215-631-5400
TX	Fort Worth, Patco Supply	817-429-8596
Can	Burnaby, B.C., R-A-E Indl. Elctrns. Ltd.	604-291-8866
Can	Don Mills, Ont., Saynor Varah Elctrns.	416-445-2347
Can	Montreal, Que., Prelco Elctrns. Ltd.	514-389-8051
Can	Pointe-Claire, Future Elctrn.	514-694-7710
Can	Willowdale, Ont., Milgray Elctrns.	416-756-4481

DELTA CONTROLS CORP., 585 Fortson St., Shreveport, LA 71107, Tel: 318-424-8471, TELEX: 784554, FAX: 318-425-2421; Empl.: 32; *Sls. Mgr.:* Steve Croom, VP Sls.

DELTA DESIGN, 5775 Kearny Villa Rd., San Diego, CA 92123-1111, Tel: 619-292-5000, FAX: 619-277-7884; Empl.: 227; *Sls. Mgr.:* Bob Williams

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 508-927-1060, FAX: 508-922-6430; FSC No.: 00795; Empl.: 108; *Sls. Mgr.:* James Gillen; *Dist. Mgr.:* James Gillen

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569, FAX: 615-483-1142; Empl.: 12

DELTA PRODUCTS CORPORATION, 3225 Laurelview Court, Fremont, CA 94538, Tel: 510-770-0660, FAX: 510-770-0122; Empl.: 5000; *Dist. Mgr.:* J.F. Amend

DELTA PRODUCTS CORPROATION(EAST COAST OFFICE), 2000 Aerial Center Pkwy., Morrisville, NC 27560, Tel: 919-380-8883, FAX: 919-380-8383

DELTA WIRE & CABLE CO., 2550 Commonwealth Ave., P.O. Box 833, North Chicago, IL 60064, Tel: 708-473-4990, FAX: 708-473-2425; Empl.: 12; *Sls. Mgr.:* Perry Stein

DELTEC CO., 13065 Tom White Way, Unit G, Norwalk, CA 90650, Tel: 310-926-2304, FAX: 310-926-8536; Empl.: 7; *Sls. Mgr.:* Dennis Orman

DELTEC ELCTRNS. CORP., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TELEX: 910-335-1241, FAX: 619-296-8039; FSC No.: 52297; Empl.: 150; *Sls. Mgr.:* Jeff Frank; *Dist. Mgr.:* Rod Pullen

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DELTONA TRANSFORMER CORP., 801 U.S. Hwy. 92, East, DeLand, FL 32724, Tel: 904-736-7900, FAX: 904-736-0379; Empl.: 140; *Sls. Mgr.:* Michael L. Prelec

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DELTROL CONTROLS, 2745 S. 19th St., Milwaukee, WI 53215, Tel: 414-671-6800; Empl.: 180; *Sls. Mgr.:* Bill Wiberg; *Dist. Mgr.:* Frank Stadler .. **B•1480-1481, 1630**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tucson, Earl Clemick & Assocs.	602-749-4003
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CA	Santa Clarita, T&C Engrg.	805-254-8778
CT	Waterbury, Cannon Assocs., Inc.	203-597-0240
FL	Tampa, Florida Comp. Sls.	813-873-3622
GA	Roswell, JWL Assoc.	404-518-8500
IL	Elk Grove Village, Tristar Group	708-593-0200
IN	Ft. Wayne, Nationwide Comps.	219-423-9535
MN	St. Paul, Kencotronics, Inc.	612-645-7717
MO	Chesterfield, Weisler & Assocs.	314-537-0010
NY	Pt. Washington, Ashtec Inc.	516-767-0336
NY	Rochester, Omni Sls.	716-248-0340
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Willoughby, Nationwide Comps.	216-946-3226
PA	Valley Forge, Providence Mktg.	215-935-3300
RI	Barrington, Cannon Assoc.	401-245-0850
TX	Houston, Weisler & Assocs.	713-467-1862
Can	Pointe Claire, Nobel-Teck Inc.	514-695-7498

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AL	Montgomery, Southern Controls	205-277-5030
AZ	Tempe, Control Design	602-829-7981
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Anaheim, Control Design	714-821-1516
CA	Canoga Park, C & A Elctrns.	818-340-6022
CA	San Jose, Consolidated Parts	408-435-1200
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, Wes-Garde Comps.	213-873-4802
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Waterbury, All-Phase Elec. Supply	203-755-0405
FL	Altamonte Springs, Control Des.	407-788-3220
FL	Ft. Lauderdale, SE Elctrns.	305-563-4131
FL	Lakeland, Wes-Garde Comps.	813-644-7564
FL	Orlando, EMSCO	407-849-6362
GA	Stone Mountain, Control Des.	404-979-3500
IL	Bensenville, Gould Elctrns.	708-860-7171
IN	Indianapolis, Control Design	317-788-4559
IA	Davenport, Warren Radio	319-322-5301
IA	Marion, Control Des.	319-373-2923
IA	West Des Moines, Ramco Co.	515-225-6933
KS	Kansas City, Kornfield Thorp Elec.	913-321-7070
KS	Wichita, Kriz-Davis Co.	316-267-4354
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
MD	Aberdeen, Harco Elctrns.	301-838-7990
MA	Brighton, Interstate Elctrns. Equip.	617-782-9000
MA	Westborough, In Stock Prods.	508-870-5750
MI	Jackson, Fulton Radio Supp.	517-784-6107
MI	Madison Hgts., Galco Indl. Elctrns.	313-542-9090
MN	Minneapolis, Control Design	612-721-6555
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Keene, Tradesmen Elctrl. Supp.	603-352-1205
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Raritan, Masters Elctrn.	201-725-3533
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Vestal, Wholesale Elec. Supp.	607-729-1526
ND	Fargo, WESCO	701-232-4446
ND	Minot, J.I. Company	801-852-4466
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Ardmore, Ardmore Elec. Supp.	405-223-3571
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Dunn Elec.	503-285-0214
PA	Erie, Rem Elctrns.	814-453-5626
PA	Malvern, Control Design	215-296-0150
PA	Philadelphia, Lindley Elec.	215-329-7005
TX	Dallas, Control Design	214-358-1441
TX	Lubbock, R & R Elec. Co.	806-765-7727
TX	San Antonio, Blackburn Drives Controls	512-349-2621
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VA	Glen Allen, Hermitage Distrs.	804-550-3030
VA	Staunton, Southern Elec.	703-886-6218
WI	Manitowoc, Englewood Elec.	414-684-6653
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Control Design	414-784-1015

DELTRON, INC., 290 Wissahickon Ave., N. Wales, PA 19454-9990, Tel: 215-699-9261, FAX: 215-699-2310; Empl.: 120

DEL-TRON PRECISION, 5 Trowbridge Drive, Bethel, CT 06801, Tel: 800-245-5013, FAX: 203-778-2721; Empl.: 50; *Sls. Mgr.:* Emil Melvin

DENNIS CHEMICAL, 2700 Papin St., St. Louis, MO 63103, Tel: 314-771-1800, FAX: 314-771-8399; Empl.: 70; *Sls. Mgr.:* Charles F. Seger III; *Dist. Mgr.:* Charles F. Seger III

DENSEPAC MICROSYSTEMS, INC., 7321 Lincoln Way, Garden Grove, CA 92641-1428, Tel: 714-898-0007, 800-64-CHIPS, FAX: 714-897-1772; FSC No.: 66847; Empl.: 50; *Sls. Mgr.:* Al Kile, VP Sls.

DENSITRON CORPORATION, Densitron International, 3425 W. Lomita Blvd., Torrance, CA 90505, Tel: 310-530-3530, TWX: 910-349-6200, FAX: 310-534-8419; FSC No.: 62483; Empl.: 42; *Sls. Mgr.:* Richard Driscoll VP Sls./Mktg.; *Dist. Mgr.:* Richard Driscoll VP Sls./Mktg. **B•1033**

Local Sales Offices & Reps

AZ	Tempe, Techni-Source	602-730-8093
CA	Irvine, Comp. Mktg. Assocs.	714-727-0688
CA	Milpitas, Telesis Sls.	408-946-7300
CO	Englewood, Comp. Sls.	303-779-8060
CT	W. Hartford, M-R Tech. Sls.	203-521-2101
FL	Margate, EPM Corp.	305-977-0331
GA	Acworth, E.A.B., Inc.	404-975-3660
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Ft. Wayne, R.L. Bontempo Assocs.	219-478-1057
KS	Overland Pk., Markline Technlgs.	913-681-8880
MA	Wellesley Hills, Sturdy Corp/Nova Assocs.	617-235-2330
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, Midtech Assocs.	314-275-8666
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, C-Tech Sls.	919-782-8100
OH	Centerville, Engrg. Mktg. Assocs.	513-433-2800
TX	Seagoville, Delta Comps.	214-287-6333
UT	Salt Lake City, Wasatch/Prorep Mktg.	801-268-3434
VA	Sterling, Beacon-North	703-478-2480
WA	Seattle, J. J. Assocs.	206-246-6619
Can	Mississauga, Ont., IntelaTech	416-629-0082

DEPAC CORP., 201 Mill St., Rome, NY 13440, Tel: 315-339-1265; Empl.: 3

DERINGER MFG. CO., 1250 Townline Road, Mundelein, IL 60060, Tel: 708-566-4100, TWX: 910-685-4231; *Sls. Mgr.:* W. Johnston

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, FAX: 617-862-3769; FSC No.: 4D417; Empl.: 5

DESIGN COMPONENTS, INC. (DCI), 1 Kenwood Circle, Franklin, MA 02038, Tel: 508-528-7300, 800-341-4811, FAX: 508-520-1424; Empl.: 50

DESIGN TECHNOLOGY, 11489 Woodside Ave., Santee, CA 92071, Tel: 619-448-2888, FAX: 619-448-3044; FSC No.: 619-440-8048; Empl.: 50; *Sls. Mgr.:* Jeff Jonas; *Dist. Mgr.:* Sherry Golden

DESIGN WORKSHOP, 4226 St. John's Blvd., Ste. 400, D.D.O., Que., Canada H9G 1X5, Tel: 514-696-4753, FAX: 514-696-5351; Empl.: 5

DESPATCH INDUSTRIES, 63 St. Anthony Parkway, P.O. Box 1320, Minneapolis, MN 55418, Tel: 612-781-5363, FAX: 612-781-5353; Empl.: 360; *Sls. Mgr.:* P. Olson

DETORONICS CORPORATION, 10660 E. Rush St., S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436, FAX: 818-579-1936; FSC No.: 29867; Empl.: 45

DETROIT COIL CO., 2435 Hilton Rd., Ferndale, MI 48220, Tel: 313-398-5600, FAX: 313-398-0481; Empl.: 120; *Sls. Mgr.:* T. Dougherty

DETROIT TESTING LABORATORY, INC., 7111 E. Eleven Mile, P.O. Box 869, Warren, MI 48090-0869, Tel: 313-754-9000, FAX: 313-754-9045; FSC No.: 0739; Empl.: 125

DEUTSCH RELAYS, INC., 65 Daly Rd., East Northport, NY 11731, Tel: 516-499-6000, FAX: 516-499-6015; Empl.: 463; *Sls. Mgr.:* Glen Telshow

DEVAR, INC., 706 Bostwick Ave., Bridgeport, CT 06605, Tel: 203-368-6751, FAX: 203-368-3747; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

DEVELCO, INC., 175 Nortech Pkwy., San Jose, CA 95134-2306, Tel: 408-945-6500, TWX: 910-339-9295, FAX: 408-945-6504; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEVERE AND LAU COMPANY, 1767 South Norfolk Lane, Anaheim, CA 92802, Tel: 310-457-7912, FAX: 714-772-1934; FSC No.: 7302-8902; Empl.: 26; *Sls. Mgr.:* G. R. Bosworth

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, FAX: 313-426-5090; Empl.: 35; *Sls. Mgr.:* Robert Toth Jr.

DEXTER SCIENTIFIC, 308 Benham St., Palatka, FL 32177, Tel: 904-328-2450; Empl.: 1

DE YOUNG MFG., INC., 12920 N.E. 125th Way, Kirkland, WA 98034, Tel: 206-823-4798, FAX: 206-821-8633; FSC No.: 54937; Empl.: 70; *Sls. Mgr.:* Ted Johnson

DGH CORPORATION, P. O. Box 5638, Manchester, NH 03108, Tel: 603-622-0452, FAX: 603-622-0487; Empl.: 10

DGS PRO AUDIO, P.O. Box 170426, Arlington, TX 76003, Tel: 800-292-2834, FAX: 817-473-7712; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* Mike Manzella

DH PRINT, DIV. OF DH TECHNOLOGY, 860 College View Dr., Riverton, WY 82501, Tel: 307-856-4821, FAX: 307-856-0412; Empl.: 280; *Sls. Mgr.:* Roger Rayburn; *Dist. Mgr.:* Roger Rayburn

DIAGOSTIC INSTRUMENT CORP., 4 Copeland Dr., Box J, Ayer, MA 01432, Tel: 508-772-4572, FAX: 508-772-5210; Empl.: 70; *Sls. Mgr.:* James F. Hashem

DIALIGHT CORPORATION, 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 908-223-9400, FAX: 908-223-8788; FSC No.: 83330; Empl.: 400; *Sls. Mgr.:* W. Moore; *Dist. Mgr.:* Gary Baker **B•1141-1147**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Shefler-Kahn Co.	602-581-0884
CA	Garden Grove, Elsco	714-891-4621
CA	Pleasanton, Moulthrop Sls.	510-463-0450
CA	San Diego, Varigon San Diego	619-576-0100
CO	Boulder, Comp. Prods. Sls.	303-530-2800
CT	Wallingford, John E. Boeing Co., Inc.	203-265-1318
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
FL	Oviedo, Panamtech Inc.	407-679-5506
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Chicago, Victory Sls.	708-490-0300
IN	Huntington, Electronic Reps.	219-356-3513
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IA	Cedar Rapids, Lowell-Kangas & Assoc.	319-362-9290
KS	Shawnee, Lowell Kangas & Assocs.	913-631-3515
KY	Lexington, Electronic Reps.	606-277-0436
LA	Covington, Cartwright & Bean	504-892-1780
MA	Chelmsford, John E. Boeing Co., Inc.	508-256-5800
MI	Grand Rapids, Hilltronics, Inc.	616-364-0010
MI	Royal Oak, Hilltronics	313-435-0920
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NY	Liverpool, Gen-Tech	315-451-3480
NY	Melville, Parallax	516-351-1000
NY	Penfield, Gen-Tech Elctrns.	716-581-5159
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OR	Tigard, Earl & Brown Assocs.	503-639-2100
PA	Broomall, L.D. Lowery	215-356-5300
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088
TN	Germantown, Cartwright & Bean	901-758-8113
TN	Knoxville, Cartwright & Bean	615-693-7450
TX	Austin, Tesco	512-834-8374
TX	Dallas, Tesco	214-553-1200
TX	Houston, Tesco, Inc.	713-690-4909
VA	Earlysville, L.D. Lowery, Inc.	804-973-6672
WA	Redmond, Earl & Brown Assocs.	206-885-5064
WI	Brookfield, Victory Sls.	414-789-5770
Can	Kirkland, PQ, Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., Longman Sls., Inc.	416-670-8100
Can	Nepean, Ontario, Longman Sls., Inc.	613-564-0100
Can	Vancouver, B.C., Arwin Tech. Ltd.	604-980-4557

Local Distributors

AR	Little Rock, Carlton Bates	501-562-9100
CA	Garden Grove, Richey Impact, Inc.	714-895-0060
CA	Gardena, California Switch	213-770-2330
CA	Los Angeles, Bell Inds.	213-826-6778
CO	Denver, CSID	303-292-9594
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	708-359-5500
LA	Lafayette, Ralph's of Lafayette	318-233-0105
MD	Baltimore, Resco	301-931-8200
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Livonia, Chelsea Ind/RS Elec.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-483-3322

MO	Maryland Hts., L Comp	314-291-6200
NJ	Kenilworth, Federated Purchaser	908-272-0505
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Melville, Arrow Elctrns.	516-391-1300
OH	Akron, Aesco Elctrns., Inc.	216-762-8818
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Stotts Friedman	513-298-5555
OH	Warren, Rem Elctrn. Supp.	216-373-1300
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Trevose, Bell	215-953-2800
TX	Dallas, Norvell Elec., Inc.	214-233-0020
TX	Houston, Harrison Equip. Co.	713-879-2600
VA	Charlottesville, Virginia Elctrns.	804-296-4184
WA	Bellevue, Almac/Arrow	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Edmonton, Alb., Cardinal Ind. Elec.	403-483-6266
Can	Willowdale, Ont., Electro Sonic	416-494-1666

DIANACHART INC., 101 Round Hill Dr., Rockaway, NJ 07866, Tel: 201-625-2299, FAX: 201-625-2449; Empl.: 10; *Sls. Mgr.:* B. McWilliams

DI/AN CONTROLS, INC., 16 Jonathan Drive, Brockton, MA 02401, Tel: 508-599-8000, FAX: 508-599-8658; FSC No.: 06900; Empl.: 25; *Sls. Mgr.:* John Sheehy

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, TELEX: 710-229-6890, FAX: 207-655-4669; FSC No.: 08441; Empl.: 220; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC LABS., Rte. 20 E., Cazenovia, NY 13035, Tel: 315-655-8710, TELEX: 882-691 Dielectric Labs., FAX: 315-655-8179; FSC No.: 55153; Empl.: 100; *Sls. Mgr.:* Gunter Vorlop

DIELECTRIC SCIENCES, INC., HVT Group, 88 Turnpike Road, Chelmsford, MA 01824, Tel: 508-250-1507, FAX: 508-250-1699; FSC No.: 50509; Empl.: 30; *Sls. Mgr.:* David J. Leary

DIE-TECH INC., 295 Sipe Rd., RDI, York Haven, PA 17370, Tel: 717-938-6771, FAX: 717-938-6099

DIETERICH STANDARD, A Dover Industries Company, P.O. Box 9000, Boulder, CO 80301, Tel: 303-530-9600, FAX: 303-530-7064; Empl.: 105; *Sls. Mgr.:* Robert Heiser; *Dist. Mgr.:* Robert Heiser

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911, FAX: 816-331-4914; FSC No.: 93652; Empl.: 40; *Sls. Mgr.:* L.M. Dietz

DIGALOG SYSTEMS, INC., 3180 South 166th St., New Berlin, WI 53151, Tel: 414-797-8000, FAX: 414-797-8003; Empl.: 35

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, FAX: 301-498-0771; Empl.: 40; *Sls. Mgr.:* Jim McLaughlin

DIGI-KEY CORP., 701 Brooks Ave. South, Thief River Falls, MN 56701-0677, Tel: 218-681-6674, 1-800-344-4539, FAX: 218-681-3380

DIGITAL DATA SYSTEMS, INC. (DDS), 1551 N.W. 65 Ave., Ft. Lauderdale, FL 33313, Tel: 305-792-3290, TWX: 910-997-4751 (Digital), ESYLNK: 62756087, FAX: 305-581-13; FSC No.: 65136; Empl.: 20

DIGITAL DESIGN ANALYSIS, 150 El Camino Real, Ste. 200, Tustin, CA 92680, Tel: 714-573-8730, FAX: 714-573-8736; Empl.: 6; *Sls. Mgr.:* Darlene Kindstrand; *Dist. Mgr.:* Darlene Kindstrand

DIGITAL DYNAMICS, INC., 5274 Scotts Valley Dr., Scotts Valley, CA 95066, Tel: 408-438-4444; FSC No.: (S.I.C. Code — 3823); Empl.: 15

DIGITAL MOTOR, INC., 1075 N.W. Murray Rd., Ste. No. 255, Portland, OR 97229-5501, Tel: 503-629-9692, FAX: 503-690-9876; Empl.: 6

DIGITAL PRODUCTS, INC., 411 Waverly Oaks Rd., Waltham, MA 02154, Tel: 617-647-1234, 800-243-2333, TELEX: 312345, FAX: 617-924-7814; Empl.: 100; *Dist. Mgr.:* Neil Peterson

DIGITAL RADIO CORP., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277, Tel: 213-316-4114, FAX: 213-543-1256; Empl.: 27; *Sls. Mgr.:* Arvin L. Perry

DIGITEC, 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-3444, TELEX: 3775688; FSC No.: 16152; Empl.: 45; *Sls. Mgr.:* Bruce Poplin

DIGITRAN

A DIVISION OF XCEL CORPORATION

FAX: 909-391-4558

DIGITRAN DIVISION, XCEL Corporation, 4290 E. Brickell St., Ontario, CA 91761, Tel: 909-391-4321; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* W. Miller; *Dist. Mgr.:* W. Miller .... **B•1708, 1825**

Local Sales Offices & Reps

CA	Ontario, Xcel Corp.	909-391-4321
CO	Littleton, Romulus	303-770-4888
FL	Margate, EPM Corp.	305-977-0331
IL	Palatine, Technlg. Sls.	708-991-6600
MI	Troy, C.B. Jensen & Assoc.	313-643-0506
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Rochester, Apex	716-272-7040
OR	Beaverton, J.J. Backer	503-627-0775
TX	Richardson, Pro-Comp	214-669-1500
WA	Seattle, J.J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elec.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	Riverside, Xcel Corp.	909-275-0257
CA	San Diego, El-Com	619-578-0900
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Electr./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
MD	Columbia, Powell Electr.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	West Borough, Powell Electrns.	617-336-6100
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
NJ	Hasbrouck Hgts., Tory Sls.	201-288-5656
NJ	Toms River, Xcel Corp.	908-830-7525
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Xcel Corp.	216-239-4998
PA	Philadelphia, Powell Electr.	215-365-1900

DILL INSTRUMENTS INC., 436 W. Willard, Kalamazoo, MI 49005, Tel: 616-388-5708, FAX: 616-388-5704; Empl.: 10; *Sls. Mgr.:* Terry Simpson; *Dist. Mgr.:* Robert Boyle

DILLON, Weigh-Tronix, Inc., 1000 Armstrong Dr., Fairmont, MN 56031, Tel: 507-238-4461, TELEX: 756594, FAX: 507-238-4195; Empl.: 500; *Sls. Mgr.:* Jim Rather

DILOG, 2652 McGaw, Irvine, CA 92714, Tel: 714-476-0303, FAX: 714-476-0633; FSC No.: 33-0243085; Empl.: 160; *Sls. Mgr.:* Dennis Edwards

DILWOL WIRE & CABLE INC., 435 Enfield Rd., Burlington, Ont., Canada L7T 2X5, Tel: 416-681-2343, FAX: 416-681-8440; *Sls. Mgr.:* J. R. Mattie

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45458, Tel: 513-433-7600, FAX: 513-433-0520; Empl.: 120; *Sls. Mgr.:* James L. Harl

DIMENSIONS UNLIMITED, INC., 1800 Buerkle Rd., St. Paul, MN 55110, Tel: 612-770-5630, FAX: 612-770-0847; *Sls. Mgr.:* David Flod

DIODES INC., 9957 Canoga Ave., Chatsworth, CA 91311, Tel: 818-882-4920, 800-821-1178, FAX: 818-341-1736; FSC No.: 12060; Empl.: 55; *Sls. Mgr.:* Marvin Zidel; *Dist. Mgr.:* Sue Reinish

DIONICS, 65 Rushmore St., Westbury, NY 11590, Tel: 516-997-7474, FAX: 516-997-7479; FSC No.: 50857; Empl.: 25; *Sls. Mgr.:* Bernard L. Kravitz

DIO-REY

THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

FAX: 201-941-4919

DIO-REY, Div. of Info-Lite Corp., 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli .... **B•1036-1042**

DIOTEC ELECTRONICS CORP., 18020 Hobart Blvd., Ste. B, Gardena, CA 90248, Tel: 310-767-1052, FAX: 310-767-7958; FSC No.: 4800; Empl.: 6; *Sls. Mgr.:* Joe S. Lin; *Dist. Mgr.:* Joe S. Lin

DIRECT CONVERSION TECHNIQUE, INC., 3132 N. Lowell Ave., Chicago, IL 60641, Tel: 312-283-1690, FAX: 1-800-282-3852; Empl.: 6; *Sls. Mgr.:* Thomas A. Ochal

DIRECT SOUND CORPORATION, The Park Square Bldg., 31 St. James Street, Ste. 901, Boston, MA 02116, Tel: 1-800-372-1616, FAX: 1-800-354-3317; Empl.: 3; *Sls. Mgr.:* A. Takayama .... **B•1709; C•1309**

DISC INSTRUMENTS, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-433-0343, TWX: 910-595-1987, FAX: 714-432-7567; Empl.: 150

DISPLAY DEVICES, INC., P.O. Box 230677, Encinitas, CA 92023, Tel: 619-753-0113; FSC No.: 26107

DISPLAYS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-2541, FAX: 717-248-8680; Empl.: 30; *Sls. Mgr.:* Kit Kennedy

DISPLAYTECH, INC., 2200 Central Ave., Boulder, CO 80301, Tel: 303-449-8933, FAX: 303-449-8934; Empl.: 24; *Sls. Mgr.:* Chris Sherman; *Dist. Mgr.:* Kelly J. Mannatt

DISPLAY TECHNOLOGIES, INC., 1355 Holmes Rd., Elgin, IL 60123, Tel: 708-931-2100, 1-800-544-8823, FAX: 708-931-2120; Empl.: 350; *Sls. Mgr.:* Robert Valentine; *Dist. Mgr.:* Timothy Knutsen

DISTRIBUTED LOGIC CORP., See DILOG

DISTRIBUTED PROCESSING TECHNOLOGY CORP., 140 Candace Dr., Maitland, FL 32751, Tel: 407-830-5522, FAX: 407-260-5366; Empl.: 200; *Sls. Mgr.:* Jim Habuda; *Dist. Mgr.:* Tom Moch

DISTRIBUTOR SPECIALISTS, 1942 14th Street, Santa Monica, CA 90404-4606, Tel: 213-452-3445

DIVELBISS CORP., 9776 Mt. Gilead Road, Fredericktown, OH 43019, Tel: 614-694-9015, FAX: 614-694-9035; Empl.: 40; *Sls. Mgr.:* Terry Divelbiss; *Dist. Mgr.:* Tim Knaul

DIVERSIFIED ELECTRONICS, INC., P.O. Box 1140, Evansville, IN 47706-1140, Tel: 812-426-2806, FAX: 812-425-8930; Empl.: 55; *Sls. Mgr.:* John L. Smith

DIVERSIFIED OPTICAL PRODUCTS, INC., 282 Main St., Salem, NH 03079, Tel: 603-898-1880, FAX: 603-898-3970; FSC No.: IHT10; Empl.: 49; *Sls. Mgr.:* James A. Greene

DIVERSIFIED SYSTEMS, INC., 6232 La Pas Trail, Indianapolis, IN 46268, Tel: 317-299-9547, FAX: 317-298-2055; FSC No.: 5693;5999;R212;R498;R698;S901;S902;S903;S908; Empl.: 1000; *Sls. Mgr.:* Paul Madden

DIVERSIFIED TECHNLG., P.O. Box 748, Ridgeland, MS 39157, Tel: 601-856-4121, TELEX: 585326, FAX: 601-856-2888; Empl.: 1000; *Sls. Mgr.:* Barrie McArthur; *Dist. Mgr.:* Barrie McArthur

DIXSON, INC., 287 27 Rd., Grand Junction, CO 81503, Tel: 303-244-1241, FAX: 303-245-6267; Empl.: 250; *Sls. Mgr.:* Ray Carlson

DJ INSTRUMENTS, INC., 18 Republic Rd., N. Billerca, MA 01862, Tel: 508-667-5301, FAX: 508-667-6804; FSC No.: 57747; Empl.: 25; *Sls. Mgr.:* David First

D. L. CUSTOM, 7250 Victoria Park Ave., Markham, Ont., Canada L3R 2M5, Tel: 416-475-0275; *Sls. Mgr.:* Les Hull, Jr.

D. O. INDUSTRIES, 200 Commerce Dr., Rochester, NY 14623, Tel: 716-359-4000, TELEX: 200802, FAX: 716-359-4999; *Sls. Mgr.:* Jeremy Goldstein

DOLAN-JENNER INDS., Box 1020, Woburn, MA 01801, Tel: 617-935-7444, TELEX: 94-8161, FAX: 617-938-7219; Empl.: 120; *Sls. Mgr.:* B.J. Dolan; *Dist. Mgr.:* Frank Tiernan

DOLPH, JOHN C., CO., New Rd., Monmouth Junction, NJ 08852, Tel: 908-329-2333, FAX: 908-329-1143; *Sls. Mgr.:* W. Rumpa

DOMINO, INC., P.O. Box 9309, Fort Wayne, IN 46899, Tel: 219-456-5512; FSC No.: 9Y350; Empl.: 19; *Sls. Mgr.:* Rick Smith

D1 INTERNATIONAL, INC., 95 E. Main St., Huntington, NY 11743, Tel: 516-673-6866, FAX: 516-673-6893; Empl.: 24; *Sls. Mgr.:* Bron Kutny

DONTECH, INC., 700 Airport Industrial Blvd., Doylestown, PA 18901, Tel: 215-348-5010, TELEX: 685 1155 DONTK, FAX: 215-348-9959; FSC No.: 63009; *Sls. Mgr.:* Jeffrey S. Reid, Dir. Mktg. & Sls.; *Dist. Mgr.:* Leda Petrou, Sls.

DORAN MANUFACTURING CO., 2834 Sidney Ave., Cincinnati, OH 45225, Tel: 513-681-5424, FAX: 513-681-5604; Empl.: 60; *Sls. Mgr.:* Jeff Stegman

DORMEYER INDUSTRIES, A.F. Dormeyer Mfg. Co. Inc., 6585 N. Avondale Ave., Chicago, IL 60631-1521, Tel: 312-775-3600, FAX: 312-775-6495; Empl.: 150; *Sls. Mgr.:* R. Steinberg .... **B•1632-1635**

Local Sales Offices & Reps

CA	Torrance, Universal Comps.	310-783-0220
CT	Guilford, Anchor Engrg.	203-458-7496
IL	Chicago, Dormeyer Inds.	312-775-3600
IA	Cedar Rapids, Dytronix	319-377-8275
KS	Wichita, Dytronix	316-838-0884
MA	Westborough, Anchor Engrg.	508-898-2724
MO	Bridgeton, Dytronix	314-291-4777
NY	Great Neck, Pacent Engrg.	516-482-4678
OH	Cleveland, KT/Depco	216-942-0051
PA	Glenshaw, Hollern Sls. Inc.	412-487-1246

Local Distributors

AL	Birmingham, W.W. Grainger	205-942-6741
AL	Huntsville, Reptron Elctrns.	205-722-9500
AZ	Phoenix, Minarik Elec.	602-233-3000
AR	Little Rock, W.W. Grainger	501-568-7800
CA	Glendale, Minarik Elec.	818-507-6500
CA	Los Angeles, Master Distr.	800-421-8153
CO	Commerce City, Minarik Elec.	303-289-5800
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Chicago, W.W. Grainger	312-486-9933
IL	Schaumburg, Reptron Elctrns.	708-882-1700
IN	Ft. Wayne, W.W. Grainger	219-484-9565
IA	Des Moines, W.W. Grainger	515-266-3460
KY	Louisville, W.W. Grainger	502-499-0001
MA	N. Billercia, Minarik Elec.	508-663-0740
MA	Sharon, Adcour Inc.	617-784-8123
MI	Detroit, W.W. Grainger	313-873-1200
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MN	Plymouth, Leeds Elctrns.	612-557-1277
MO	Kansas City, W.W. Grainger	816-241-5600
MO	St. Louis, W.W. Grainger	314-231-5031
NJ	Newark, W.W. Grainger	201-648-0040
NC	Charlotte, W.W. Grainger	704-376-0785
NC	Raleigh, Reptron Elctrns.	919-870-5189
OH	Cleveland, W.W. Grainger	216-398-1880
OH	Solon, Reptron Elctrns.	216-349-1415
PA	Lansdale, Reptron/Pyttronic	215-855-0925
TX	Irving, Minarik Elec.	214-402-8188
WA	Redmond, Minarik Elec.	206-885-0832
WI	Milwaukee, Elctrn. Expeditors, Inc.	800-558-8547
WI	Milwaukee, Leeds Elctrns.	414-789-6995
Can	W.W. Grainger	800-633-8487

DOTRONIX, 160 First St. SE, New Brighton, MN 55112, Tel: 612-633-1742, TWX: 910-563-3541, FAX: 612-633-7025; Empl.: 200; *Sls. Mgr.:* D. Michael Hunter, Natl. Sls. Mgr.

DOUGLAS
CORPORATION

FAX: 612-942-3125

DOUGLAS CORP., 7180 Washington Ave. So., Eden Prairie, MN 55344-3512, Tel: 612-941-3847, 1-800-728-3189; Empl.: 500 .... **B•1826**

DOUGLAS ELECTRONICS, INC., 2777 Alvarado St., San Leandro, CA 94577, Tel: 510-483-8770, FAX: 510-483-6453; Empl.: 15

DOUGLAS INTERNATIONAL, INC., 312 West State Street, Geneva, IL 60134-0761, Tel: 708-232-7419, ESYLNK: 708-232-9394

DOUGLAS
RANDALL INC.

FAX: 203-599-1754

DOUGLAS RANDALL, P.O. Box 506, 100 Mechanic St., Bldg. 26, Pawcatuck, CT 06379, Tel: 203-599-2075; Empl.: 50; *Sls. Mgr.:* Gil Yanishevsky .... **A•2144-2145; B•1473-1478; D•1155-1157**

Local Sales Offices & Reps

AL	Madison, R.W. Mitscher	205-464-0745
CA	Tormace, O'Donnell Assoc.	310-316-9445
FL	Lutz, R.W. Mitscher	813-948-2351
FL	Tequesta, R.W. Mitscher	407-575-4485
GA	Lawrenceville, R.W. Mitscher	404-923-3239
IL	Arlington Hgts., Thermek Inc.	708-577-6900
MD	Gaithersburg, Deltatronics	301-253-0615
MI	Ypsilanti, Allied Entprs.	313-434-7616
MN	Minneapolis, Automation, Inc.	612-571-3336
MN	Plymouth, R.C.O.M.	612-557-2801
MO	Bridgeton, HiTec Central	314-291-5920
MO	Independence, HiTec Central	816-796-6684
NJ	Mahwah, North East Comps	201-825-0233
NY	Penfield, Upstate Comps.	716-381-6070
NC	Raleigh, R.W. Mitscher	919-848-0941
OH	Cleveland, Allied Entprs.	216-779-0080
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Blue bell, Deltatronics	215-641-9930
TN	Johnson City, R.W. Mitscher	615-929-7258
TX	Austin, Electra Reps	512-339-1163
TX	Dallas, Electra Reps	214-248-3852
UT	Bountiful, Advance Control	801-298-8585
VA	Alexandria, Deltatronics	703-971-1733
WA	Kirkland, SPS Elctrns.	206-323-4140
Can	Mont., Que., Solid State Engrg. Co.	514-481-3313

Local Distributors

CA	Chatsworth, Mill-Comm Dist.	818-998-3111
CA	S. San Francisco, Steven Engrg.	415-588-9200
CT	Wallingford, Control Design	203-269-9955
FL	Hollywood, MRO Elctrn. Distrs.	305-966-4847
FL	Orlando, Accurate Temperature Controls.	407-292-6800
LA	Jefferson, Butler & Land	504-734-8888
MA	Middleboro, Glynn Elctrns.	508-947-4262
MN	Minneapolis, Automation, Inc.	612-571-3336
MN	Minneapolis, Control Design	612-721-1628
NC	Burlington, AC DC Elctrns.	919-226-0496
OH	Richfield, Alpha Distrs.	216-659-7100
OK	Tulsa, Butler & Land	918-665-7979
PA	Narberth, Power Modules	215-668-0664
PA	Norristown, Power Modules	215-292-8900
PA	Yeadon, Y-L Prods.	215-583-2800
TX	Dallas, Butler & Land	214-343-8800
TX	Ft. Worth, Butler & Land	817-838-9100
TX	Houston, Butler & Land	713-896-0808
TX	Tomball, Woffard Elctrns.	713-351-2255

DOVA CONTROLS, 4052 148th Ave. N.E., Redmond, WA 98052-5165, Tel: 206-881-7414, FAX: 206-861-8080; Empl.: 6; *Sls. Mgr.:* Phil Johnson

DOVER
ELECTRONICS
MANUFACTURING

FAX: 607-772-9274

DOVER ELECTRONICS MANUFACTURING, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212, Tel: 607-772-7563, TWX: 510-252-1990; Empl.: 371; *Sls. Mgr.:* Robert P. Egan .... **D•2310**

Local Sales Offices & Reps

NY	Binghamton, Dover Elctrns. Mfg.	607-772-7563

DOW CORNING CORP., Box 0994, Midland, MI 48686-0994, Tel: 517-496-4000, TELEX: 227450, TWX: 810-266-9006; Empl.: 7,000

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CORPORATION

FAX: 805-650-1734

DOW-KEY MICROWAVE CORPORATION, 1667 Walter St., Ventura, CA 93003, Tel: 805-650-0260; FSC No.: 00471; Empl.: 69; *Sls. Mgr.:* Jerry Satuloff; *Dist. Mgr.:* Jerry Satuloff .... **B•1710**

Local Sales Offices & Reps

AZ	Scottsdale, Detomasi & Grupp., Inc.	602-947-3724
CA	Dow-Key	805-650-0260
CA	Mission Hills, Detomasi & Grupp Inc.	818-365-8285
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CA	San Diego, Keller Simonsen Assocs.	619-453-5720
CA	Torrance, Detomasi & Grupp, Inc.	310-618-8898
CO	Parker, W. Howard Assoc.	303-841-5755
CT	Mount Carmel, Sci. Dvcs. Conn., Inc.	203-248-9361
FL	Indian Harbor Bch., South Eastern Comp. Sls.	407-773-3767
GA	Marietta, Gruber & Assocs.	404-993-6052
IL	Palatine, Wave Mktg.	708-934-8008
IN	Fort Wayne, Naunas Sls, Co.	219-432-4792
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Columbia, Delta III Assocs.	410-730-4700
MN	Bloomington, Bill Deming & Assocs.	612-888-5000
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NJ	Ridgefield Pk., Scientific Dvcs.	201-440-3430
NY	Rochester, Lamb Comps., Inc.	716-272-7720
OH	Miamisburg, Elctrns. Comps.	513-866-3340
TX	Richardson, Beacon Microwave	214-437-1505
TX	Round Rock, Beacon Microwave	512-244-6675
WA	Kirkland, Anzak Corp.	206-822-1510
Can	Nepean, Ont., Dynasty Comps.	613-723-0671

Local Distributors

MD	Beltsville, Allied Elctrns.	800-433-5700
MD	Beltsville, Applied Specs.	301-595-5393

DOWTY AVIONICS, 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5955, FAX: 818-447-0880; FSC No.: 10412; Empl.: 164; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Mgr. Business Dev.

DOWTY CUSTOM ELCTRNS. INC., THERMOCONTROL DIV., See Nexus Custom Elctrns., Thermocontrol Div.

DRACON DIV., See Harris Corp., Dracon Div.

DRANETZ TECHNOLOGIES, INC., 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 908-287-3680, TELEX: 499-708, TWX: 710-997-9553, FAX: 908-248-9240; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* Chris Fensham

DREEFS SWITCH, INC., 3782 Hawthorn Ct., Waukegan, IL 60087, Tel: 708-662-7667, 800-323-9605, FAX: 708-662-0906; Empl.: 29; *Sls. Mgr.:* Ed Magiera; *Dist. Mgr.:* Ed Magiera

DRESSER INSTRUMENT DIV., Dresser Industries, 250 East Main St., Stratford, CT 06497, Tel: 203-378-8281, FAX: 203-385-0408; Empl.: 1500; *Sls. Mgr.:* William Mahoney; *Dist. Mgr.:* Richard Gordon .... **B•1933**

Local Sales Offices & Reps

AL	Mobile, District Sls. Off.	205-473-1692
CA	Long Beach, Pacific Reg. Sls. Off.	310-595-4691
IL	Roselle, Midwest Reg. Sls. Off.	708-980-9030
PA	WillowGrove, Atlantic Reg. Sls. Off.	215-657-2886
TX	Houston, Southwest Reg. Sls. Off.	713-590-1092

Local Distributors

AL	Mobile, Bell & Co.	205-432-5666
AZ	Mesa, Aztech Controls Corp.	602-966-4400
CA	San Francisco, Leighton Stone Corp.	415-285-3600
CO	Englewood, Applied Control Equip.	303-799-9300
CT	Newington, Reet Corp.	203-667-1584
FL	Tampa, Solares Florida Corp.	813-622-8822

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(510) 835-1500
1026 6th. AVENUE
OAKLAND, CA 94606

GA	Decatur, Solares S.E. Corp.	404-981-9282
HI	Honolulu, Process Vlv. & Control	808-834-7675
IL	Peoria, Tecco, Inc.	309-692-2312
IN	Indianapolis, Jay Instr.	317-639-6494
KS	Wichita, Tulsa Gauge & Instr.	316-267-6088
KY	Jefferstown, Jay Instr.	502-491-0560
MD	Millersville, Hi-Tech, Inc.	410-987-4000
MI	Warren, Smith Instr. & Equip.	313-755-3110
MN	Minneapolis, Power Sy & Engrg.	612-827-5743
MO	St. Louis, O'Brien Equip.	314-781-6400
NJ	Hohokus, Valley Tech. Sls.	201-670-8070
NY	Orchard Park, David S. Reynolds	716-821-5921
NC	Charlotte, Ind. Valve & Gauge	704-333-3786
OH	Medina, Stress Anal. Svcs.	216-725-7733
OK	Tulsa, Tulsa Gauge & Instr.	918-622-5061
OR	Portland, Steam Sy. & Rubber	503-228-9625
RI	Cranston, Intl. Supply	401-944-1600
SC	Greer, Trask Instrumn.	803-848-3993
TN	Memphis, Centro, Inc.	901-357-1261
TX	Dallas, Inotek Corp.	214-243-8370
VA	Midlothian, Associated Tech., Inc.	804-794-6094
WA	Seattle, Steam Supp. & Rubber	206-622-4690
WI	Mequon, Simone Engrg.	414-243-3600

DRI-DEK CORPORATION, 2706 South Horseshoe Dr., Naples, FL 33942, Tel: 800-348-2398, FAX: 800-828-4248; *Sls. Mgr.:* Carol Smykowski

DRIVECON CORPORATION, 1840 Industrial Dr., Ste. 220, Libertyville, IL 60048, Tel: 708-918-1406, FAX: 708-918-7427; Empl.: 8; *Sls. Mgr.:* Richard Parat; *Dist. Mgr.:* Richard Parat

DRUMLIN, Micro/Sys, Inc., 3447 Ocean View Blvd., Glendale, CA 91208, Tel: 818-244-4600, FAX: 818-244-4246

DSA, INC. DIRECT SOUND CORPORATION, See Direct Sound Corporation

DSP TECHNOLOGY, 48500 Kato Rd., Fremont, CA 94538-7338, Tel: 510-657-7555, TELEX: 263608, FAX: 510-657-7576; Empl.: 75; *Sls. Mgr.:* Robert LeBrun

DUBBELDEE HARRIS DIAMOND CORP.:D. DRUKKER & ZN. N.V., 100 Stierli Ct., Mt. Arlington, NJ 07856, Tel: 201-770-1420, TELEX: RCA 236064, FAX: 201-770-1549; *Sls. Mgr.:* Keith Harris

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174-9984, Tel: 708-584-2300, TELEX: 720426, FAX: 708-584-2792; FSC No.: 5830 Group 58; Empl.: 650; *Sls. Mgr.:* Warren Anderson, VP of Sls.; *Dist. Mgr.:* Sam Boskovich, Distr. Devel. Mgr.

DUMONT OSCILLOSCOPE, E & R Electronics, Inc., 323 New Road, Parsippany, NJ 07054, Tel: 201-575-8666, TELEX: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* Edward Petrasek

DUNCAN ELECTRONICS
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DUNCAN ELECTRONICS, 2865 Fairview Rd., Costa Mesa, CA 92626, Tel: 714-545-8261; FSC No.: 5905;Multiple; Empl.: 110; *Sls. Mgr.:* J. Colligan; *Dist. Mgr.:* S. Huntley **A•2078-2079**

Local Sales Offices & Reps

AL	Huntsville, L. & D., Inc.	205-837-1469
AZ	Tempe, Southwest E/M Engrg.	602-831-1795
AR	El Dorado, Kemp Instruments, Inc.	501-862-5869
CA	Irvine, English/Damco Sls.	714-753-1950
CA	Santa Clara, Caltron Comps.	408-980-0181
CT	Bloomfield, SIR/DSA	203-243-9235
FL	Boca Raton, R.O. Whitesell & Assoc.	407-393-6139
FL	Longwood, R.O. Whitesell & Assoc.	407-682-6662
FL	Palm Harbor, R.O. Whitesell & Assoc.	813-787-0898
GA	Atlanta, L. & D., Inc.	404-395-7079
IL	Arlington Hgts., KMA Sales Co.	708-398-5300
IN	Indianapolis, Mktg. Engrs., Inc.	317-872-5665
KS	Shawnee Mission, Florence & Meyer	913-722-5210
LA	Lafayette, Kemp Instruments, Inc.	318-269-9452
MA	Westford, SIR/DSA	508-692-2500
MI	Walled Lake, Elcon O.E.M. Sls.	313-960-9680
MN	New Brighton, The Mackubin Grp.	612-636-5533
NY	Buffalo, Advanced Comps.	716-832-6791
NY	Dix Hills, Sencor	516-499-7748
NY	E. Syracuse, Advanced Comps.	315-437-6700
NY	Endicott, Advanced Comps.	607-785-3191
NC	Raleigh, L. & D., Inc.	919-876-5301
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Westlake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
OK	Tulsa, Kemp Instruments, Inc.	918-663-4501
PA	Wynnewood, Metz-Jade Assoc., Inc	215-896-7300
TX	Addison, Kemp Instrs., Inc.	214-931-7100
TX	Houston, Kemp Instruments, Inc.	713-466-1465
TX	Marble Falls, Kemp Instruments, Inc.	512-598-6115
WA	Camas, Elctrn. Mktg. Grp.	206-834-6548
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Milwaukee, KMA Sales Co.	414-259-1771

DUPLICON, INC., 516 E. Second St., S. Boston, MA 02127, Tel: 617-269-5859, FAX: 617-269-5484; FSC No.: 0ASD8; Empl.: 3; *Sls. Mgr.:* William A. Currier

DUPONT CONNECTOR SYSTEMS, See BERG Electronics

DUPONT ELECTRO-OPTIC PRODUCTS, Dupont Electronics, P.O. Box 13625, Research Triangle Park, NC 27709, Tel: 1-800-888-LAN1, 919-481-5100, FAX: 919-481-0753; Empl.: 65; *Sls. Mgr.:* Glenn R. Constable

DUPREE, INC., 14395 Ramona Ave., Chino, CA 91710, Tel: 909-597-4889, FAX: 909-597-3043; Empl.: 65

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FAX: 203-791-3273

DURACELL INC., OEM Sales & Marketing, Berkshire Corporate Park, Bethel, CT 06801, Tel: 203-791-3274; Empl.: 8000; *Sls. Mgr.:* Cal Nicholson, Natl. Sls. Mgr. **D•1435-1438**

Local Sales Offices & Reps

CA	Newport Beach, Duracell Inc.	714-720-8111
CT	Danbury, Duracell Inc.	203-790-7541
IL	Oak Brook, Duracell Inc.	708-954-2714

Local Distributors

CA	Costa Mesa, Battery Specialties Inc.	714-755-0888, FAX:714-755-0889
CA	Mtn. View, Energy Sales. Inc.	415-969-0800,F, 415-961-2000
CA	San Diego, Tauber Elctrns. Inc.	619-274-7242, FAX:619-274-2220
IL	Downers Grove, Telecommunication Dvcs.	312-971-3460,FAX:312-971-3903
MA	Sharon, Adcour	617-784-8123,FAX:617-784-5565
MN	St. Paul, DC Battery Prods.	612-646-7478, FAX:612-646-5018
NY	Bohemia, Battery Assemblers, Inc.	516-567-8855, FAX:516-567-8278
NY	Commack, Bren-Tronics Inc.	516-499-5155, FAX:516-499-5504
NY	Mt. Kisco, Multiplier Industries. Corp.	914-241-9510,FAX:914-241-1103
NC	Winston Salem, Progressive Technologies, Inc.	919-761-1375,FAX:919-748-0495
TX	Stafford, Southwest Electronics Inc.	713-240-4000, FAX:713-240-5672

DURAKOOL, See American Electronic Components

DUREL CORPORATION, Affiliate of 3M & Rogers Corp., 645 W. 24th St., Tempe, AZ 85282, Tel: 602-731-6200, FAX: 602-731-6210

DURGIN & BROWNE, See Tridyne Process Systems, DBI Inds.

DURMITOR INC., Box 413, 23 Crossley Ct., King City, Ont., Canada LOG 1K0, Tel: 416-833-3148, FAX: 416-833-2112; FSC No.: IC560; Empl.: 6

DUTEC, INC., 4801 James McDivitt, P.O. Box 964, Jackson, MI 49204-0964, Tel: 800-248-1632, FAX: 517-750-4740; *Sls. Mgr.:* Bruce Reynolds, Gen. Mgr.

Local Sales Offices & Reps

FL	Pompano Beach, Digital I/O Assocs.	305-785-1255
TN	Knoxville, Will Hogue & Assocs.	615-691-9749
TX	Missouri City, Ron Stewart & Assocs.	713-438-2565
VA	Herndon, Instrulogic	703-318-0000

Local Distributors

AZ	Phoenix, Summit Elec.	602-957-1100
CA	Laguna Hills, Measurequipment	714-831-8766
CO	Englewood, Applied Controls Equipmt.	303-799-9300
GA	Dalton, Indl. Controls	706-275-4400
IL	Chicago, Don Johns Engrg.	312-666-2210
MA	Harvard, Douglas Lee Assocs.	508-772-9887
MI	Burton, Fenton Sys., Inc.	313-742-3580
NV	Sparks, Applied Indl. Ctrls.	702-356-7401
NM	Albuquerque, Summit Elec.	505-884-4400
NY	Oyster Bay, Cascade Grp.	516-624-9362
OH	Chesterfield, EQS Sys.	800-729-8084
OR	Portland, R & T Factors, Inc.	503-287-6114
UT	Salt Lake City, Protronix Controls	800-464-2456
WI	Waukesha, Wisconsin Controls, Inc.	414-542-1588
Can	Edmonton, Alberta, Dycor Indl. Research	800-663-9267
Can	Scarborough, Ont., Multitest Elctrns.	416-609-8396

DY 4 SYSTEMS INC., 21 Fitzgerald Rd., Nepean, Ont., Canada K2H 9J4, Tel: 613-596-9911, FAX: 613-596-0574; FSC No.: 0BYC3; Empl.: 200; *Sls. Mgr.:* Don Waterman

DYLON GRAPHITE COMPANY, Dylon Industries, Inc., 7700 Clinton Rd., Cleveland, OH 44144, Tel: 216-651-1300, FAX: 216-651-1777; Empl.: 45; *Sls. Mgr.:* K.A. Partee

DYMEC INC., 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870; Empl.: 50

DYNACAST INC., 1401 Front Street, Yorktown Heights, NY 10598, Tel: 914-962-6300, FAX: 914-245-7185; Empl.: 150; *Sls. Mgr.:* David Simas

DYNACIRCUITS MFG., CO., 11230 W. Addison, Franklin Park, IL 60131, Tel: 708-451-1700, FAX: 708-451-9266; Empl.: 300; *Sls. Mgr.:* Dennis A. Dworzak

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DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3462, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; FSC No.: 9Y852; Empl.: 25; *Sls. Mgr.:* Sidney C. Oakleaf ... **A•2318-2321; D•1660-1664**

DYNALCO CONTROLS, 3690 N.W. 53 St., Ft. Lauderdale, FL 33309, Tel: 305-739-4300, FAX: 305-484-3376; Empl.: 85; *Sls. Mgr.:* Duane Dement

DYNALLOY, INC., 18662 MacArthur Blvd., Ste.103, Irvine, CA 92715, Tel: 714-476-1206, FAX: 714-476-3167; Empl.: 25

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, FAX: 201-887-3678; FSC No.: 27908; Empl.: 19; *Sls. Mgr.:* Jay Parton

DYNAMATION TRANSDUCERS CORPORATION, 348 Marshall St., Holliston, MA 01746, Tel: 508-429-8440, FAX: 508-429-1317 **A•2081-2083**

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMIC POWER SYSTEMS, 12 Sunhill Road, Nesconset, NY 11767, Tel: 516-361-6771, 1-800-422-0708, FAX: 516-361-6361; Empl.: 5; *Sls. Mgr.:* Dorian Robins; *Dist. Mgr.:* Jim Nemec

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, TELEX: 69-6171, FAX: 818-407-1320; Empl.: 30; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193, Tel: 508-658-6100, FAX: 508-658-0522; Empl.: 125; *Sls. Mgr.:* Joe Portada **B•1935**

Local Sales Offices & Reps

CO	Northglean, Jim Reid;Reg. Mgr.	303-457-9666
WI	West Bend, Dennis Herr, Reg. Sls. Mgr.	414-675-2331

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 150

DYNAPOWER CORPORATION, Box 9210, S. Burlington, VT 05407, Tel: 802-860-7200, FAX: 802-864-3782; Empl.: 100; *Sls. Mgr.:* John S. Hurst **D•1665-1667**

Local Sales Offices & Reps

MI	Farmington Hills, Dynapower Corp.	313-471-1800

DYNAROLL CORPORATION, 551 A Fifth St., San Fernando, CA 91340, Tel: 818-837-3456, FAX: 818-837-3466; *Sls. Mgr.:* Roy Wilson; *Dist. Mgr.:* Molly Kosmak

DYNISCO, 4 Commerical St., Sharon, MA 02067, Tel: 617-784-8400, TELEX: 174-292, FAX: 617-784-2902; FSC No.: 15687; Empl.: 153; *Sls. Mgr.:* Richard McQuiggan

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, FAX: 516-669-0785; FSC No.: 72794; Empl.: 140; *Sls. Mgr.:* John Scappatura; *Dist. Mgr.:* John Scappatura

EAGLE ELECTRIC MFG. CO. INC., 45-31 Court Square, Long Island City, NY 11101, Tel: 718-937-8000, FAX: 718-482-0160; Empl.: 3000; *Sls. Mgr.:* Joseph Mannarino; *Dist. Mgr.:* Bob Lofgren

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, FAX: 317-299-1323; FSC No.: 34718; Empl.: 34; *Sls. Mgr.:* Gary Noble

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EAGLE-PICHER, Box 47, Joplin, MO 64801, Tel: 417-623-8000; FSC No.: 81855; Empl.: 700; *Sls. Mgr.:* Douglas Pennington ... **D•1440-1445**

Local Sales Offices & Reps

AR	Hot Springs, ASI Inc.	501-767-5444
CA	Torrance, O'Donnell Assoc.	310-781-2235
OR	Beaverton, Pacific Mktg.	503-641-9373
TX	Irving, Space Elctrns.	214-251-3636
Can	Toronto, CEA Associated	416-231-9717

EAGLE-PICHER, P.O. Box 130, Bethel Road, Seneca, MO 64865; Tel: 417-776-2256, FAX: 417-776-2257; FSC No.: 3L498; Empl.: 400; *Sls. Mgr.:* Earl Anderson; *Dist. Mgr.:* Earl Anderson ... **D•1440-1442**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, Shefler-Kahn Co. Inc.	602-581-0884
AR	Hot Springs, Automation Supp. Inc. (ASI)	501-767-5444
CA	Orange, Prism Assocs.	714-283-8744
CA	San Jose, O'Donnell Assocs.-North	408-263-6500
CA	Santa Clara, Quorum Tech. Sls.	408-980-0812
CA	Torrance, O'Donnell Assoc.	213-539-9664
CO	Broomfield, Connors Co.	303-466-9628
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Longwood, NSL Assocs., Inc.	305-629-5226
GA	Atlanta, Elctrn. Solutions, Inc.	404-396-2541
IL	Woodbridge, Golten Assocs.	708-985-5100
KS	Overland Park, Spectrum Sls.	913-648-6811
MA	Westboro, Zaslow Sls. Co.	617-393-8150
MI	Livonia, Electro-Mktg. Grp., Inc.	313-421-7590
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Londonderry, Zaslow Sls. Co.	603-432-8907
NH	Nashua, Key Sls. of New England, Inc.	603-880-0110
NY	Massapequa Pk., HC Assocs.	516-541-0262
NY	Morrisville, Naylor Elec. Co.	315-684-9620
NC	Raleigh, L & D Inc.	919-876-5301
OH	Dayton, Electro-Mktg. Grp., Inc.	513-890-8322
OH	Dayton, Lyons Corp.	513-278-0714
OR	Beaverton, Pacific Mktg. Spec.	503-641-9373
TX	Dallas, Rem Air Comps.	214-234-1069
WA	Redmond, Pacific Mktg. Spec.	206-882-3144
Can	Mississauga, Continental Elctrn. Assocs.	416-602-9717

Local Distributors

AZ	Tempe, Lynntronics	602-433-0288
AR	Hot Springs, Automation Supp. Inc.	501-767-5444
CA	Anaheim, Carefree Unltd.	714-630-3433
CA	Mountain View, The Power Source	415-960-0700
CO	Denver, Car-Go Battery Co.	303-296-8763
FL	Dunedin, Battery Powered Lighting & Sys.	813-734-9498
GA	Smyrna, Mark C. Pope Assocs.	404-435-2471
IL	Cincinnati, M & B Battery	513-385-5900
IL	Villa Park, The Battery Shop	708-833-6300
KS	Wichita, RSC Elctrns.	316-267-5213
LA	New Orleans, William B. Allen	800-535-9593
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Methuen, Generation Elctrns., Inc	508-683-1177
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
NJ	Teterboro, Engrd. Assemblies	201-288-4477
OH	Cincinnati, M & B Battery	513-385-5900
PA	Bensalem, Scotts Emergency Lighting	215-639-1777
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Lubbock, R & R Elctrn. Supply Co.	806-765-7727
UT	Salt Lake City, Standard Supp. Co.	801-846-3371
WA	Seattle, Radar Electric	206-282-2511
WI	Milwaukee, Battery Shop	414-384-5410
Can	New Westminster, B.C., Magnacharge Battery	604-525-0391
Can	Toronto, Continental Elctrn. Assocs.	416-602-9717

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E & L INSTRUMENTS, Interplex Electronics, Inc., 70 Fulton Terrace, New Haven, CT 06512, Tel: 800-368-0880, FAX: 203-468-0060; Empl.: 40; *Sls. Mgr.:* Katina Boulais

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ... **B•1713**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg. Co. of AZ	602-949-9333
CA	Los Gatos, Luscombe Engrg. Co. of S.F.	408-370-2020
CA	Montrose, Signal Entprs.	818-957-0640
CA	San Diego, Signal Entprs.	619-679-5086
CO	Longmont, Luscombe Engrg. Co. of CO	303-772-3342
CT	Bethel, Ray Perron & Co.	203-798-0261
CT	Waterbury, Ray Perron & Co., Inc.	203-756-9684
FL	Tampa, Florida Comp. sls.	813-873-3622
GA	Alpharetta, Pinnacle Mktg.	404-410-9980
IL	Arlington Hgts., Brainard-Nielsen Mktg., Inc.	708-437-2700
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Delltron Co., Inc.	319-393-0075
MD	Columbia, Delta III Assocs., Inc.	410-730-4700
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Plymouth, Jay Mktg. Assocs., Inc.	313-459-1200
MN	Plymouth, Highland Elctrn. Sls.	612-557-7002
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	Rochester, Apex Assocs., Inc.	716-272-7040
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OR	Lake Oswego, Luscombe Engrg. Northwest	503-636-6664
PA	Horsham, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, R. W. Kneip	412-823-0169
TX	Dallas, Glidden Electro Equip. Co	214-341-0610
UT	Salt Lake City, Luscombe Engrg. Utah	801-268-3434
WA	Bellevue, Luscombe Engrg. N.W.	206-223-1541
WI	Mequon, Badgerep	414-241-9200

Local Distributors

AZ	Phoenix, Minarik Elec.	602-233-3000
AZ	Scottsdale, Electronic Supp.	1-800-622-3726
CA	Anaheim, Minarik Elec. Co.	714-994-2251
CA	Cupertino, Cal. Switch & Signal	408-279-8848
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Fresno, Minarik Elec. Co.	209-255-8089
CA	Gardena, California Switch & Sig.	310-538-9830
CA	Glendale, Minarik Elec. Co.	818-507-6500
CA	Ontario, Minarik Elec. Co.	714-391-0064
CA	Riverside, Electronic Supp.	909-683-7300
CA	S. San Francisco, Bell Elctrl. Supp.	415-589-7055
CA	Salinas, Bell Elctrl. Supp.	408-758-6110
CA	San Diego, Electronic Supp.	619-693-8222
CA	San Diego, Minarik Elec. Co.	619-560-6632
CA	San Jose, Electronic Supp.	408-453-3770
CA	San Jose, Minarik Elec. Co.	408-955-9030
CA	Santa Clara, Bell Elctrl. Supp.	408-727-2355
CA	Sunnyvale, Target Elctrns., Inc.	408-733-0384
CA	Van Nuys, Wes-Garde Comp. Grp.	213-873-4802
CO	Commerce City, Minarik Elec. Co.	303-289-5800
CO	Denver, CSID, Inc.	303-292-9594
CT	Hartford, Wes-Garde Comp. Grp.	203-525-6907
CT	Wallingford, Sager Elec. Supp. co.	203-265-4600
FL	Lakeland, Wes-Garde/Switch Controls, Inc.	813-644-7564
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Oviedo, Dixie Sls.	407-365-5211
GA	Atlanta, Motion Elctrns.	404-455-8262
GA	Norcross, Sager Elctrns.	404-446-0085
IL	Carol Stream, Wes-Garde Comp. Grp.	708-653-1460
IL	Elk Grove, Martec Assoc.	708-956-8090
IL	Rosemont, Advent Elctrns., Inc.	708-297-6200
IL	Schaumburg, Marsh Elctrns.	708-240-9290
IL	Schaumburg, Minarik Elec. Co.	708-885-9337
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	Baton Rouge, Menard Elctrns.	504-355-0323
LA	New Orleans, Menard Elctrns.	504-734-8445
ME	Bar Mills, Nelson & Wright	207-929-8238
MD	Columbia, Sager Elctrns.	410-995-4900
MD	Gaithersburg, Axis Elctrns.	301-840-9640, 800-368-2815
MD	Jessup, Treeko Sls.	410-470-3300
MA	Hingham, Sager Elec. Supp. Co.	617-749-6700
MA	N. Billerica, Minarik Elec. Co.	508-663-0740
MA	Walpole, Richey Impact Elctrns.	508-668-8200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	St. Claire Shores, SPEMCO Switches	313-771-2700
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MO	St. Louis, Beckwith, Inc.	314-343-6463
MO	St. Louis, Wes-Garde Comp. Grp.	314-567-7776
NH	Salem, Sager Elec. Supp. Co.	603-898-1348
NJ	Cranford, Garden State Indl. Elctrns., Inc.	908-272-6400
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
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NC	Charlotte, Resource/Dixie Elctrns.	704-521-8682
NC	Raleigh, Sager Service Plus	919-850-9550
NC	Winston-Salem, Kirkman Elctrns., Inc.	919-722-9131,800-334-8688
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Highland Hgts., Electronics Mktg. Corp.	216-442-3441
OH	Westerville, Wes-Garde Comp. Grp.	614-885-0319
OR	Portland, Minarik Elc. Co.	503-253-3402
PA	Harrisburg, Ad-Tech Elctrns.	717-561-9905
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Norristown, Kimberly-James Co.	215-666-7286
PA	Philadelphia, Sager Elctrns.	215-464-4336
PA	Wayne, Peak Elctrns. Corp.	215-293-9000
SC	Columbia, Resource/Dixie Elctrns.	803-779-5332
TN	Lawrenceburg, Mfg. Solutions	615-762-8773
TX	Dallas, Wes-Garde Comp. Grp.	214-357-1768
TX	Houston, Minarik Elec. Co.	713-847-0808
TX	Irving, Minarik Elec. Co.	214-402-8188
TX	San Antonio, Minarik Elec. Co.	210-822-7097
UT	W. Valley City, IEC/Utah	801-977-9750
VA	Glen Allen, Hermitage Distrs.	804-550-3030
WA	Bellevue, Minarik Elec. Co.	206-649-0880
WA	Seattle, Platt Elec.	206-624-4083
WI	Milwaukee, Marsh Elctrns. Corp.	414-475-6000

E-A-R SPECIALTY COMPOSITES, Cabot Safety Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-692-1111, FAX: 317-692-3111; *Sls. Mgr.:* Greg R. Handy

EASI FILE, 6 Wrigley St., Irvine, CA 92718, Tel: 714-855-4121, FAX: 714-380-0561; Empl.: 10; *Sls. Mgr.:* Jean A. James

EAST CONTROLS, 6851 Church St., Hanover Park, IL 60103, Tel: 708-837-7709, TELEX: 708-837-6235; Empl.: 1

EASTERN AIR DEVICES, INC., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, FAX: 603-742-9080; Empl.: 150; *Sls. Mgr.:* K. Russo .... **B•1249**

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OH	Cincinnati, KCH Co.	513-931-1686
OR	Bellevue, Eltech Co.	206-643-4330
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WI	Racine, KMG Sls., Inc.	414-639-9005

Local Distributors

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EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 800-835-2393, FAX: 516-483-7071; Empl.: 6; *Sls. Mgr.:* L. Sherman; *Dist. Mgr.:* L. Sherman

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EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, 800-289-3866, TWX: 910-260-3713, FAX: 414-261-9097; Empl.: 350

EATON CORPORATION, Industrial Controls Division, 3122-14th Avenue, Kenosha, WI 53141, Tel: 414-656-4011, 800-356-5077, TELEX: 910-274-2356, FAX: 414-656-4370; Empl.: Approx. 300

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EBG-ELEKTRONISCHE BAUELEMENTE, Gesellschaft m.b.H., 8082 Kirchbach 384, Austria, Tel: (43) 03116 2625, TELEX: 312540, FAX: 43/3116/27540; Empl.: 63; *Sls. Mgr.:* Mag. G. Klauser

EBM INDUSTRIES, INC., 110 Hyde Road, Farmington, CT 06034, Tel: 203-674-1515, FAX: 203-674-8536; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski .... **C•1578-1579**

EBY COMPANY, 4300 H Street, Philadelphia, PA 19124, Tel: 215-537-4700, FAX: 215-537-4780; FSC No.: 72825; Empl.: 75; *Sls. Mgr.:* Alan S. Olshansky

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ECHO SPEECH CORP., 6420 Via Real, Carpinteria, CA 93013, Tel: 805-684-4593, FAX: 805-684-6628; *Dist. Mgr.:* Mark Pfeffer

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ECLIPTEK CORPORATION, 3545-B Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-433-1200; FSC No.: 0GUG6; Empl.: 70; *Sls. Mgr.:* Bob Bishop; *Dist. Mgr.:* Bob Bishop .... **A•1258, 1326, 1383-1387**

Local Distributors

AL	Huntsville, Ecliptek Corp.	205-830-4228
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NJ	Marlton, Ecliptek Corp.	609-596-8500

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ECM MOTOR COMPANY, 1099 Proctor Dr., Elkhorn, WI 53121, Tel: 414-723-6400, FAX: 414-723-7373; Empl.: 500; *Sls. Mgr.:* Robert Forschler

ECOSOFT, INC., 8295 Indy Court, Indianapolis, IN 46214, Tel: 317-271-5551, FAX: 317-271-5561; Empl.: 2; *Sls. Mgr.:* Emma Alkire

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ECS COMPOSITES, 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, Tel: 503-476-8871; FSC No.: 24995; Empl.: 112; *Sls. Mgr.:* Jill K. Gleysteen ... **C•1021**

Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
CA	Garden Grove, Elctrn. Pkg. Solutions	714-638-4455
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
CA	Mtn. View, Kim Buurma	415-962-9027
CO	Englewood, Electronic Comp. Sys.	303-762-9576
FL	Altamonte Springs, EMA	407-339-2333
FL	Winter Springs, Harold Scott	407-699-1888
GA	Roswell, EMA	404-992-7240
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Needham, Apex Assocs.	617-444-8070
NY	New York City, Smith Engrg. Sls.	516-689-6514
NC	Raleigh, EMA	919-846-6888
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
OR	Grants Pass, ECS Inc.	503-476-8871
TX	Dallas, Advance Tech. Sls.	214-340-1300
Can	Stittsville, Ont., Production Case Co.	613-836-2248

Ectron CORPORATION

FAX: 619-278-0372

ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111-1980, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford .... **D•1010**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Tempe, Aztec Entprs.	602-431-8401
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Fremont, FLW Inc.	510-651-6511
CA	Oxnard, FLW Inc.	805-984-0167
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	407-724-0920
GA	Norcross, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850

IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
KS	Independance, Ramsey Assocs.	816-373-3111
MD	Laurel, Elctrn. Mktg. Assoc.	301-792-9300
MA	Needham, Addelco Corp.	617-444-4754
MI	Troy, Satullo Assocs.	313-585-4811
MN	Minneapolis, Sector Engrg. Sls. Inc.	612-378-2123
MO	St. Louis, Ramsey Assocs.	314-532-9386
NM	Albuquerque, Westfhal & Assocs.	505-268-1433
NY	Liverpool, Northern Tech Sls.	315-451-1090
NY	Plainview, Eastern-Metro Assoc.	516-931-1414
NC	Clayton, Saber Assocs.	800-327-0853
OH	Cleveland, Instrmn. Sys.	216-845-8800
OH	Dayton, Instrmn. Sys.	513-294-2838
PA	Pittsburgh, Instrmn. Sys.	412-823-7005
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Seattle, Datacom Assoc. Inc.	206-285-2525
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280
Can	Toronto, Intertechnology, Inc.	416-445-5500

EDAC INC

FAX: 514-333-2881

EDAC INC., 5778 Thimens, St. Laurent, Que., CAN H4R 2K9, Tel: 514-333-7288, 1-800-565-2811; FSC No.: 31781; Empl.: 80; *Sls. Mgr.:* Terry Thornton; *Dist. Mgr.:* Terry Thornton .... **C•1311-1313**

Local Sales Offices & Reps

AZ	Mesa, Hartland Sls.	602-834-7042
CA	Napa, Stewart Fullerton Assocs.	707-258-1160
CA	Redondo Beach, Jerde & Assocs.	310-372-8637
CA	San Diego, Centinske Sls.	619-487-3335
CO	Littleton, Romulus Elctrns.	303-770-4888
CT	Bloomfield, S.I.R. Assocs.	203-243-9343
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
FL	Maitland, Krutek & Assocs.	407-628-4837
GA	Norcross, F & J Squared	404-368-9191
IL	Lisle, W. G. Controls	708-963-5954
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Westford, S.I.R. Assocs.	508-692-2500
MI	Livonia, Leading Edge Sls.	313-478-6700
MN	Minneapolis, George Russell & Assocs.	612-854-1160
NY	Port Washington, Ashtec Inc.	516-767-0336
OH	Medina, J.C. Hofstetter	216-241-4880
OR	Beaverton, Quest Mktg. Inc.	503-641-7377
PA	Horsham, Jacobsen Assocs.	215-674-2937
SC	Tega Cay, F & J Squared	803-548-2133
TX	Dallas, Marketronics	214-388-2237
WA	Renton, Quest Mktg.	206-228-2660
Can	Montreal, Shelly Newman	514-486-6984
Can	North Vancouver, Arwin Technical Sls.	604-980-4557
Can	Scarborough, Edac Inc.	416-754-3322

EDA INC., Div. of Connector, 637 S. Palm St. Ste. F, La Habra, CA 90631, Tel: 213-697-7151, FAX: 213-691-1509; Empl.: 160; *Sls. Mgr.:* Roy Wang

EDA INSTRUMENTS, INC., 4 Thorncliffe Park Dr., Toronto, ON, Canada M4H1H1, Tel: 416-425-7800, TELEX: 06 23222 FEDA TOR, FAX: 416-425-8135; Empl.: 100; *Sls. Mgr.:* Bill Laham

EDAK INC., EDAK Ltd., 285 North Drive,Ste.H, Melbourne, FL 32934, Tel: 407-242-2953, 800-462-8478, FAX: 407-242-3430; FSC No.: 8145; Empl.: 210; *Sls. Mgr.:* Max Reichlin; *Dist. Mgr.:* Jack Lenett

EDAL INDUSTRIES, 4 Short Beach Rd., East Haven, CT 06512, Tel: 203-467-2591, FAX: 203-469-5928; FSC No.: 06288; Empl.: 75; *Sls. Mgr.:* Dino Vagnini; *Dist. Mgr.:* Dino Vagnini

EDCLIFFE DIV., BEI Electronics Co., 13100 Telfair Avenue, Sylmar, CA 91342, Tel: 818-362-7151, FAX: 818-362-2487; FSC No.: 00153; Empl.: 110; *Sls. Mgr.:* Cosmo L. Avellis

EDITRON SYSTEMS INC., 1560 Teaneck Rd., Teaneck, NJ 07666, Tel: 201-837-0051, FAX: 201-837-0504; *Sls. Mgr.:* Joseph G. Bentitou

EDL, INC., Rt. 5, Box 1398, Danville, VA 24540, Tel: 804-799-0807, 1-800-DIAL EDL, FAX: 804-799-0847; FSC No.: 27281; Empl.: 35; *Sls. Mgr.:* Jean Moore

EDO CORPORATION, Acoustics Division, 2645 South 300 West, Salt Lake City, UT 84115, Tel: 801-486-2115, TELEX: 388-315, FAX: 801-484-3301; Empl.: 300; *Sls. Mgr.:* Yvonne Bartholomew

EDWARDS CO., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06034, Tel: 203-678-0410; Empl.: 1000; *Sls. Mgr.:* Al Canevari; *Dist. Mgr.:* Al Canevari

EDWARDS HIGH VACUUM INTERNATIONAL, Div. of the BOC Group, 301 Ballardvale St., Wilmington, MA 01887, Tel: 508-658-5410, 800-848-9800, FAX: 508-658-7969; Empl.: 5000; *Sls. Mgr.:* Diane Busch

EECO DIV.,TRANSICO INC., 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, Tel: 714-835-6000, FAX: 714-953-3747; FSC No.: 97525; Empl.: 140; *Sls. Mgr.:* Greg Littler; *Dist. Mgr.:* Steve Hyter

EEMCO, Datron, Inc., 4585 Electronics Pl., Los Angeles, CA 90039, Tel: 818-247-7060, FAX: 818-244-6621; FSC No.: 72121; Empl.: 200; *Sls. Mgr.:* Russell Johnson

EEV INC., 4 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-6050, TELEX: 6818096, FAX: 914-682-8922; Empl.: 36; *Sls. Mgr.:* Mike Kirk

EFD INC., 977 Waterman Ave., E. Providence, RI 02914, Tel: 800-556-3484, 401-434-1680, FAX: 401-431-0237; Empl.: 150

EFECTOR, INC., a subsidiary of ifm electronic, 805 Springdale Dr., Exton, PA 19341, Tel: 215-524-2000, 800-441-8246, FAX: 215-524-2010; Empl.: 70; *Sls. Mgr.:* J. Kelly

EFI ELECTRONICS CORP., 2415 South 2300 West, Salt Lake City, UT 84119, Tel: 801-977-9009, 800-877-1174, FAX: 801-977-0200; Empl.: 130; *Sls. Mgr.:* Mark A. Norrie

EFOS INC., 5716 Coopers Ave., Unit 1-5, Mississauga, Ont., Can L4Z 2E8, Tel: 416-568-4268, FAX: 416-568-4280; Empl.: 25-50; *Sls. Mgr.:* Beverley Barber

EFRATOM, See Ball Corp., Efratom Div.

EG&G, INC., Electronics Components Div., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 329; *Sls. Mgr.:* J. Murachver

EG & G BIRTCHER, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, Tel: 818-442-2572, FAX: 818-442-8127; FSC No.: 18915; Empl.: 115; *Sls. Mgr.:* Bill Hayes; *Dist. Mgr.:* Bill Hayes .... **C•1022, 1135**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Eng. Sls.	602-265-0344
CA	Huntington Beach, EG & G Rotron	714-848-7550
CO	Broomfield, Conners Co.	303-466-9628
FL	Winter Park, EG & G Rotron	407-671-5935
IL	Inverness, Heartland	708-358-6622
IN	Indianapolis, Heartland	317-845-5480
MD	Towson, Arbotek	301-825-0775
MA	Chelmsford, EG & G Rotron	508-256-6061
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114
NY	Syracuse, Hotze & Murcon	315-455-8807
OH	Dayton, Electro Mktg. Grp.	513-890-8322
OR	Portland, Halbar/RTS	503-244-4123
PA	Lancaster, EG & G Rotron	717-392-8805
TN	Mil Spec Sls.	615-360-7714
WA	Vashon, Halbar/RTS	206-285-1363
WI	Brookfield, Heartland	414-789-6860
Can	Bolton, Ontario, P.J. Heenan Ltd.	416-857-4948

Local Distributors

AZ	Phoenix, Aero-Space Southwest Inc.	800-289-2779,602-582-2779
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CO	Aurora, Jet Elctrns. Supp. Co., Inc.	303-364-1000
CT	S. Windsor, Car-Lac Elctrns.	203-282-0631
KS	Shawnee Mission, Aero-Space Computer Supp.	913-432-8508
MA	Milford, Car-Lac Elctrns.	508-478-7797
MA	Winchester, Webb Distr/Distrbn.	617-729-5800
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	Minneapolis, Stark Elctrns., Inc.	612-332-1325
NY	Bohemia, Car Lac Inds. Sls., Inc.	516-567-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Rochester, Summit Distrs.	716-334-8110
OR	Beaverton, Murphy Elctrns.	503-642-2001
TX	Ft. Worth, Industrial Elctrns.	817-731-7321
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Mukwonago, Aero-Space Computer Supp.	414-547-8405
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280

EG&G ELECTRO-OPTICS, EG&G Optoelectronics, EG&G Inc., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, 1-800-950-3441, FAX: 508-745-0894; *Sls. Mgr.:* Jacques Murachver; *Dist. Mgr.:* Jacques Murachver

EG & G FLOW TECHNOLOGY, INC., Box 52103, Phoenix, AZ 85072, Tel: 602-437-1315, TELEX: 187-163, FAX: 602-437-4459; Empl.: 100; *Sls. Mgr.:* Ron Madison

EG & G FREQUENCY PRODUCTS INC., EG & G Inc., 4914 Gray Rd., Cincinnati, OH 45232, Tel: 513-542-5555, FAX: 513-542-5146; FSC No.: 58997; Empl.: 100; *Sls. Mgr.:* D. Hughes, Sls. Engr.

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 8581 Aero Drive, San Diego, CA 92123, Tel: 619-279-8034, TELEX: 697938, FAX: 619-576-9286; Empl.: 30; *Sls. Mgr.:* Bill Oker

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94089, Tel: 408-734-4616, TELEX: 357-435, FAX: 408-745-6131; FSC No.: 34314; *Dist. Mgr.:* Doug Crice

EG & G JUDSON, 221 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-368-6900, TELEX: 846120, ESYLNK: 62820476, FAX: 215-362-6107; Empl.: 65; *Sls. Mgr.:* Andrew Allen

EG&G OPTOELECTRONICS, EG&G Canada Ltd., 22001 Dumberry Road, Vaudreuil, Quebec, Canada J7V 8P7, Tel: 514-424-3300, TELEX: 05-823646, FAX: 514-424-3411

EG&G OPTOELECTRONICS- RETICON, 345 Potrero Ave., Sunnyvale, CA 94086-4197, Tel: 408-738-4266, FAX: 408-738-6979; Empl.: 200

EG & G POWER SYSTEMS, INC., 1330 E. Cypress St., Covina, CA 91724, Tel: 818-967-9521, FAX: 818-967-3151; Empl.: 280; *Sls. Mgr.:* Dave Adams .... **D•1670-1671**

Local Sales Offices & Reps

CA	Orange, RD & D Sls. Engrg.	714-771-6110
CO	Littleton, Mercier & Assoc.	303-770-0666
FL	Deland, World Sls. Dev.	904-228-2727
FL	Orlando, Truex Assocs.	407-859-2160

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[209] 441-1725

[800] CAL-SWCH

GA	Marietta, Electro-Comp Sls.	404-992-2344
MA	Dover, George Urban Assoc.	508-329-4068
NY	Fayetteville, Tri-Tech Elctrns., Inc.	315-446-2881
PA	Glenside, Koebert Assoc.	215-887-2310

EG&G ROTRON, Industrial Division, North Street, Saugerties, NY 12477, Tel: 914-246-3401, TELEX: 981511, FAX: 914-246-3802; FSC No.: 551496; Empl.: 75; *Sls. Mgr.:* Jay Jarboe; *Dist. Mgr.:* Jay Jarboe

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811, FAX: 314-423-3956; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley

EG&G WAKEFIELD ENGINEERING

FAX: 617-246-0874

EG & G WAKEFIELD ENGINEERING, 60 Audubon Rd., Wakefield, MA 01880, Tel: 617-245-5900; Empl.: 250; *Sls. Mgr.:* Frank Casdia; *Dist. Mgr.:* David Mendel .... **C•1580-1583**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Phoenix, Sanford Sls. Assoc.	602-957-3570
CA	Huntington Bch., West Elctrn. Sls. Team	714-375-6500
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, West Elctrns. Sls. Team	619-233-0236
CO	Denver, Donohue Sls.	303-455-1719
CT	Stamford, Francis J. Bigda	203-322-0240
FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
FL	Brandon, Over & Over, Inc.	813-684-6486
FL	Ft. Lauderdale, Over & Over Inc.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IA	Cedar Rapids, C.H. Horn & Assoc.	319-393-8703
MI	Farmington Hills, Luebbe Sls. Co.	313-489-8828
MN	Bloomington, Prof. Sls. for Ind.	612-944-8545
MO	Chesterfield, Weisler & Assocs., Inc.	314-537-0010
MO	Kansas City, Weisler & Assocs.	816-421-1679
NY	Commack, ERA, Inc.	516-543-0510
NY	E. Rochester, Tri Tech Elctrns.	716-385-6500
NY	Fayetteville, Tri Tech Elctrns.	315-446-2881
NY	Fishkill, Tri Tech. Elctrns.	914-897-5611
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
OH	Cincinnati, Luebbe Sls. Co.	513-530-0600
OH	Dayton, Luebbe Sls. Co.	513-438-0490
OH	Westlake, Luebbe Sls. Co.	216-899-0071
OR	Tigard, Halbar-RTS Inc.	503-624-5741
PA	Narbeth, Bresson Assocs.	215-664-6460
TX	Austin, Milco Mktg.	512-835-5359
TX	Houston, Milco Mktg.	713-469-5156
TX	Plano, Milco Mktg.	214-578-1996
WA	Redmond, Halbar-RTS Inc.	206-882-0990
WA	Vashon, Halbar-RTS Inc.	206-463-2277
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Calgary, Alberta, Cana Rep Grp., Inc.	403-255-0294
Can	Dartmouth, N.S., Cana Rep. Grp., Inc.	902-456-4400
Can	Edmonton, Alb., Cana Rep. Grp., Inc.	403-487-5578
Can	Markham, Ont., Cana Rep. Grp., Inc.	416-930-4621
Can	Montreal, Que., Cana Rep. Grp., Inc.	514-276-4477
Can	Oakville, Ont., Cana Rep. Grp., Inc.	416-338-3399
Can	Otawa Manotick, Ont., Cana Rep. Grp., Inc.	613-692-4682
Can	Surrey, B.C., Cana Rep. Grp., Inc.	604-599-1232

Local Distributors

AL	Birmingham, Newark	205-979-7003
AZ	Tempe, Bell	602-966-7800
AR	Little Rock, Newark	501-225-8130
CA	Agora Hills, Bell	818-879-9494
CA	Belmont, Richardson	415-592-9225
CA	Canoga Park, Caltronics	818-346-4936
CA	Cypress, Bell	714-895-7801
CA	Foster City, Newark	415-572-8300
CA	Fountain Valley, Comps. Center	714-979-0433
CA	Los Angeles, Newark	310-672-8548
CA	Redwood City, Stotts Friedman	415-368-3800
CA	Rocklin, Bell	916-652-0414
CA	San Diego, Bell	619-268-1277
CA	San Jose, Quement	408-998-5900
CA	Santa Ana, Elcom	714-432-6630
CA	Santa Clara, Comps. Center	408-988-3751
CA	Santa Fe Spgs., Bell	310-921-3611
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Woodland Hills, Richardson	818-347-5580
CO	Denver, Newark	303-757-3351
CT	Bloomfield, Newark	203-243-1731
CT	Wallingford, Bell	203-269-6801
FL	Altamonte Springs, Bell	407-339-0078
FL	Ft. Lauderdale, Newark	305-587-2372
FL	Miami, Elctrn. Equip.	305-526-6000
FL	Orlando, Newark	407-896-8350
FL	Sanford, Afcom	407-321-9225
FL	Sanford, Elctrn. Fasteners	407-321-4000
FL	Tampa, Reptron	813-854-2351
FL	Winter Park, Richardson	407-644-1453
GA	Norcross, Newark	404-448-1300
ID	Boise, Newark	208-342-4311
IL	Bensenville, Goold	708-860-7171
IL	Chicago, Newark	312-784-5100
IL	Elk Grove Village, Bell	708-640-1910
IL	LaFox, Richardson	708-208-2200
IL	Morton Grove, Nedco	708-967-0500
IN	Carmel, Altex	317-848-1323
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Newark	317-844-0047
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
IA	Cedar Rapids, Newark	319-393-3800
KS	Overland Park, Newark	913-677-0727
KS	Wichita, RSC	316-267-5213
KY	Louisville, Newark	502-423-0280
LA	Metarie, Newark	504-838-9771
LA	Shreveport, Indl. Elctrn. Supp.	318-222-9459
MD	Beltsville, Newark	301-604-1700
MD	Columbia, Bell	410-290-5100
MD	Gaithersburg, Capitol Radio	301-840-5700
MA	Andover, Bell	508-474-8880
MA	Ashland, Quality Comps.	508-881-6504
MA	Tewksbury, Jaco	508-640-0010
MA	Winchester, Webb Dist. Inc.	617-729-5800
MA	Woburn, Newark	617-935-8350
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Flint, RS Elctrns.	313-742-5000
MI	Grand Rapids, Newark	616-455-9190
MI	Livonia, RS Elctrns.	313-525-1155
MN	St. Paul, Gopher	612-490-4900
MS	Jackson, Newark	601-956-3834
MO	Maryland Heights, RS Elctrns.	314-997-7709
MO	St. Louis, Newark	314-298-2505
MT	Helena, Newark	406-443-6192
NE	Omaha, Newark	402-592-2423
NV	Las Vegas, Newark	702-796-5090
NH	Nashua, Newark	603-888-5790
NH	Salem, Tech Mark	603-893-8380
NJ	Camden, G.R.S.	609-964-8560
NJ	Mountainside, Route Elctrns.	908-654-8283
NJ	Pennsauken, Newark	609-663-9490
NM	Albuquerque, Bell	505-292-2700
NY	Bohemia, Car-Lac	516-567-4200
NY	Brooklyn, Richardson	718-646-6300
NY	Buffalo, Summit	716-887-2800
NY	Cheektowga, Newark	716-862-9700
NY	Farmingdale, Semispecialists	516-293-2710
NY	Hauppauge, Farmont Elctrns.	516-231-3313
MI	Madison Hgts., Galco	313-542-9090
NY	Monsey, Nobel Elctrns.	914-352-0182
NY	Penn Yan, Advacom Tech.	315-536-2221
NY	Rochester, Summit	716-334-8110
NY	Valley Stream, Newark	516-561-8400
NC	Greensboro, Newark	919-292-7240
NC	Raleigh, Cameron & Barkley	919-828-2311
NC	Winston-Salem, Kirkman	919-722-9131
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cleveland, Cam Ohio	216-461-4700
OH	Columbus, Newark	614-447-8282
OH	Dayton, Stotts Friedman	513-298-5555
OH	Toledo, RS Elctrns.	419-893-0721
OH	Warren, REM Elctrns.	216-373-1300
OK	Altair	918-252-5781
OK	Oklahoma City, Newark	405-495-5000
OR	Beaverton, Component Resources	503-641-8488
OR	Portland, Newark	503-257-0741
PA	Allentown, Newark	215-434-7171
PA	Pittsburgh, Cam-RPC	412-963-6202
PA	Trevose, Bell	215-953-2800
RI	Walpole, Newark	401-943-3340
SC	Columbia, Newark	803-798-0198
TN	Knoxville, Newark	615-588-6493
TX	Austin, Wofford	512-339-1131
TX	Dallas, Richardson	214-239-3680
TX	Garland, Newark	214-494-5911
TX	Houston, Altair	713-462-3029
TX	Richardson, Jaco/QC	214-234-5565
TX	Stafford, Harrison Equip.	713-879-2727
UT	Midvale, Bell	801-561-9691
UT	Salt Lake City, Newark	801-484-8611
VT	South Burlington, Newark	802-860-1856
VA	Arlington, Newark	703-522-7552
VA	Charlottesville, Virginia Elec.	804-296-4184
WA	Bellevue, Newark	206-641-9800
WA	Redmond, Bell	206-867-5410
WA	Walpole, Richey Impact Elctrn.	508-668-8200
WV	Dunbar, Newark	304-768-6872
WI	Milwaukee, Newark	414-453-9100
WI	Waukesha, Bell	414-547-8879
Can	Calgary, Zentronics	403-295-8838
Can	Montreal, Zentronics	514-737-9700
Can	Ottowa, Electrosonic	613-728-8333
Can	Quebec City, Zentronics	418-654-1077
Can	Toronto, Electrosonic	416-494-1555
Can	Vancouver, Electrosonic	604-273-2911
Can	Winnipeg, Electrosonic	204-783-3105

EGIS CORPORATION, 655 Plum Tree Rd., Barrington Hills, IL 60010, Tel: 708-639-1555, FAX: 708-639-8710; Empl.: 6

EH ELECTRONICS, INC., See Wavetek San Diego, Inc.

EHRHORN TECHNOLOGICAL OPERS., INC., 4975. North 30th St., Colorado Springs, Colorado 80919-4101, Tel: 719-260-1191, FAX: 719-260-0395; FSC No.: 1106; Empl.: 5; *Sls. Mgr.:* Tim Coutts; *Dist. Mgr.:* Tim Coutts

EI & S, Prime Technology Inc., Twin Lakes Rd., P.O. Box 185, North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 14908; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson, Mktg. VP. ... **B•1482**

Local Sales Offices & Reps

AZ	Phoenix, CPS Assocs.	602-589-0282
CA	Canoga Pk., C & W Comps. Sls.	818-700-2684
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Haywood, Pacific Mktg. Inc.	415-887-1620, 415-887-7595
CA	Newbury Pk., Interconn Tech. Mktg.	805-499-4024
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	N. Branford, EI&S	203-481-5721
DC	Washington, AM-Tech Assoc.	301-461-5599
FL	Lakeland, Munday Sls.	813-858-5606,818-858-7257
IL	Arlington Hgts., Mertons Assoc.	314-993-6600
IL	Arlington Hgts., MB Sls.	708-392-9499
MD	Ellicott City, Am-Tech Assoc.	301-461-5599
MA	Norwell, Norris Assocs.	617-659-7988, 617-659-0790
MA	Shrewsbury, Advanced Comps. Grp.	508-845-2023
MO	St. Louis, Mertens Co.	314-993-6600,314-993-6630
MO	St. Charles, Microtronics	314-946-8500
NY	Buffalo, Lynn Assocs., Inc.	716-631-0054, 716-631-0101
OH	Cleveland, John O. Olsen Co.	216-838-0510
NY	Hauppauge, Masin-Esco, Inc.	516-273-3500, 516-273-3516
PA	Gibsonia (West), John O. Olsen Co.	216-838-0510
PA	Malvern (East), Stitzer Assocs.	215-664-5500, 215-664-5503
OH	Westlake, Advanced Technlg. Assocs.	216-835-5050,216-835-3599
TX	The Colony, Juliana Co.	214-625-1075
WA	Seattle, Datacom Assoc.	206-285-2525
Can	St. Laurent,PQ, Electronique Versatech	514-335-3833

Local Distributors

AZ	Phoenix, Keystone Electro Sls.	602-995-3005
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Canoga Pk., Acort Inds.	818-700-2991
MD	Columbia, DK Elctrns.	301-995-1950
MA	Billerica, A. W. Mayer Co.	508-229-2255
MA	Newton, The Greene-Shaw Co.	617-969-8900
NJ	Oakland, Relay Specialties	201-337-1000

FAX: 401-738-7154

EICHHOFF ELECTRONICS, 205 Hallene Rd., Warwick, RI 02886, Tel: 401-738-1440, 800-678-1040; Empl.: 2,000; *Sls. Mgr.:* Randall Jones .... **A•1588-1591, 2323**

Local Sales Offices & Reps

AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	Mountainview, The Pentagon Co.	415-961-3610
CT	W. Simsbury, Electrotechnika	203-658-6762
FL	W. Melbourne, Kennedy Assocs.	407-676-6875
IL	Wheaton, CS Tech. Sls.	708-653-8126
IA	Marion, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Annapolis, Rynone Assocs.	410-263-0794
MA	Needham, Sturgeon Tech.Sls.	617-444-6603
MN	Minneapolis, Electro-Serv Co.	612-338-3475
MO	St. Charles, MSB Assocs. Inc.	314-946-5577
NJ	Mt. Laurel, Paragon Sls.	609-778-1190
NY	Fairport, Advanced Comps.	315-437-6700
NC	New Hill, Tom Santel	919-362-4091
OH	Mansfield, Rich Tech Sls.	419-756-1953
OR	Mission Hills, Pentagon Co.	818-894-0299

E.I.L. INSTRUMENTS, INC., 10946A Golden West Drive, Hunt Valley, MD 21031-1320, Tel: 410-584-7400, FAX: 410-584-7561; Empl.: 500; *Sls. Mgr.:* Keith D. Hadley

EI MICROCIRCUITS, INC., 1651 Pohl Road, Mankato, MN 56001, Tel: 507-345-5786, FAX: 507-345-7559; Empl.: 60; *Sls. Mgr.:* Perry Eimers

EIP MICROWAVE, INC., 1589 Centre Pointe Dr., Milpitas, CA 95035, Tel: 408-945-1477, FAX: 408-945-0977; FSC No.: 34257; Empl.: 65; *Sls. Mgr.:* Rick Bush

EKTRON APPLIED IMAGING, INC., 23 Crosby Dr., Bedford, MA 01730, Tel: 617-271-1940, FAX: 617-271-1860; Empl.: 175; *Sls. Mgr.:* Richard Rollins

elan

FAX: 408-778-2597

ELAN SYSTEMS, INC., 365 Woodview Ave., Ste. 700, Morgan Hill, CA 95037, Tel: 800-541-3526; *Sls. Mgr.:* Bill White .... **A•1696-1697; D•1087**

Local Sales Offices & Reps

CA	Morgan Hill, Elan Sys., Inc.	408-778-7267

ELAN TECHNICAL CORP., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-335-2115, FAX: 203-335-2723

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-333-6314, FAX: 408-945-9305; FSC No.: 64762; Empl.: 112; *Sls. Mgr.:* Ralph Granchelli; *Dist. Mgr.:* Nancy Serdynski

ELASTOMERIC TECHNOLOGIES, INC., 2940 Turnpike Dr., Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 387-236, FAX: 215-672-4633; FSC No.: 64914; Empl.: 43; *Sls. Mgr.:* John Seibert (West)/George Glatts (East) .... **C•1314**

Local Sales Offices & Reps

AL	Huntsville, Remco/Huntsville	205-533-3763
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Orange, Libratronix	714-871-1513
CA	San Jose, W I N	408-559-8118
CO	Monument, Sunbird Inds.	719-481-2900
FL	Ft. Lauderdale, Synergistic Tech. Inc.	305-791-8255
FL	Melbourne, Synergistic Tech. Inc.	407-242-9661
FL	Odessa, Synergistic Tech.	813-920-5814
GA	Lilburn, Remco/Atlanta	404-447-6937
IL	Des Plaines, Lincoln, Hodges	708-297-3810
IN	Ft. Wayne, Outman Sls.	219-489-7699
KS	Wichita, Baka Corp.	316-682-8411
MD	Gaithersburg, Carwithen	301-921-9545
MA	Needham, Comp. Technlg., Inc.	617-449-8490
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Bloomington, Northmark Assocs.	612-854-9299
MO	St. John, Baka Corp.	314-878-4224
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, C-Tech Sls. Co.	919-782-8100
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Tigard, L. D. Elctrns.	503-684-8221
PA	Hatboro, A.Q.S. Electro	215-674-3562
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-REP	713-271-5635
UT	Ogden, Sunbird Inds., Inc.	801-479-7151
WA	Snohomish, L. D. Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Janesville, Lincoln,Hodges	608-754-4214

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, FAX: 814-643-0426; FSC No.: 91662; Empl.: 300; *Sls. Mgr.:* C. Demars; *Dist. Mgr.:* M. Grove

EL-COM CABLETEK, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-432-6630

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, FAX: 314-429-9706; Empl.: 25; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 407-994-1774, FAX: 407-994-1770; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek

ELCON INSTRUMENTS, INC., Whessoe, Plc, 137 Gibralter Street, Annapolis, MD 21401, Tel: 410-280-6686, FAX: 410-263-5790; Empl.: 10; *Sls. Mgr.:* Robert Siska

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 510-490-4200, FAX: 510-490-3740; FSC No.: 85901; Empl.: 120; *Sls. Mgr.:* Tom Johnson, Dir. of Sls.

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Carlsbad, Tarco/Prime Source	619-434-1297
CA	Los Gatos, Norwest Elctrns.	408-356-7670
CO	Wheat Ridge, Waugaman Assocs.	303-423-1020
FL	Tampa, APM Assocs.	813-886-2457
GA	Atlanta, Electronic Mktg. Assoc.	404-448-1215
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
MD	Towson, Arbotek Assocs.	410-825-0775
MA	Brookline, Harman Assocs.	617-232-6687
MI	Farmington, J P Bergin Assoc.	313-471-7940
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NJ	Cherry Hill, Tritek Sls.	609-667-0200
NY	Rochester, ELDRE Corp.	716-427-7280
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Raleigh, Electronic Mktg. Assocs.	919-847-8800
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
OH	Centerville, Omega Sls.	513-434-5507
Can	St. Laurent, Que., Componetics, Ltd.	514-331-9930
UT	Murray, Waugaman Assocs./Utah	801-261-0802
WA	Redmond, Electronic Mktg. Grp.	206-882-0962

ELECSYS,INC., Div. of C & C Jetronic, 370 Wall St., Princeton, NJ 08540, Tel: 609-259-8866, FAX: 609-259-9347; Empl.: 3; *Sls. Mgr.:* Edward Hwung .... **A•1693**

ELECTRA-SSEMBLY, Lancer Chemical, 80 Cutter St. - Box 30, Warren, RI 02885, Tel: 401-245-5493

ELECTRA-TEC, INC., Div. of Impert Industries, Inc., 567 West M-89, Otsego, MI 49078, Tel: 800-225-3532, 616-694-2058, FAX: 616-694-5880; FSC No.: 4J966; Empl.: 20; *Sls. Mgr.:* William Robinson

ELECTRICAL INDUSTRIES CORP., 691 Central Ave., Murray Hill, NJ 07974, Tel: 908-464-3200, FAX: 908-464-7619; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 .... **D•1252**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CO	Commerce City, Williams Assocs.	303-289-5647
IL	Lincolnwood, Saffro & Assocs.	708-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Columbus, Comtel Instrs. Co.	614-876-8305
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312
Can	Beaconsfield, Que., Mesurina Ltee/Ltd.	514-630-5990

ELECTRICAL INSULATION SUPPLIERS, INC., 300 N. Mannheim Road, Hillside, IL 60162, Tel: 708-547-5400, FAX: 708-544-7297; Empl.: 550; *Sls. Mgr.:* Mike Driscoll

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224, FAX: 818-765-2939; Empl.: 6

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861, FAX: 203-846-3933; FSC No.: 73693; Empl.: 60

ELECTRIC MOTOR ENGINEERING, INC., 23362 Madero, Suite C, Mission Viejo, CA 92691, Tel: 714-583-9802, FAX: 714-583-9785; Empl.: 5; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim .... **B•1724-1725**

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-726-7723, FAX: 215-724-3682; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 508-359-4396, FAX: 508-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062-2319, Tel: 708-498-6520, FAX: 708-272-2915; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

FAX: 716-759-2562

ELECTROCHEM INDUSTRIES, Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-5428; FSC No.: 6U589; Empl.: 500; *Dist. Mgr.:* Mark Amatuzzo .... **D•1447**

Local Sales Offices & Reps

NJ	Medford, Champion Elctrn. Sls., Inc.	609-983-0932
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555

Local Distributors

AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	Costa Mesa, Battery Specialties	714-755-0888
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Rose Elctrns.	408-943-0200
CO	Englewood, AVT, Inc.	303-795-1958
MA	Sutton, Engrd. Assemblies Corp.	508-865-0722
FL	St. Petersburg, Engrd. Assemblies Corp.	813-328-1970
GA	Norcross, Engrd. Assemblies & Comps. Corp.	404-446-3135
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
NJ	Teterboro, Engrd. Assemblies Corp.	201-288-4477
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NC	Raleigh, Engrd. Assemblies Corp.	919-790-9700
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Houston, K Power Elctrns.	713-783-2288
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Brampton, Innovative Power Pak	416-791-2132
Can	Victoria, BC, Pacific Coast Elctrns. Ltd.	604-385-5111

ELECTROCOM INDUSTRIES, 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTROCUBE, 1307 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-301-0122, FAX: 818-357-8099; FSC No.: 14752; Empl.: 125; *Sls. Mgr.:* Harold Neubert .... **A•1067**

Local Sales Offices & Reps

AZ	Scottsdale, EDP & Assocs.	602-991-6119
CA	Mountain View, Westech Sls.	415-961-1422
CA	Newport Beach, Forbes Pacific, Inc.	714-722-6174
FL	Orlando, Richmar Elctrns.	407-352-3755
GA	Roswell, JWL Assocs.	404-518-8500
IL	Downers Grove, Richmar Elctrns.	708-968-0118

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MA	Reading, Charles E. Godfrey Co.	617-944-2230
MI	Brighton, W. R. Hummon & Assoc.	313-486-5333
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Raytown, Centech Sls.	816-358-8100
NY	Great Neck, M. O. S. Assocs.	516-487-3966
NY	Rochester, Gislason Sls.	716-328-7400
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Dayton, K. W. Elctrns.	513-890-2150
PA	Allison Park, K. W. Elctrns.	412-492-0777
PA	Paoli, Tyler Griffin Co.	215-647-1550
TX	Plano, Richmar Elctrns.	214-424-8388
WA	Kirkland, James Findlay Co.	206-822-1510
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Tempe, Acacia Sls., Inc.	602-894-2874
CA	Chatsworth, Mil-Comm Dist.	818-998-3111
CA	Fremont, Acacia Sls., Inc.	510-623-7500
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Tustin, Projections Unltd.	714-544-2700
CO	Lakewood, Acacia Sls., Inc.	303-232-2882
FL	Largo, Elctrn. Precepts of FL	813-544-3636
IL	Elk Grove Village, Nu-Way Elctrns.	708-437-7120
IL	Morton Grove, Nedco	708-967-0500
MD	Gaithersburg, MS Elctrns.	301-921-0200
MI	Madison Heights, Galco Ind. Elctrns.	313-542-9090
NJ	Newark, Meltronics	201-242-1686
NY	Penn Yan, Advacom	315-536-2221
NY	Rochester, Masline Elctrns.	716-546-5373
OH	Englewood, ADS Electra	513-836-8636
OH	Solon, Repco Elctrns.	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia Sls., Inc.	503-646-3377
PA	Levittown, Aim Elctrns.	215-946-3900
PA	McKean, Advacom	814-476-7774
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
WA	Redmond, Acacia Sls., Inc.	206-881-5566

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280, FAX: 216-663-0507; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Anthony Cardone; *Dist. Mgr.:* Anthony Cardone

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ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 708-259-0740; FSC No.: 10236; Empl.: 200; *Sls. Mgr.:* Frank Rafferty .... **D•1159**

Local Sales Offices & Reps

CA	Alameda, Liaison, Inc.	415-769-1991
CA	Alhambra, James Gerry Co.	213-283-7694
CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Altamonte Spgs., Quantum Sls.	407-788-0550
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
KS	Wichita, Magna Engrg. Sls.	316-744-0851
MD	Severna Park, Delmarva Engrg. Assocs., Ltd.	301-647-8007
MA	Burlington, FJS Assocs.	617-273-5959
MO	St. Louis, Magna Engrg. Sls.	314-849-6590
NJ	Basking Ridge, Churchill Assocs.	908-735-6626
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
OR	Tigard, ElTech, Inc.	503-684-3458
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Dallas, Kruvand Assoc.	214-437-3355
UT	Centerville, West, Inc.	801-292-8787
WA	Bellevue, ElTech, Inc.	206-643-4330

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027-4038, Tel: 206-392-2493; FSC No.: 9J838; *Sls. Mgr.:* W. A. Pommer

ELECTRO-DYN ELECTRONICS, 1201-19th St., Niagara Falls, NY 14301, Tel: 716-284-8747, FAX: 716-284-9112; *Sls. Mgr.:* Paul Grzeskowiak

THE ELECTRODYNE COMPANY, INC., 4188 Taylor Rd., Batavia, OH 45013, Tel: 513-732-2822, TELEX: 241 463, FAX: 513-732-6953

ELECTROFILM, 25395 Rye Canyon Road, Valencia, CA 91355, Tel: 805-257-2242, FAX: 805-257-7738; FSC No.: 85932; Empl.: 77; *Sls. Mgr.:* Richard W. Pearson

ELECTRO-FILMS INCORPORATED

FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150; FSC No.: 57252; Empl.: 210; *Sls. Mgr.:* Jim Brush .... **A•1721, 1932-1934**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	San Jose, NES Assocs.	408-437-9300
CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	Apopka, Micro Mktg., Inc.	407-889-2022
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Palatine, M & S Sls.	708-934-1200
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Greenfield, Corrao Marsh, Inc.	317-462-4446
MA	Bedford, Vector Assocs.	617-271-0000
MN	Minneapolis, Ferrian Sls.	612-721-8915
NM	Albuquerque, Western High Tech. Mktg.	505-884-2256
NY	Clifton Park, Empire Technlg., Inc.	518-371-2480
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Lewisville, Component Circuits, Inc.	919-945-5678
OH	Cincinnati, Arthur Baier Co.	513-779-2395
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Columbus, Arthur Baier Co.	614-764-1144
OH	Toledo, Arthur Baier Co.	513-276-4128
OK	Broken Arrow, Merlin Elctrns.	918-251-2084
OR	Portland, Demarest Assocs., Inc.	503-645-4788
PA	Erdenheim, OMNI Sls.	215-233-4600
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Ft. Worth, Merlin Elctrns.,	817-429-4420
TX	Missouri City, Jackson Arnold Assocs.	713-261-0798
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Seattle, Demarest Assocs.	206-523-3210
Can	Montreal, Que., Solid State Engr. Co.	514-481-3313

ELECTRO FORCE CORP., 727 Oakstone Way, Anaheim, CA 92806, Tel: 714-774-3666; Empl.: 4

ELECTROHOME LIMITED, 809 Wellington St. N., Kitchener, Ontario, Canada N2G 4J6, Tel: 519-744-7111, FAX: 519-749-3136; *Sls. Mgr.:* Alan Caskey

ELECTROID CO., Div.of Valcor Engrg. Corp., 45 Fadem Rd., Springfield, NJ 07081, Tel: 201-467-8100, TELEX: 139241, FAX: 201-467-5656; Empl.: 100; *Sls. Mgr.:* E.D. Lazorchak

ELECTRO IMPULSE, 1805 Corlies Ave. Box 278, Neptune, NJ 07754-0278, Tel: 908-776-5800, FAX: 908-776-6793; FSC No.: 91161; Empl.: 48; *Sls. Mgr.:* Mark Rubin

ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 40; *Sls. Mgr.:* S. Kagan

For further information call toll free: 800-645-6342

ELECTRO INSULATION CORP., 3921 Ventura Drive, Arlington Hgts., IL 60004, Tel: 708-632-1020, FAX: 708-632-1089; Empl.: 25; *Sls. Mgr.:* Mike Kamperschroer; *Dist. Mgr.:* Mike Kamperschroer

ELECTROL CO., 321 Dewey St., P.O. Box 29, York, PA 17405, Tel: 717-848-1722, FAX: 717-848-4514; Empl.: 30; *Sls. Mgr.:* Debra Dudley; *Dist. Mgr.:* Debra Dudley

ELECTROL, Hamlin, Inc., 612 East Lake St., Lake Mills, WI 53551, Tel: 414-648-3000, FAX: 414-648-3001; Empl.: 350; *Sls. Mgr.:* Mike Bucher .... **B•1513**

Local Sales Offices & Reps

AZ	Tempe, Westrep	602-820-9932
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Jose, Vernexx	408-972-4903
CO	Boulder, Design Tech. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Tampa, Electramark, Inc.	813-889-7775
GA	Atlanta, Wallace Elec. (Sen/Sw only)	404-634-3159
GA	Norcross, Electramark, Inc. (Relays only)	404-446-7915
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IA	Davenport, Rush & West	319-388-9609
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Gaithersburg, Naudain Assocs. South	301-258-5040
MA	Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Farmington Hills, J.L. Montgomery	313-489-0099
MN	Minneapolis, RK Sls.	612-571-1001
MO	St. Louis, Rush & West	314-965-3529
NJ	Hackensack, Coakley, Boyd, Abbett/Metro	201-440-4114
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Richfield, Bear Mktg.	216-659-3131
OR	Tigard, Earl & Brown	503-639-2100
PA	Allison Pk., Bear Mktg.	412-492-1150
TN	Tullahoma, Wallace Elctrns. Sls.	615-455-0501
WA	Redmond, Earl & Brown	206-885-5064
WI	Watertown, Deaken Tech. Sls.	414-261-7600
Can	Ontario, Indigo	416-670-0284

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns	602-966-2256
AR	Springdale, Radio Inc.	501-751-8200
CA	Agoura Hills, Cypress Elctrns.	881-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Los Angeles, Master Distrs.	301-452-1229
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	San Jose, Capstone	408-453-9804
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone Elctrns.	303-375-2550
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Harrison Equip. Co.	303-694-6320
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Wallingford, Sager Elec.	203-262-1700
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lakeland, AA Elec.	813-665-6941
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, AA Elec.	404-449-8670

GA	Norcross, EMSCO	404-925-8366
GA	Norcross, Hammond Elctrns.	404-449-1996
ID	Boise, Radar Elec.	208-336-2227
IL	Bensenville, Cypress Elctrns.	708-350-2005
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Itasca, Capstone	708-250-0300
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
KS	Wichita, Radio, Inc.	316-264-2798
MD	Baltimore, Bell Inds.	301-953-2566
MD	Columbia, DK Elctrns.	301-995-1950
MD	Columbia, Peerless Radio	301-997-1717
MD	Columbia, Sager Elec.	301-995-4900
MA	Andover, Bell Inds.	508-474-8880
MA	Hingham, Sager Elctrl. Supp.	617-749-6700
MA	Wilmington, Capstone	508-657-5874
MA	Wilmington, Heiland Elctrns.	508-657-4870
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Pk., Newark Elctrns.	313-967-0600
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MN	Thief River Falls, Voyager Elctrns.	612-571-7766
NH	Salem, Sager Elec.	603-898-1348
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Marlton, Capstone	609-596-7500
NJ	Oakland, Relay Specs.	201-337-1000
NJ	W. Berlin, Genl. Comps.	609-768-6767
NM	Alburquerque, Bell Inds.	505-292-2700
NM	Alburquerque, Harrison Intl.	505-291-9951
NM	Los Alamos, Capstone	505-662-0745
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
NY	Hauppauge, Sager Elec.	516-348-1300
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Plainview, Astrex	516-433-1700
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Rome, Rome Elctrns. Inc.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone	919-954-0600
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Solon, Repco Elctrns.	216-248-8900
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Oswego, Bell Inds.	503-635-6500
OR	Portland, Cypress Elctrns.	503-223-8900
OR	Portland, Radar Elec.	503-232-3404
PA	McKean, Advacom Inc.	814-476-7774
PA	Pittsburgh, Bell Inds.	412-787-3883
PA	Trevosa, Bell Inds.	215-953-2899
SC	Greenville, EMSCO Inc.	803-233-4121
TX	Austin, Harrison Equip. Co.	512-258-1320
TX	Carrollton, Capstone	214-380-9049
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	El Paso, Harrison Equip. Co.	915-598-3406
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, Tandy Elctrns.	812-870-5614
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Kent Elctrns.	713-780-7770
TX	Stafford, Harrison Equip. Co.	713-879-2727
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Richland, Radar Elec Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Cedarburg, Automation Engrg.	414-377-7500
WI	Green Bay, Automation Engrg.	414-449-6000
WI	Mequon, Taylor Elec.	414-241-4321
Can	Burnaby, BC, ITT Multicomps.	604-291-8866
Can	Calgary, Alb., ITT Multicomps.	403-273-2780
Can	Concord, Ont., ITT Multicomps.	416-798-7884
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Mississauga, Ont., Capstone	416-670-2010
Can	Nepean, Ont., ITT Multicomps.	613-596-6980
Can	Ville St. Laurent, PQ, ITT Multicomps.	514-335-7697
Can	Winnipeg, Manitoba, ITT Multicomps.	403-273-2780

ELECTRO MAGNETIC PROCESSES, INC., 20360 Plummer St., Chatsworth, CA 91311-5371, Tel: 818-882-6333, FAX: 818-709-4668; FSC No.: 51290; Empl.: 100

ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 708-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Mike Meurer

ELECTRO MAZE AIR FILTERS, 5936 Don Way, Carmichael, CA 95608, Tel: 916-485-4079, FAX: 916-485-7925; Empl.: 7

ELECTROMECH, INC., 2 Cordier St., Irvington, NJ 07111, Tel: 201-318-7999, FAX: 201-318-7995; Empl.: 40; *Sls. Mgr.:* Soloman Ezra .... **A•2324-2325; D•1672**

Local Sales Offices & Reps

NJ	Irvington, Electromech, Inc.	201-318-7999

ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 26; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANISMS, INC., 990 Amelia, San Dimas, CA 91773, Tel: 909-394-9953, FAX: 909-394-0782; FSC No.: 52592; Empl.: 27 .... **B•1636-1637**

Local Sales Offices & Reps

OH	Dayton, Harvey Teplitz	513-898-5282

ELECTRO-MECH CO., 707 Hathaway Dr., Colorado Springs, CO 80915, Tel: 719-597-1620, FAX: 719-597-1628 .... **D•1673**

Local Sales Offices & Reps

AZ	Phoenix, C.T. Carlberg & Assocs.	602-468-0782
CA	Santa Clara, Caltronics	408-727-7552
GA	Roswell, JWL Assocs.	404-518-8500
IL	Cary, Bob Burns & Assocs.	708-516-3322
IA	Cedar Rapids, KKB & Co.	319-373-7111
MN	Minneapolis, Harold Mercer Co.	612-933-7111
MO	Blue Springs, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Berkley Hgts., Cambridge Allen & Assocs.	908-464-0203
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NC	Charlotte, JWL Assocs.	704-541-5750
OR	Lake Oswego, Abacus Sls.	503-777-8111

Local Distributors

AL	Birmingham, Forbes Elctrns.	205-251-3941
AL	Huntsville, Mock Elctrns.	205-539-2401
AL	Montgomery, Handeys Elctrn. Ctr.	205-262-4885
FL	Ft. Walton Bch., Key Elctrn. Supp.	904-863-2191
FL	Pensacola, Pensacola Elctrns.	904-478-3771
FL	Tampa, Applied Power	813-725-9587
GA	Norcross, Applied Power	404-263-0421
IL	Mount Prospect, Tri-State Elctrns.	708-255-0600
IA	W. Des Moines, Ramco Elec. Co.	515-225-6933
MA	Boston, IME	800-254-1700
MI	Brighton, Applied Power	313-227-3604
MN	St. Paul, DC Battery Prods.	612-646-7478
MO	Kansas City, Elctrn. Supp., Inc.	816-931-0250
NC	Greensboro, Guilford Elctrn. Supp.	919-275-1385
SC	Spartanburg, Harley's Whlse. Elctrns.	803-582-7961
TN	Clarksville, Randolph Hale & Mathews	615-647-2325
TN	Columbia, Randolph & Williams	615-388-7686
TN	Nashville, Randolph & Rice	615-255-5602
TN	Tullohoma, Randolph & Vandergriff	616-455-4531
TX	Dallas, Computer Comps.	214-239-0271
TX	Richardson / Dallas, Off the Shelf Comps.	214-238-9625
UT	Salt Lake City, Standard Supply	801-486-3371
WI	Madison, Wisconsin Elctrn. Supp.	608-222-3400

ELECTRO-MECH COMPONENTS, INC., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, Tel: 818-442-7180, FAX: 818-350-8070; FSC No.: 07150; Empl.: 15; *Sls. Mgr.:* Terry Trumbull; *Dist. Mgr.:* Terry Trumbull .... **B•1714-1715**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	San Diego, Qualtronics	619-695-0118
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Boulder, Design Technlg. Sls.	303-440-5121
FL	Orlando, Publicover	407-898-9361
IL	Chicago, IRI	708-967-8430
MD	Baltimore, Callas Elctrns., Inc.	410-744-7711
MI	Livonia, Leading Edge Sls.	313-478-6700
MN	Minneapolis, D. A. Case Assocs.	612-831-6777
NJ	Medford, Comp. Consits.	609-654-5300
NY	Mamaroneck, Bassin Tech.	914-698-9332
NY	Orchard Pk., SHR	716-662-0589
OH	Cincinnati, KCH Co.	513-931-1686
OR	Hillsboro, Doran Sls.	503-640-4500
RI	Smithfield, Todino Engr. Sls.	401-232-5656
TX	Richardson, McCoy Assocs.	214-864-1838
WA	Redmond, Doran Sls.	206-488-1200

Local Distributors

CA	Los Angeles, Elec. Switches	213-660-1310
CA	Los Angeles, Master Distrs.	310-452-1229
NY	Mamaroneck, Logicomp Elctrns.	800-431-2625

ELECTRO-METRICS, INCORPORATED, A Penril Corp., 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798, FAX: 518-843-2812; FSC No.: 18581; Empl.: 80; *Sls. Mgr.:* Colleen M. DiCaprio

EMC **Electro-Miniatures Corp.**

FAX: 201-935-8153

ELECTRO MINIATURES CORP., 68 West Commercial Ave., Moonachie, NJ 07074, Tel: 201-460-0510; FSC No.: 17399; Empl.: 45; *Sls. Mgr.:* Barbara Triolo .... **B•1251-1253**

ELECTRO NATIONAL CORP., P.O. Box 402 Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, FAX: 601-859-5518; FSC No.: M-54208; Empl.: 32; *Sls. Mgr.:* Patsy Hicks

ELECTRONETICS, INC., 3101-111th St. S.W., Everett, WA 98204, Tel: 206-355-1855, FAX: 206-355-1855; Empl.: 10

EAC

FAX: 818-442-6873

ELECTRONIC APPLICATIONS CO., 4918 Santa Anita Ave., El Monte, CA 91734, Tel: 818-442-3212; Empl.: 92 .... **B•1483**

ELECTRONIC COIL CORP., 125 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-243-5233, FAX: 203-243-2247; Empl.: 8; *Sls. Mgr.:* R.B. Gorski

ELECTRONIC COMPONENTS & MATERIALS, GTE Sylvania, 816 Lexington Ave., Warren, PA 16365, Tel: 814-726-6500, FAX: 814-726-6942; Empl.: 1800; *Sls. Mgr.:* Robert Scalise

FAX: 908-542-0524

ELECTRONIC CONCEPTS, INC., Box 1278, Eatontown, NJ 07724, Tel: 908-542-7880, TELEX: 7107226661; FSC No.: 50558; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore .... **A•1068-1073**

Local Sales Offices & Reps

CA	La Mirada, Select Elctrns.	714-739-8891
CA	Simi Valley, Elctrn. Concepts, Inc.	805-582-9501
CO	Englewood, TMC	303-770-8995
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MN	Minneapolis, Components Grp.	612-374-1250
MO	Grandview, Harris-Hanson Co.	816-763-6200
NJ	Eatontown, Elctrn. Concepts, Inc.	908-542-7880
MO	St. Louis, Harris-Hanson Co.	314-432-3611

Local Distributors

NJ	Clifton, Elcon Sls.	201-546-5022

ELECTRONIC CONNECTION CORP., 125 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-243-3356, FAX: 203-243-2247; Empl.: 15; *Sls. Mgr.:* Ray Gorski, Jr.

ELECTRONIC CONNECTORS, INC., 125 South Fifth St., Reading, PA 19602, Tel: 215-374-3796, FAX: 215-374-0630; FSC No.: 15971; Empl.: 34; *Sls. Mgr.:* D. E. Fronheiser; *Dist. Mgr.:* D. E. Fronheiser

ELECTRONIC CONTROLS DESIGN, 4287-A SE International Way, Milwaukie, OR 97222, Tel: 503-659-6100, FAX: 503-659-4422; Empl.: 100; *Sls. Mgr.:* Steven Glass

ELECTRONIC DESIGN ENGINEERING, 1820 Temescal Av., Norco, CA 91760, Tel: 909-735-1761; Empl.: 3

ELECTRONIC DESIGNS INC., 42 South Street, Hopkinton, MA 01748, Tel: 508-435-2341, TELEX: 948004, FAX: 508-435-6302

ELECTRONIC DEVELOPMENT ASSOCIATES, 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881, FAX: 516-673-5979; FSC No.: 9V841

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596, FAX: 617-268-6754; FSC No.: 12619; Empl.: 25; *Sls. Mgr.:* R. B. Ross .... **D•1253**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer	205-883-4163
AZ	Tempe, Rusler Tech	602-897-2877
CA	All of CA, F.L.W.	800-339-6030
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Cape Canaveral, Teqspec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
IL	Arlington Heights, Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MA	Boston, Elctrn. Dev. Corp.	617-268-9696
MA	Needham, Addelco Corp.	617-444-4754
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	Chesterfield, Ramsey Assocs.	314-532-9386
NJ	Union, Friedman Assocs.	908-964-6200
NM	Albuquerque, Mesa Technlg.	505-883-8833
NY	Victor, SAN WAL Technlg.	716-924-1950
NC	Raleigh, Teqspec	919-851-9112
OH	Cleveland, Tiby Co.	216-371-5335
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Hatboro, Rhodes Technlg.	215-672-3336
TX	Richardson, Scientific Sls.	214-231-6541
VA	Richmond, Advance Control Equip.	804-282-9499
WI	Milwaukee, Berndt Assoc.	414-545-8400
Can	Mississauga, Ont., Omnitronix Ltd.	416-828-6221

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TELEX: 681-8047, FAX: 914-965-5531; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler .... **A•2143**

Local Sales Offices & Reps

CA	Northridge, Myco Sls.	818-886-7101
CA	San Jose, Nelson	408-437-9300
CO	Englewood, Dynatech	303-773-2830
FL	Melbourne, Kennedy	407-676-6875
GA	Lawrenceville, Funderburk	404-963-9495
IL	Arlington Hgts., Rozner Sls.	312-577-0067
IN	Carmel, Berndt Assoc.	317-844-0114
MA	Sharon, Cummings Assoc.	617-784-5600
MI	Livonia, Amtech	313-474-8300
MN	Burnsville, Xerotex Tech	612-894-5007
MO	St. Louis, Reptronics	314-997-4707
NY	Bohemia, Optimum Metro Sls.	516-244-5744
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, Funderburk	919-846-2373
OH	Willoughby Hills, Versatron	216-944-0082
OR	Portland, Index Inc.	503-289-9627
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Dallas, Kruvand Assoc.	214-437-3355
WI	Mequon, Stumm Sls.	414-241-8414
Can	Toronto, Norgay Entprs.	416-234-8966

Local Distributors

AL	Huntsville, Comp. Distrs.	205-851-7800
AZ	Costa Mesa, Orange Cnty. Comps.	714-979-3597
CA	San Jose, Compass	408-432-7515
CO	Englewood, Comp. Distrs.	303-770-6214
CT	Greenwich, Wise Comps.	203-531-4880
FL	Melbourne, Comp. Distrs.	407-724-9910
GA	Norcross, Comp. Distrs.	404-441-3320
IL	Chicago, E.M.D.	708-577-0067
IN	Indianapolis, Gateway Megatech	317-844-3906
KY	Louisville, Peerless Elctrns.	502-637-7672
MA	Billerica, Mayer Elctrns.	617-229-2255
MI	Grand Rapids, SF Elctrns. Supp.	616-459-0216
MN	Minneapolis, Berquist Inc.	612-835-2322
MO	St. Louis, Ric-Tronics	314-576-9816
NY	Albany, Ed Taylor Co.	518-438-7811
NY	Buffalo, Summit Distr.	716-887-2815
NY	Elmsford, Multimetrics	914-347-3666
NY	Mt. Vernon, Janesway	914-699-6710
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Century Elctrns.	919-782-2116
NC	Raleigh, Comp. Distr.	919-787-7311
OH	Willoughby, Gateway Megatech	216-953-0333
OR	Portland, Radar Elec.	503-232-3404
PA	Pittsburgh, Advacom	814-476-7774
VA	Roanoke, Peoples Elctrns.	703-342-8933
WI	Racine, Badger Elctrns.	414-637-1256

ELECTRONIC DISPLAYS, INC., 780 Creel Dr., Wood Dale, IL 60191, Tel: 708-860-5838, FAX: 708-860-0502; *Sls. Mgr.:* Bob Holmberg .... **B•1043**

ELECTRONIC ENCLOSURES, Div. Wyle Laboratories, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 310-643-8181, FAX: 310-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Robert Sproul

ELECTRONIC ENGRG. CO. OF CAL., See EECO

EEM/ELECTRONIC ENGINEERS MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

FAX: 203-755-0659

ELECTRONIC FILM CAPACITORS, INC., 41 Interstate Lane, Waterbury, CT 06705, Tel: 203-755-5629; Empl.: 65 .... **A•1075**

Local Sales Offices & Reps

CA	San Carlos, Francisco & Assocs.	415-591-8009
CA	Torrance, Orion Eclipse	213-326-0999
FL	Melbourne, Phoenix Comps.	407-723-4414
FL	Palm Harbor, Phoenix Comps.	813-786-1391
IL	Schaumburg, ABC Elctrn. Sls.	708-924-9974
MD	Columbia, PSA, South	301-953-4884
MA	Hudson, Compak, Inc.	508-568-0331
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
NJ	E. Brunswick, Winch Sls., Assocs.	908-613-1515
NY	Plainview, Winch Sls. Assocs.	516-681-3163
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OH	Columbus, Elctrn. Comps. Inc.	614-231-2318
OH	Miamisburg, Elctrn. Comps., Inc.	513-866-3340
OH	Rocky River, Elctrn. Comps. Inc.	216-331-5330
OH	Westlake, Elctrn. Comps. Inc.	216-835-4856
PA	Exton, The Wright Rep Co.	215-594-9654
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	509-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
Can	Vancouver, B.C., Advanced Power Comps.	604-436-0552

Local Distributors

CA	Chatsworth, Passive Comps., Inc.	818-700-8838
CA	Garden Grove, Capacitor Supply	714-638-0510
CA	Irvine, IEC	714-837-9960
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, California Capacitor, Inc.	408-262-6000
CA	San Jose, Stotts Friedman	800-869-5558
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Melbourne, Pridmore	407-727-2491
GA	Norcross, NRC Elctrns.-Dixie	404-729-0411
IN	Indianapolis, Mar Elctrns. Inc.	317-633-6699
MA	North Adams, Elctrn. Supp.	413-664-1086
MI	Grand Rapid, Calder Elctrns.	616-698-7400
MN	North Plymouth, Leeds Electro Comps.	612-557-1277
NH	Hampstead, Astrum Elctrns.	603-329-5656
NJ	Ft. Lee, ATI Inc.	201-592-8810
NJ	Rockaway, Tonar Inds.	201-586-9000
NY	Bohemia, RBD Elctrns.	516-589-7717
OH	Dayton, Stotts Friedman	513-298-5555
PA	Harrisburg, Ad Tech Elctrns.	717-561-9905
PA	Norristown, Century Elctrns.	215-631-5400
VT	Charlotte, Kellner Elctrns	802-425-3250
WI	Salem, Badger Capacitor Sls.	414-281-1330

FAX: 516-752-1971

ELECTRONIC HARDWARE CORP, Formerly Jan Hardware Mfg. Co., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950; FSC No.: 23480; Empl.: 75; *Sls. Mgr.:* John Powers .... **C•1523-1529**

ELECTRONIC INDUSTRIES ASSOC., 2001 Pennsylvania Ave. NW, Washington, DC 20006, Tel: 202-457-4900, FAX: 202-457-4985

ELECTRONIC INNOVATIONS CORP. (E.I.C.), 3333 S. Wadsworth Blvd. C101, Lakewood, CO 80227, Tel: 303-987-2441, FAX: 303-988-5907; Empl.: 4

FAX: 908-922-9334

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 908-922-9300; FSC No.: 89022; Empl.: 250; *Sls. Mgr.:* Charles Lehmann .... **D•1674-1683, 2104-2105**

Local Sales Offices & Reps

AL	Currie, Peak & Frazier	205-536-1506
AZ	Tempe, Trembly Assoc.	602-431-9417
CA	Huntington Beach, Tri Tek	714-840-3501
CA	San Diego, Tri Tek	619-573-0157
CA	San Jose, Tri Tek/SD	408-554-0455
CO	Golden, Trembly Assoc.	303-279-3019
FL	Currie, Peak & Frazier	407-855-0843
IL	Elmhurst, Sector Engrg.	708-530-7850
IN	Indianapolis, Sector Engrg.	317-253-9221
MD	Landover, Seltronics	301-341-2700
MA	Winchester, FJS Assoc.	617-729-3135
MN	Edina, Dytec Instrs.	612-831-7169
NJ	Laurel Springs, Williams Assocs.	609-346-2876
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Whitney Point, Tae Rep	607-692-3705
OH	Dayton, WKM Assoc.	513-434-7500
PA	Pittsburgh, WKM Assoc.	412-892-2953
TX	Houston, Kemp Instrs.	713-466-1465
WA	Redmond, Sci. Dvcs.	206-885-0004
WI	Milwaukee, Sector Engrg.	414-352-8280

ELECTRONIC MODULES, INC., 10410 Vista Park Rd., Dallas, TX 75238-1687, Tel: 214-340-6789; Empl.: 40-50; *Sls. Mgr.:* Leo Rios; *Dist. Mgr.:* Paul Stolar

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Div. of Astec America, Inc.

FAX: 319-377-3674

ELECTRONIC PACKAGING SYSTEM, 201 35th St., Marion, IA 52302, Tel: 319-377-3423; FSC No.: OH1KZ; Empl.: 5; *Sls. Mgr.:* G.R. Grishaber .... **C•1023**

ELECTRONIC PRECISION COMPONENTS, 519 South 5th Ave., Mt. Vernon, NY 10550-4430, Tel: 914-664-2333, FAX: 914-664-4729; FSC No.: 59131; Empl.: 8; *Sls. Mgr.:* Don Edwards .... **A•1633; D•1254**

FAX: 617-661-2989

ELECTRONIC PRECISION TECHNOLOGY INC., 126 Jackson St., Cambridge, MA 02140, Tel: 617-661-2454; Empl.: 4; *Sls. Mgr.:* Werner Christ ... **C•1315-1320**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108, FAX:205-533-4667
AZ	Tempe, Phase 4, Inc.	602-966-2018, FAX:602-968-7565
CA	Campbell, PCA Mktg. & Sls. Engrg.	408-559-2866, FAX:408-559-8277
CA	Dana Point, P C A	714-493-9822, FAX:714-240-1894
CO	Boulder, Comp. Prod. Sls. Co., Inc.	303-530-2800, FAX:303-530-9568
FL	Hialeah, Hughes Assocs.	305-362-8167, FAX:305-823-9873
FL	Melbourne, Hughes Assocs.	407-253-3031, FAX:407-253-3031
FL	Palm Harbor, Hughes Assocs.	813-785-6696, FAX:813-533-9108
GA	Marietta, Hughes Assocs.	404-578-0064, FAX:404-578-0820
IL	Crystall Lake, Komac Entrprs., Inc.	815-459-7456, FAX:815-459-8612

IN	Fishers, Carter, McCormic & Peirce Inc.	317-842-9277,FAX:317-577-2741
MD	Randallstown, Chesepeak Indl. Mktg.	301-653-0476,FAX:301-653-4675
MA	Concord, Noyes Assoc.	508-369-0425, FAX:508-371-2931
MI	Farmington Hills, Carter, McCormic & Pierce Inc.	313-477-7700,FAX:313-477-4149
MS	Corinth, Hughes Assocs.	601-287-2915, FAX:205-533-9108
MO	St. Louis, Acorn Elctrns.	314-421-1751, FAX:314-421-1752
NY	Peconic, HLJ Comp-Tech.	516-734-7760, FAX:516-734-7784
NC	Gary, Hughes Assocs.	919-467-7029, FAX:919-460-8607
OH	Englewood, Carter, McCormic & Peirce Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter,McCormic & Peirce Inc.	216-398-0400,FAX:216-398-0766
PA	Pittsburgh, Carter, McCormic & Peirce Inc.	412-826-3800,FAX:412-826-3800
PA	Southampton, Campbell Assocs.	215-322-6630, FAX:215-322-2627
TX	Plano, Connector Specs.	214-517-1207, FAX:214-517-3660
WA	Edmonds, Advanced Comp. Des. Corp.	206-745-5445,FAX:206-745-5445

Local Distributors

CA	Burbank, Atwater Elctrns., Co.	215-631-5404, FAX:215-631-5406
CA	Costa Mesa, Eric Elctrns.	714-751-1185, FAX:619-236-9910
CA	San Diego, Cableconn	619-571-7111, FAX:619-571-0309
CA	San Jose, Eric Elctrns.	408-432-1111, FAX:408-433-0570
CA	Santa Ana, BDS Elctrns., Inc.	714-662-1050, FAX:714-662-3929
CA	Santa Anna, Elcom Cabletek	714-432-6630; FAX:714-556-0468
CA	Sunnyvale, PSC	800-654-1518,FAX:408-737-0502
CO	Denver, QPS Elctrns.	303-373-2766, FAX:303-373-4029
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
IL	Schaumburg, QPS Elctrns.	708-884-6620, FAX:708-884-7573
MD	Beltsville, PSC/Petricko Sls.	800-333-5292, FAX:301-937-5299
MD	Gaithersburg, Axis Elctrns.	800-368-2815, FAX:301-840-9299
MA	Ashland, Quality Components	508-881-6504, FAX:508-881-1704
NJ	Burlington, Secom Elctrns.	609-386-9400, FAX:609-386-9333
PA	Clifton Hgts., Tri-Com	215-259-7400, FAX:215-259-4785
TX	Arlington, Bell Comp. Sls. Inc.	817-461-5303
Can	Mississagua, Ont., R. Theta	416-890-0221, FAX:416-890-1628

ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1444

ELECTRONIC RESEARCH CO., 7618 Wedd St., Overland Park, KS 66204, Tel: 913-631-6700, FAX: 913-631-7849; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler

THE ELECTRONICS GROUP, INC., 2828 Interstate St., Charlotte, NC 28208, Tel: 704-391-9500, FAX: 704-597-9500 Ext. 20; Empl.: 30; *Sls. Mgr.:* Doug Mckenzie

Electronic Solutions
UNIT OF ZERO CORPORATION

FAX: 619-452-9464

ELECTRONIC SOLUTIONS, Zero Corporation, 6790 Flanders Dr., San Diego, CA 92121, Tel: 800-854-7086, TELEX: 910-335-1169; FSC No.: 61081; Empl.: 150 .... **C•1116-1117, 1128-1133**

Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
AZ	Tempe, Holder Hauer	602-431-1212
CA	San Diego, Amasco	619-292-7666
CA	Santa Clara, Amasco	408-987-7760
CA	Simi Valley, Amasco	805-581-2031
CA	Torrance, Amasco	310-781-9494
CO	Denver, Holder Hauer	303-427-3443
CT	Bethany, Trilogic	203-393-1040
FL	Altamonte Springs, EMA	407-339-2333
FL	Boca Raton, EMA	407-394-6709
GA	Roswell, EMA	404-992-7240
IL	Hoffman Estates, Micro-Tex, Inc.	708-765-3000
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Annapolis Junction, Stemler Assocs.	301-490-1078
MD	Rockville, Spectro Assocs.	301-294-9770
MA	Wilmington, Trilogic	508-658-3800
MI	Ann Harbor, The Sys. Grp.	313-930-1800
MI	Livonia, The Sys. Grp.	313-478-6700
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashua, Trilogic	603-595-9859
NJ	Clementon, Systech Assocs., Inc.	609-784-8300
NJ	Florham Pk., Gebhardt Mktg.	201-377-3696
NM	Albuquerque, Holder Haver	505-888-9614
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Clarence Center, Tech-Mark, Inc.	716-741-9138
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Rochester, Gebhardt Mktg.	716-256-6240
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Charlotte, EMA	704-553-0110
NC	Raleigh, EMA	919-846-9317
OH	Cincinnati, The Sys. Grp.	513-742-2700
OK	Tulsa, Acudata, Inc.	918-743-1875
OR	Portland, Thorson Co. NW	503-293-9001
PA	Aston, Systech Assocs., Inc.	215-459-2223
PA	Bala Cynwyd, Systech Assocs., Inc.	215-238-0267
TX	Austin, Acudata, Inc.	512-478-1018
TX	Houston, Acudata, Inc.	713-580-2451
TX	Plano, Acudata, Inc.	214-424-3567
UT	Salt Lake City, Holder Hauer	801-487-7077
WA	Bellevue, Thorson Co. N.W.	206-455-9180
WA	Lynnwood, Blair Hirsh Co., Inc.	206-774-8151
WI	Waukesha, Micro-Tex	414-542-5352

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, RS Elctrns.	205-721-9999
AZ	Phoenix, Force Elctrns.	602-437-1060
AR	Phoenix, Hall-Mark Elctrns.	602-437-1200
CA	Chatsworth, Hall-Mark Elctrns.	818-773-4500
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Inglewood, Newark Elctrns.	310-672-8548
CA	Irvine, Hall-Mark Elctrns.	714-727-6000
CA	Rocklin, Hall-Mark Elctrns.	916-624-9781
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Jose, Hall-Mark Elctrns.	408-432-4000
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Clara, Force Elctrns.	408-748-1324
CO	Denver, Newark Elctrns.	303-757-8531
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Enlgewood, Harrison Equip. Co., Inc.	303-694-6320
CT	Cheshire, Hall-Mark Elctrns.	203-271-2844
CT	Danbury, Heilind Elctrns., Inc.	800-243-1043
CT	Danbury, Pilgram Elctrns.	203-792-7274
CT	Wallingford, Greene-Shaw Co., Inc.	203-265-3333
FL	Casselberry, Hall-Mark Elctrns.	407-830-5855
FL	Largo, Hall-Mark Elctrns.	813-541-7440
FL	Pompano Bch., Hall-Mark Elctrns.	305-971-9280
GA	Duluth, Hall-Mark Elctrns.	404-623-4400
GA	Norcross, RS Elctrns.	404-242-0520
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Des Plaines, Advent Elctrns.	708-297-6200
IL	Wood Dale, Hall-Mark Elctrns.	708-860-3800
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Chelsea Elctrn. Dist. Grp.	317-253-9065
IN	Indianapolis, Hall-Mark Elctrns.	317-872-8875
IN	Indianapolis, RS Elctrns.	317-253-9065
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
KS	Overland Pk., Olive Elctrns., Inc.	913-362-1923
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MD	Jessup, Treeko Elctrns., Inc.	301-470-3300
MA	Billerica, Hall-Mark Elctrns.	617-935-9777
MA	Newton, Greene-Shaw Co., Inc.	800-678-6876
MA	Wilmington, Heilind Elctrns., Inc.	508-657-4870
MI	flint, RS Elctrns.	313-742-5000
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, Hall-Mark Elctrns.	313-462-1205
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrns.	313-967-1570
MN	Eden Prairie, Hall-Mark Elctrns.	612-881-2600
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Earth City, Hall-Mark Elctrns.	314-291-5350
MO	Maryland Hgts., Olive Elctrns., Inc.	314-997-7709
NJ	Cranford, Garden State Ind. El., Inc.	908-272-6400
NJ	Moorestown, Hall-Mark Elctrns.	609-235-1900
NJ	Parsippany, Hall-Mark Elctrns.	201-515-3000
NM	Albuquerque, Harrison Int. Elctrns.	505-291-9951
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
NY	Fairport, Hall-Mark Elctrns.	716-425-3300
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rochester, Summit Distrs., Inc.	716-334-8110
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600
NC	Raleigh, Greene-Shaw Co., Inc.	508-791-7861
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
OH	Maumee, RS Elctrns.	419-893-0721
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OH	Valley View, Newark Elctrns.	216-447-8866
OH	Worthington, Hall-Mark Elctrns.	617-888-3313
OK	Tulsa, Hall-Mark Elctrns.	918-254-6110
PA	Clifton Hgts., Tri-Com, Inc.	215-259-7400
SC	Gaffney, Newark Elctrns.	803-487-1900
TX	Austin, Force Elctrns.	512-258-8848
TX	Austin, Hall-Mark Elctrns.	512-258-8848
TX	Austin, Harrison Equip. Co., Inc.	512-258-1320
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Dallas, Hall-Mark Elctrns.	214-553-4300
TX	Dallas, Harrison Equip. Co., Inc.	214-239-2750
TX	El Paso, Harrison Int. Elctrns.	915-598-3406
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Force Elctrns.	512-476-2104
TX	San Antonio, Harrison Equip. Co., Inc.	512-490-0615
TX	Stafford, Harrison Equip. Co., Inc.	713-879-2789
WA	Seattle, Hall-Mark Elctrns.	206-547-0415
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	New Berlin, Hall-Mark Elctrns.	414-797-7844
WI	West Allis, Advent Elctrns.	414-475-6860
Can	Burnaby, BC, Semad	604-420-9889
Can	Calgary, Alb., Semad	403-252-5661
Can	Markham, Ont., Semad	416-475-8500
Can	Ottawa, Ont., Semad	613-727-8325
Can	Pt. Claire, Que., Semad	514-694-0864

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 508-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 508-369-7641; FSC No.: 15175; Empl.: 140; *Sls. Mgr.:* Stephen J. Contons

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 508-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Frank Brown

FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., Vancouver, WA 98685, Tel: 206-574-5000; FSC No.: 98927; Empl.: 100; *Sls. Mgr.:* Leon Fuller .... **B•1484-1485**

Local Sales Offices & Reps

MN	Hopkins, The Kits Co.	612-933-1888
MN	Stillwater, The Kits Co.	612-439-8088
OR	Beaverton, Earl & Brown Co., Inc.	503-643-5500
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064

EP/ELECTRONICS PRODUCTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, TELEX: 516-227-1901

ELECTRONICS REPRESENTATIVE ASSOC., 20 E. Huron St., Chicago, IL 60611, Tel: 312-649-1333, FAX: 312-649-9509

ELECTRONIC SYSTEMS DIVISION, Boeing Defense & Space Grp., P.O. Box 3999, M/S 3E-WF, Seattle, WA 98124-2499, Tel: 206-657-7474, TELEX: 329430, FAX: 206-657-1439; FSC No.: 81205; Empl.: 4,000; *Sls. Mgr.:* A.M. Sullivan

ELECTRONICS SYSTEMS, INC., P.O. Box 5013, Sioux Falls, SD 57117, Tel: 605-338-6868, FAX: 605-338-5061; Empl.: 150; *Sls. Mgr.:* Leo Reynolds

ELECTRONICS TEST CENTRE, Alberta Research Council, 250 Karl Clark Road, Edmonton, AB, Canada T6N 1E4, Tel: 403-450-5370, TELEX: 0372147, FAX: 403-462-7285; Empl.: 16; *Sls. Mgr.:* Chris Talliss

ELECTRONIC TELE-COMMUNICATIONS, INC., 3605 Clearview Place, Atlanta, GA 30340-2178, Tel: 404-457-5600, FAX: 404-455-3822; Empl.: 200; *Sls. Mgr.:* Doug Altman; *Dist. Mgr.:* Doug Altman

ELECTRONIC TRANSFORMER CORP., P.O. Box 487, Paterson, NJ 07544-0487, Tel: 201-942-2222, FAX: 201-942-9014; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRON PRODUCTS, 5367 Third St., Irwindale, CA 91706, Tel: 818-960-2299, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* Cliff Sailor; *Dist. Mgr.:* Ann Meunier

FAX: 909-695-7246

ELECTRO-NUMERICS, INC., 42213 Sarah Way, Temecula, CA 92590, Tel: 909-699-2437; FSC No.: 51666; Empl.: 16; *Sls. Mgr.:* Ro Shultz .... **D•1345**

Local Distributors

IL	Chicago, Dalec Distrs.	312-283-0300
CA	Costa Mesa, FLW, Inc.	714-751-7512
GA	Atlanta, FLW S.E., Inc.	404-424-1731
MI	Detroit, RAM Meter, Inc.	313-398-6767
NY	Syracuse, W.E.I., Inc.	315-437-4281
UT	Murray, Instr. Specialists, Inc.	801-261-0142
VA	Roanoke, Elctrl. Equip. Sls. Co.	703-985-0446

ELECTRO OPTICAL INDUSTRIES INC., 859 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 50

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 708-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 373 Route 46 West Bldg. E, Fairfield, NJ 07004, Tel: 201-882-0211; Empl.: 25; *Sls. Mgr.:* Frank J. Vallese

ELECTRO-PREP, INC., 14 Kendrick Rd, Unit 3, Wareham Ind. Park, Wareham, MA, MA 02571, Tel: 508-291-2880, FAX: 508-291-2882; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420, FAX: 714-776-9683; FSC No.: 26073; Empl.: 60; *Sls. Mgr.:* Chris Allen; *Dist. Mgr.:* Mike Deming, V.P. Mktg. .... **C•1097**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-536-0242
AZ	Phoenix, Mercier & Assoc.	602-404-1318
CA	Los Gatos, Norwest Elctrns.	408-395-9019
CO	Littleton, Mercier & Assoc.	303-770-0666
FL	Altamonte Springs, DHR Mktg., Inc.	407-331-1199
GA	Duluth, DHR Mktg., Inc.	404-564-0529
NC	Statesville, DHR Mktg., Inc.	704-872-0242
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Knoxville, DHR Mktg., Inc.	615-690-0870
UT	Sandy, Mercier & Assoc.	801-942-2665
WA	Seattle, Horton Assoc.	206-365-2795

ELECTRO RENT CORP., 6060 Sepulveda Blvd., Van Nuys, CA 91411, Tel: 800-688-1111, FAX: 818-786-4224; Empl.: 460; *Sls. Mgr.:* Gary Phillips

ELECTRO-SCIENCE LABS., INC., 416 E. Church Rd., Po Box 1533, King of Prussia, PA 19406-1533, Tel: 215-272-8000, TELEX: 83-4788, FAX: 215-272-6759; Empl.: 120

ELECTRO SCIENTIFIC INDUSTRIES, INC. (ESI), 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 500; *Sls. Mgr.:* Dick Donaca, Sys.

Electro-Space Fabricators, Inc.

FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* Robert J. Flynn .... **C•1026-1029**

Local Sales Offices & Reps

CA	Anaheim, Alpha Electro Sls.	714-665-6580
CA	Los Gatos, Shursales	408-399-7487
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Davie, DTS Mechanical Sls.	305-581-2884
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Northbrook, Howard Benjamin Assocs.	312-272-2900
MD	Manchester, Imagitron Sls. Co.	800-638-3592
NJ	Boonton, Winter Assocs.	201-334-3434
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Tonawanda, Promark Elctrns., Inc.	716-877-6300
OH	Galion, James R. Bright	419-468-3787
PA	Trevose, Omega Elctrns. Sls.	215-244-4000
TX	Dallas, DJ Sls. & Assocs.	214-783-8876
WA	Issaquah, Elctrns. Northwest	206-557-0851

Local Distributors

CA	Irvine, McGillis Inds.	714-551-4004
CA	Redwood City, HdB Elctrns.	415-368-1388
MD	Columbia, DK Elctrns.	301-995-1950
NY	Baldwin, Accessories for Elctrns.	516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2106, TELEX: 163590 ESIUT, TWX: 910-867-4768, FAX: 214-470-2466; FSC No.: 33875; Empl.: 1047; *Sls. Mgr.:* Richard M. McCloskey

ELECTRO STANDARDS LAB., INC., Data Communications Products Div., 36 Western Industrial Dr., Cranston, RI 02921, Tel: 401-943-1164, FAX: 401-946-5790; Empl.: 40; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATIC CONSULTING ASSOCS., 556 Lowell Rd., P.O. Box 552, Groton, MA 01450, Tel: 508-448-5485, FAX: 508-448-5583; Empl.: 5; *Sls. Mgr.:* Paul Malinaric

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414, FAX: 619-279-1126; FSC No.: 34538; Empl.: 6

ELECTRO-SUPPORT SYSTEMS, 43445 Business Park Dr., Temecula, CA 92590, Tel: 909-676-2751, FAX: 909-694-0097; FSC No.: 66760; Empl.: 37; *Sls. Mgr.:* Don Pretot

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello .... **B•1716**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Irvine, Vale Elctrns.	714-551-4004
CA	San Ramon, W. Nott & Co.	415-820-8102
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Apopka, Floritronics	407-886-4818
GA	Albany, Holman-Gillespie	912-883-5565
GA	Atlanta, Holman-Gillespie	404-992-8820
IL	Wheeling, Electroswitch	708-593-2225
MD	Baltimore, Eastern Comps. Sls.	301-788-7050
MD	Gaithersburg, Naudain Assocs.-Southern	301-258-5040
MA	Weymouth, Electroswitch	617-340-0066
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics	313-435-0920
MN	Roseville, Pro Tech Power Sls., Inc.	612-483-0409
MO	Chesterfield, Weisler & Assocs.	314-537-0010
MO	Kansas City, Weisler & Assocs.	816-421-1679
NH	Salem, Sales Engrg. Co.	603-893-5521
NJ	Fairfield, Electroswitch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Buffalo, Upstate Engrg.	716-632-0011
NY	Johnson City, Upstate Engrg.	607-729-0827
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	Cary, L.G. White Co.	919-380-8084
NC	Winston-Salem, L.G. White Co.	919-765-1665
OH	Medina, Rockford Controls OH, Inc.	216-725-3705
PA	Pittsburgh, R. F. Clark	412-242-9500
PA	W. Conshohocken, Eastern Comps.	215-825-8610
SC	Greenville, L.G. White Co.	803-271-0630
TX	Plano, Brice Co.	214-442-9808
TX	Stafford, Brice Co.	713-240-1788
VA	Ashland, L.G. White Co.	804-752-7055
WA	Kent, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
OH	Medina, R.C.O.	216-725-3705
TX	Stafford, Barclay Whls.	713-240-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373

ELECTRO-TEC CORPORATION A KAYDON COMPANY, 1501 North Main St., Blackburg, VA 24060, Tel: 703-552-2111, FAX: 703-951-3832; Empl.: 200; *Sls. Mgr.:* John J. Daly

ELECTRO-TECH SYSTEMS, INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, TELEX: 797137, FAX: 215-887-0131; Empl.: 14; *Sls. Mgr.:* Brian E. Hohman; *Dist. Mgr.:* Brian E. Hohman

ELECTROVERT USA CORP., 805 W. North Carrier Pkwy., No. 200, Grand Prairie, TX 75050, Tel: 214-606-1900, FAX: 214-606-1700; Empl.: 500; *Sls. Mgr.:* Craig Biggs

ELECTROWEAVE, INC., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-752-8932, FAX: 508-753-2173; FSC No.: 54207; Empl.: 25; *Sls. Mgr.:* Peter Andrews

ELEKTRISOLA INC., 126 High Street, Boscawen N, NH 03303, Tel: 603-796-2114, FAX: 603-796-2119; Empl.: 150; *Sls. Mgr.:* John W. Mueller

ELETECH ELECTRONICS, INC., 1262 E. Katella Ave., Anaheim, CA 92805, Tel: 714-385-1707, FAX: 714-385-1708; Empl.: 5

ELF ATOCHEM NORTH AMERICA, Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, FAX: 215-587-7497

ELFORM, INC., P.O. Box 7362, Reno, NV 89510, Tel: 702-829-1905, FAX: 702-829-1693; *Sls. Mgr.:* Roger R. Reinke

ELGAR

FAX: 619-458-0267

ELGAR ELECTRONICS CORPORATION, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, 800-733-5427, TELEX: 211063 ELSD UR; FSC No.: 25965; Empl.: 275 .... **D•1684-1685, 2257-2259**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs., Inc.	205-534-6020
AZ	Phoenix, Tech. Mktg. Spec.	602-678-4940
CA	Carpenteria, Elgar Corp.	805-684-4400
CA	Redondo Beach, Ward/Davis Assocs.	310-643-6977
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
FL	Longwood, Southern Mktg. Assocs., Inc.	407-682-7317
FL	Satellite Bch., Southern Mktg. Assocs., Inc.	407-777-3587
GA	Alpharetta, Southen Mktg. Assocs., Inc.	404-664-9797
IL	Arlington Heights, Dytec/Midwest	708-255-3200
IN	Indianapolis, Dytec/Midwest	317 849-9898
KS	Lenexa, Dytec/South	913-888-0215
KS	Wichita, Dytec/South	316-262-3189
MD	Columbia, Creative Mktg. Assoc.	410-880-4161
MA	Beverly, P. Jenks Assocs.	508-921-4600
MI	Troy, WKM Assocs.	313-588-2300
MN	Edina, Dytec Instrs.	612-831-7169
MO	Maryland Heights, Dytec/South Inc.	314-739-0665
NJ	Ridgewood, Elgar East	201-652-2898
NJ	Wayne, Advanced Tech. Mktg.	201-633-7070
NM	Albuquerque, Tech. Mktg. Specialists	505-291-1363
NY	Syracuse, Labtronics	315-455-7314
NC	Greensboro, Southern Mktg. Assocs., Inc.	919-632-9370
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
PA	Wexford, WKM Assocs.	412-934-2730
TX	Austin, Testech	512-338-9246
TX	Euless, Testech, Inc.	817-540-1944
TX	Houston, Testech	713-893-9661
TX	Richardson, Testech, Inc.	214-644-5010
TX	San Antonio, Jack Howard Assoc.	512-828-5741
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
WI	Hartland, Dytec Midwest	414-367-4550
Intl	CA San Diego, Elgar Intl. Corp.	619-450-0085

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954, FAX: 801-635-2158; FSC No.: 15455; *Sls. Mgr.:* D. E. Beecher .... **D•1255**

Local Sales Offices & Reps

CA	Sherman Oaks, Windsor Dynamics	818-990-4173
CA	Sunnyvale, N-S Westronics	408-745-1102
CT	Meriden, Polytek Assoc.	203-634-4499
MA	Ashland, Polytek Assoc.	508-881-4741
NJ	Marmore, SWR Tech., Inc.	609-390-0094
NM	Albuquerque, Technology Mktg. Assoc.	505-345-8921
PA	Broomall, SWR Tech., Inc.	215-353-6639

ELGIN ELECTRONICS, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, FAX: 814-864-1260; Empl.: 300; *Sls. Mgr.:* Paul R. Barlock; *Dist. Mgr.:* Stanley R. Carlburg

ELITE ELECTRONIC ENGINEERING CO., 1516 Centre Circle, Downers Grove, IL 60515, Tel: 708-495-9770, FAX: 708-495-9785; FSC No.: 099-9999; Empl.: 34

ELITE ELECTRONICS, INC., 1408 Summit - Suite #5, Plano, TX 75074, Tel: 214-881-0026, 800-553-4376, FAX: 214-424-7299; Empl.: 4

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, FAX: 409-846-4367; Empl.: 9; *Sls. Mgr.:* Terri J. King

ELIWELL INC., 2121 Downer St., Baldwinsville, NY 13027, Tel: 315-638-9598, FAX: 315-638-9718; *Sls. Mgr.:* William Corcoran; *Dist. Mgr.:* Joseph Markert

ELMA

FAX: 510-656-3783

ELMA ELECTRONIC INC., 44350 Grimmer Blvd., Fremont, CA 94538, Tel: 510-656-3400; Empl.: 60; *Sls. Mgr.:* Kris Holla .... **B•1148, 1718-1720, 1827; C•1031-1033, 1530**

Local Sales Offices & Reps

AZ	Scotsdale, I.M. Systems	602-948-1495
CA	Fremont, Bear Resources	510-793-1064
CA	Fremont, ELMA Elctrn. Inc.	510-656-3400
CA	La Habra, West Coast Reps	213-690-9960
CA	Ontario, Elma Elctrn. Inc.	714-986-3753
IL	Schaumburg, Martan, Inc.	708-303-5660
MI	Ann Arbor, The Systems Grp.	313-930-1800
MN	Medina, James R. Johnson & Assocs.	612-478-9442
NH	Nashua, Bell Controls Inc.	603-882-6984
NY	Port Chester, Radiation Elctrns., Inc.	914-937-2300
OH	Cincinnati, The Systems Grp.	513-742-2700
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Lakewood, The Systems Grp.	216-226-6535
OH	West Lake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
OR	Beaverton, Cascade Data Mktg.	503-626-9348
PA	Hatboro, Monument Tech. Assoc.	215-443-5493
TX	Austin, Strategic Solutions Inc.	512-343-6323
TX	Houston, Strategic Solutions Inc.	713-496-0363
TX	Lewisville, Strategic Solutions Inc.	214-434-1921
TX	Plano, Elma Elctrn. Inc.	214-964-1700
VA	Newington, Scott Data Corp.	703-550-1300
WA	Redmond, Cascade Data Mktg.	206-747-6190
WI	Mequon, Martan, Inc.	414-241-4955
Can	Mississauga, Ont., Tracan Elctrns. Corp.	416-625-7752
Can	N. Vancouver, Tracan Elctrns. Corp.	604-984-4141

ELMA ENGINEERING, 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, TELEX: 345-560, FAX: 415-494-1093; FSC No.: 59810; Empl.: 38; *Sls. Mgr.:* T. A. Beno; *Dist. Mgr.:* T. A. Beno

ELMEC, INC., Technautic Corp., 300 N. McKemy Ave., Chandler, AZ 85226, Tel: 602-961-7100, FAX: 602-961-7173; FSC No.: 50691; Empl.: 55; *Sls. Mgr.:* Jim Hunt

ELMEC®
Delay Lines

FAX: 415-341-2370

ELMEC TECHNOLOGY OF AMERICA, INC., 1875 South Grant St., Ste. 560, San Mateo, CA 94402, Tel: 415-341-1611; *Sls. Mgr.:* Thomas Y. Miracle .... **A•1546-1551**

Local Sales Offices & Reps

CA	Seal Beach, TEXEL	213-596-9411
CA	Sunnyvale, Repron Assocs.	408-737-0510
CO	Denver, Promo Tech Sls.	303-692-8484
IL	Northfield, Feller Assocs. Inc.	708-446-8065
MA	Natick, Wayland Engrg. Sls.	508-655-6080
MN	Minneapolis, HMR Inc.	612-888-2122
OR	Portland, General Elctrns., Inc.	503-297-8500
WA	Stanwood, General Elctrns., Inc.	206-652-5917

Elmwood Sensors

FAX: 401-728-5390

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, TELEX: 6814066 ELMWOOD; Empl.: 1,000; *Sls. Mgr.:* Cesare Giammarco, Dir. of Sls. .... **B•1872-1873**

Local Sales Offices & Reps

AL	Decatur, Tenn. Tech. Sls.	205-350-5548
AZ	Phoenix, O'Donnell SW	602-944-9542
CA	San Diego, O'Donnell South	619-578-1645
CA	San Jose, O'Donnell South	408-456-2950
CA	Torrance, O'Donnell South	301-781-2255
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Coral Springs, CBC Electronics	305-755-1111
FL	Longwood, CBC Elctrns.	407-831-5380
FL	Tampa, CBC Elctrns.	813-969-1901
GA	Marietta, Tenn. Tech. Sls.	404-971-1419
IL	Arlington Heights, Thermek	708-577-6900
IN	Fort Wayne, O. H. Bromberg	219-456-6010
KY	Alexandria, O. H. Bromberg & Assocs.	606-635-3036
KY	Louisville, O. H. Bromberg	502-456-1498
MD	Towson, Arbotek	410-825-0775
MN	Mendota, G-II Sls.	612-454-3086
MO	Kansas City, Hill & Company	816-361-1669
MO	St. Louis, Hill & Co.	314-842-6868
NH	Barrington, Global Tech. Sls.	603-664-5780
NJ	Pitman, Colrud Corp.	609-589-5866
NM	Albuquerque, O'Donnell Assocs.	505-889-4522
NY	E. Syracuse, Bastian Sales Agency	315-437-1482
NY	Fairport, Bastian Sls.	716-223-0237
NY	Islip, Cogent Technlgs.	516-277-7101
NY	Katonah, Cogent Technlg. Assocs.	914-232-2500
NC	Garner, Tenn-Tech	919-779-3309
OH	Cleveland, Allied Entprs.	216-779-0080
OH	Dayton, O. H. Bromberg	513-434-8788
OR	Hillsboro, Temco-Northwest	503-645-2030
NJ	Pittman, Colrud Corp.	609-589-5866
PA	Pittsburgh, Allied Entprs. East	412-788-2992
TX	Arlington, Ion Assocs.	817-695-8000
TX	Austin, Ion Assocs.	512-331-7251
TX	Houston, Ion Assocs.	713-537-7717
WA	Birch Bay, Temco B.C.	206-371-0423
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392
WI	Mequon, Dickson-Zingler Assoc.	414-241-9140
Can	Mississauga, Ont., Andy Baumen Assocs.	416-828-2600

ELNA AMERICA, INC., 5686 Corporate Ave., Cypress, CA 90630, Tel: 714-761-8600, FAX: 714-761-9188; Empl.: 3500; *Sls. Mgr.:* Barbara Andrews; *Dist. Mgr.:* Barbara Andrews

ELNA FERRITE LABORATORIES, INC., PO Box 395, 234 Tinker St., Woodstock, NY 12498, Tel: 800-553-2870, FAX: 914-679-7010; Empl.: 14; *Sls. Mgr.:* Deborah McIntosh

ELNETIC ELECTRONICS, INC.:PLANT LOCATIONS, 1332 130th St., Gardena, CA 90247, Tel: 310-515-1546; FSC No.: 98460; Empl.: 10; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELNIK SYSTEMS, IPM, Inc., 3 Edison Place, Fairfield, NJ 07004, Tel: 201-882-8033, FAX: 201-882-8037; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

ELOGRAPHICS INC., 105 Randolph Rd., Oak Ridge, TN 37830, Tel: 615-482-4100, FAX: 615-482-4943; *Sls. Mgr.:* Joe Barresi

ELPAC COMPONENTS, Elpac Electronics, Inc., 1562 Reynolds, Irvine, CA 92714, Tel: 714-476-6070, FAX: 714-476-6085; FSC No.: 12406; Empl.: 130; *Sls. Mgr.:* Jim Degerstrom; *Dist. Mgr.:* Jim Degerstrom .... **A•1076-1081**

Local Distributors

CA	Chatsworth, Mil-Comm	818-998-3111
CA	Irvine, Kelex	714-863-1230
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, PSC Elctrns.	800-654-1518
FL	Melbourne, New Yorker	407-727-0955
IL	Northbrook, Classic Components	312-272-9650
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Andover, Aved Elctrns.	508-688-3800
MN	Roseville, Parts 1	612-633-8079
NJ	S. Hackensack, Waltech	201-641-7300
NJ	Whippany, American Distr. Inc.	201-428-0510
NY	Mamaroneck, New Yorker Elec.	914-698-7600
NY	Elmsford, Ancar	914-592-7100
OH	Dayton, Electro Supply	513-299-5020
OK	Tulsa, Altair Co.	918-252-5781
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair	214-231-5166
VT	Charlotte, Kellner	802-425-3250
WA	Seattle, Kam Elec.	206-382-1300
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Classic	414-786-5300
WI	Racine, Badger Elctrns.	414-637-1256

ELPAC POWER SYSTEMS, Elpac Electronics, Inc., 1562 Reynolds, Irvine, CA 92714, Tel: 714-476-6070, FAX: 714-476-6075; Empl.: 115; *Sls. Mgr.:* H. Myers; *Dist. Mgr.:* H. Myers

ELPAKCO, INC., 70 Wilbur St., Lowell, MA 01851, Tel: 508-453-3000, FAX: 508-453-9348; Empl.: 10; *Dist. Mgr.:* Stephen Fallon

ELPAQ, Elmo Semiconductor, 7590 N. Glenoaks Blvd., Burbank, CA 91504-1052, Tel: 818-768-7500, FAX: 818-767-3195; Empl.: 150

ELPAZ INSTRUMENTS, INC., 3000 Reed Blvd., Murrysville, PA 15668, Tel: 412-327-8744, FAX: 412-733-7609; FSC No.: OA2J2; Empl.: 5; *Sls. Mgr.:* Jim Shipman; *Dist. Mgr.:* Jim Shipman

E-L PRODUCTS COMPANY, Sub. of Astronics Corporation, 77 Olean Rd., E. Aurora, NY 14224, Tel: 716-655-0800, FAX: 716-655-0309; FSC No.: 14550; Empl.: 75; *Sls. Mgr.:* Time Zeigler

ELTECH, 181 Gibraltar Rd., Horsham, PA 19044, Tel: 215-441-0404, FAX: 215-441-8299; Empl.: 50; *Sls. Mgr.:* Brad Lizotte .... **B•1149**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark	602-968-9037
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CO	Golden, Cristee-Meade	303-279-5070
IL	Rolling Meadows, Staffco	708-259-8756
IN	Angola, Staffco	219-833-3323
MI	Rockford, Staffco	616-866-3070
OH	Cleveland, Staffco	216-331-5100
RI	Warwick, Ertronics	401-732-3567
TN	Brentwood, Staffco	615-377-9938

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32120, Tel: 904-253-5328, TWX: 810-832-6294, FAX: 904-258-3791; Empl.: 75; *Sls. Mgr.:* Douglas S. Armstrong

ELTEK CORPORATION, 445 E. Main St., Hagerstown, IN 47346, Tel: 317-489-6121, FAX: 317-489-5491; Empl.: 7

ELTROL CORPORATION, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, Tel: 818-709-0131, FAX: 818-709-0132; FSC No.: IER54; Empl.: 6; *Sls. Mgr.:* Terry E. Donovan .... **B•1250**

Local Sales Offices & Reps

CA	Van Nuys, Halbar Assocs.	818-906-3941
OH	Broadview Hgts., Controlled Prods.	216-838-5700

ELVO:DIVISION OF ZUMBACH ELECTRONICS CORPORATION, 140 Kisco Avenue, Mt. Kisco, NY 10549-1407, Tel: 914-241-1008, FAX: 914-241-7096; *Sls. Mgr.:* Thomas O'Connor

E-MARK, INC., 4 Daniels Farm Rd., Ste. 328, Trumbull, CT 06611, Tel: 203-452-1003, FAX: 203-452-1135; FSC No.: 0L7X6; Empl.: 4; *Sls. Mgr.:* Bryan West

EMC GLOBAL TECHNOLOGIES INC., 4059 Skyron Dr., Doylestown, PA 18901, Tel: 215-340-0650, FAX: 215-340-1737; Empl.: 70; *Sls. Mgr.:* Joel Hayes

EMCO, Components Specialties Inc., 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, FAX: 516-957-9142; Empl.: 20; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Angela Carolan

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626, 800-546-3680, TELEX: 5101008006, FAX: 209-223-2779; FSC No.: 3T243; Empl.: 38; *Sls. Mgr.:* Jennifer Jackson ... **D•1686**

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6346, FAX: 317-497-6348; FSC No.: 11770; Empl.: 300; *Sls. Mgr.:* Nathan B. Barlow; *Dist. Mgr.:* Nathan B. Barlow

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, FAX: 507-287-3405; *Sls. Mgr.:* Dan Estes .... **C•1034-1037**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, FAX: 609-429-6814; FSC No.: 24602; Empl.: 70; *Sls. Mgr.:* Peter Semitschew

E M D ELECTRONICS, Sigmatron L.P., 2201 Landmeier Rd., Elk Grove Village, IL 60007, Tel: 708-956-8000, FAX: 708-956-8082; Empl.: 150; *Sls. Mgr.:* Glen Holmes

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710, FAX: 301-840-8589; *Sls. Mgr.:* Anne Ledger .... **D•1256**

EMERSON & CUMING, INC., 77 Dragon Court, Woburn, MA 01888, Tel: 617-938-8630

EMERSON COMPUTER POWER, 9650 Jeronimo Rd., Irvine, CA 92718, Tel: 714-457-3600, FAX: 714-457-3788; Empl.: 20; *Dist. Mgr.:* R. Braud

Please call factory for sales offices and nearest reps.

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., 920 Candia Rd., Manchester, NH 03109, Tel: 603-669-5121, FAX: 603-669-5922; FSC No.: 85925; Empl.: 3000; *Sls. Mgr.:* Eileen M. Fagan

EMI TECHNOLOGY INC., See Penny & Giles Data Sys., Inc.

EMPIRE MAGNETICS, 5780 B LaBath Ave, Rohnert Park, CA 94928, Tel: 707-584-2801, FAX: 707-584-3418; Empl.: 10

Empro
SHUNTS ®

FAX: 317-823-4835

EMPRO MANUFACTURING COMPANY, INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 .... **D•1257**

Local Sales Offices & Reps

CA	Montrose, Signal Entprs. Inc.	818-957-0640
GA	Atlanta, Brownell Electro Inc.	404-362-9009
IL	Chicago, Best Rep Co.	708-632-0473
MA	Burlington, E.I.L. Instr,	617-272-9450
NJ	Franklin, D. F. Tobias & Co.	201-209-8825
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
PA	Philadelphia, Sunshine Sci. Instr. Inc.	215-673-5600
TX	Houston, Ev Smith Sls.	713-931-0403
WA	Seattle, Branom Instr. Co.	206-762-6050

Local Distributors

AZ	Tempe, Metermaster	602-431-0880
CA	Glendale, Instr. Meter Specialties	818-243-0416
CA	Livermore, Std. Meter Lab	510-449-0220
CA	Santa Fe Springs, Dae Instr. & Svc., Inc.	213-942-8843
FL	Miami Beach, PA Instrs., Inc.	305-868-5686
LA	Harahan, Indl. Instrs. Works	504-733-8355
MD	Hunt Valley, E.I.L. Instrs.	301-584-7400
NJ	Belleville, Miscorp	201-751-1190
OR	Portland, Westcon Inc.	503-283-0132
PA	Norristown, Kimberly-James	215-666-7286
TX	Beaumont, Straughn Elctrns.	409-838-4563
TX	Houston, American Analog	713-941-7265
TX	Houston, Meters & Instrs.	713-644-1631
WA	Seattle, Branom Instr. Co.	206-762-6050
WI	Milwaukee, E-M Instrs.	414-272-7799

E.M.S., Div. of Sandberg Industries, 14251 Chambers Rd., Tustin, CA 92680, Tel: 714-669-9473, FAX: 714-838-2967; Empl.: 125; *Sls. Mgr.:* Duane Halverson, VP Sls. .... **C•1672**

Local Distributors

RI	Warwick, E.M.S.	401-884-4790

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, FAX: 516-694-1093; FSC No.: 51435; Empl.: 100

ET
Emulation
Technology, Inc.

FAX: 408-982-0664

EMULATION TECHNOLOGY, INC., 2344 Walsh Ave., Bldg. F, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866; Empl.: 18; *Sls. Mgr.:* Joseph J. Bagliere, Jr., Mktg. Mgr. .... **C•1321**

Local Sales Offices & Reps

IL	Chicago, El/Mech Inc.	312-794-9100
OR	Beaverton, Blair Hirsh Co.	503-649-1007
TX	Carrollton, CTI Elctrns.	214-245-1266
WA	Kirland, Turn-A-Round	206-822-4634
Can	Ottawa, Ont., E.G. Lomas Ltd.	613-725-2177

Local Distributors

MI	Bloomfield Hills, Mackellar Assocs.	313-335-4440
NJ	Union, Meridian Supply Co.	908-687-6220
TX	Allen, Prime Distributing Co.	214-231-0170
TX	Richardson, Off The Shelf Comps., Inc.	214-238-0808

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 75; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601 B Dover Rd.-Hwy.2, Sandpoint, ID 83864, Tel: 208-263-8541, FAX: 208-263-0541; Empl.: 100; *Sls. Mgr.:* Jim Burcham; *Dist. Mgr.:* Jim Burcham

ENCORE ELECTRONICS, INC., 4400 Route 50, Saratoga Springs, NY 12866, Tel: 518-584-5354, FAX: 518-584-5963; Empl.: 20

Local Sales Offices & Reps

CA	Huntington Beach, Transducer Sys.	714-969-7690
PA	Blairsville, Meas. Instrs. East, Inc.	412-459-8090

ENDECO, Leads Metal Products Inc., 1125-C Brookside Ave., Indianapolis, IN 46202-2748, Tel: 317-631-7200, FAX: 317-631-7237; Empl.: 6; *Sls. Mgr.:* Eileen Alexander; *Dist. Mgr.:* Eileen Alexander

ENDEVCO CORPORATION, Meggitt Aerospace, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, FAX: 714-661-7231; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* B. Clark

ENDICOTT COIL CO., INC., 24 Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, FAX: 607-797-0151; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

ERG™ Endicott Research Group, Inc.

FAX: 607-754-9255

ENDICOTT RESEARCH GROUP, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187; FSC No.: 63312; Empl.: 120 ... **B•1045-1048; D•1687, 2106-2107**

Local Sales Offices & Reps

AZ	Finn-Patt	602-954-8275
CA	Granada Hills, Plustronics	818-830-3304, FAX:714-475-0717
CA	Imperial Counties, Mesa Comps., Inc.	619-278-8021,FAX:619-576-0964
CA	Newport Beach, Plustronics	714-476-8009, FAX:714-475-0717
CA	Saratoga; Testco, Inc.	408-253-1900, FAX:408-253-3444
CO	Seale & Assocs.	303-695-1980,FAX:303-695-1984
CT	Bloomfield, Sir/DSA	203-243-9343, FAX:203-243-8346
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240,FAX:708-956-8289
IA	Spectrum Sls.	319-366-0576,FAX:319-366-0635
KS	Overland Park, Spectrum Sls.	913-648-6811, FAX:913-648-6823
MD	Freedman-Malta Assocs.	301-879-3148, FAX:301-838-0789
MA	Westford, SIR/DSA	508-692-2500, FAX:508-692-9085
MN	Minneapolis, OEM Prods.	612-831-7373, FAX:612-831-7376
MO	Florissant, Spectrum Sls.	314-921-1313, FAX:314-921-0701
NJ	Budd Lake, Guido Assoc.	201-347-4643, FAX:201-691-1468
NC	Kernersville, Wallace Elctrns. Sls., Inc.	919-996-2742,FAX:919-996-1630
OH	EMA/DeMuesy	614-436-9452,FAX:614-436-0969
OH	EMA, Inc.	216-562-6104,FAX:216-562-7498
OH	Centerville, EMA, Inc.	513-433-2800, FAX:513-433-3147
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211,FAX:215-265-8764
WA	Bellevue, Testco, Inc.	206-454-7422, FAX:206-455-1706
WA	Vancouver, Testco, Inc.	206-693-7262, FAX:206-455-1706
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790, FAX:414-476-2682
Can	Delta, B C, Norgay Entprs. Ltd.	604-275-1121
Can	New Foundland, Indigo Elctrns., Ltd.	613-831-3106, FAX:613-831-3107
Can	Ontario, Indigo Elctrns., Ltd.	416-670-0284, FAX:416-670-1743
Can	Ottawa, Ont., Norgay Entprs. Ltd.	613-745-4051, FAX:613-745-5626
Can	Quebec, Indigo Elctrns., Ltd.	514-696-6104, FAX:514-626-1244
Can	Sackville. NS, Norgay Entprs. Ltd.	902-864-4321, FAX:902-865-9044
Can	Toronto, Ont., Norgay Entprs.	416-234-8966, FAX:416-234-8970
Can	Westmount, Que., Norgay Entprs. Ltd.	514-932-3233,FAX:819-657-4337

ENDRESS & HAUSER INSTRUMENTS, 2350 Endress Place, Greenwood, IN 46143, Tel: 317-535-7138, 800-428-4344, TELEX: 27-2195, FAX: 317-535-8498; Empl.: 200; *Sls. Mgr.:* Mike Stilabower

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGY

FAX: 301-699-8107

ENERGY, LTD., 4714 Upshur Street, Bladensburg, MD 20710, Tel: 301-699-1144; Empl.: 10 .... **D•2260**

Local Sales Offices & Reps

MD	Bladensburg, Energy, Ltd.	301-699-1144

Local Distributors

MD	Bladensburg, Energy, Ltd.	301-699-1144

ENERGY SYSTEMS, 12004 NE 95th St., No. 840, Vancouver, WA 98682, Tel: 206-896-8310, FAX: 206-896-8457; Empl.: 25

ENERTECH CONSULTANTS, 300 Orchard City Dr.,Ste. 132, Campbell, CA 95008, Tel: 408-866-7266, FAX: 408-866-7279; Empl.: 20; *Sls. Mgr.:* Carolyn J. Persall

ENGINEERED ASSEMBLIES & COMPONENTS CORP., 380 North St., Teterboro, NJ 07608, Tel: 201-288-4477, 800-447-5639, FAX: 201-288-1515; Empl.: 106; *Sls. Mgr.:* Tim Teem / Peter Hunkeler; *Dist. Mgr.:* John Deleodice .... **D•1448-1449**

Local Sales Offices & Reps

FL	St. Petersburg, EAC-Engrd. Assemblies & Comp. Corp.	813-328-1970
GA	Norcross, EAC-Engrd. Assemblies & Comp. Corp.	404-446-3135
MA	Sutton, EAC-Engrd. Assemblies & Comp. Corp.	508-865-0722
NJ	Teterboro (Hdqtrs.), EAC-Engrd. Assemblies & Comp. Corp.	201-288-4477
NC	Raleigh, EAC-Engrg. Assemblies & Comp. Corp.	919-790-9700

ENGINEERED COMPONENTS CO., P. O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-3800, FAX: 805-544-8091; FSC No.: 32440; Empl.: 102

ENGINEERED MAGNETICS, INC., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 310-635-9555, TWX: 910-325-6208, ESYLNK: 310-631-0313; FSC No.: 06509; Empl.: 100; *Sls. Mgr.:* S. Miller

ENGINEERED SYSTEMS & DESIGNS, 119A Sandy Dr., Newark, DE 19713, Tel: 302-456-0446, FAX: 302-456-0441; Empl.: 12; *Sls. Mgr.:* Jamie C. Smith

ENGINEERING DESIGN & SLS., One E.D.S. Way, Danville, VA 24541, Tel: 804-792-6405, FAX: 804-792-6415; Empl.: 75; *Sls. Mgr.:* Mark Gignac

ENGLER INSTRUMENTS OPERATION, See Stemco Instruments, Colt Inds.

ENI, DIV. OF ASTEC AMERICA, INC., 100 Highpower Road, Rochester, NY 14623, Tel: 716-427-8300, ESYLNK: 62855365, FAX: 716-427-7839; Empl.: 300 ..... **D•1011**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Chatsworth, Technlgs. West	818-700-6426
CA	Santa Clara, ENI	408-727-0993

CO	Golden, Trembly Assocs.	303-279-3019
FL	Cocoa Beach, Teqspec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
GA	Snellville, Teqspec	404-972-7955
IL	Elmhurst, Sector Engrg.	708-530-7850
IN	Indianapolis, Sector Engrg.	317-253-9221
KS	Overland Pk., Ramsey Assocs.	913-541-1007
MD	Laurel, Elctrn. Mktg. Assoc.	301-953-7800
MA	Stow, HG Assocs.	508-897-3190
MI	Troy, WKM Assocs.	313-588-2300
MN	Minneapolis, Sector Engrg.	612-378-2123
MO	St. Louis, Ramsey Assocs.	314-532-9386
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Great Neck, RTI, Inc.	516-829-3770
NY	Rochester, Taerep, Inc.	716-586-8710
NY	Whitney Pt., Taerep, Inc.	607-692-3705
NC	Winston Salem, Teqspec	919-765-5553
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	N. Salt Lake, Trembly Assocs.	801-295-4703
WA	Bellevue, Syntek	206-462-7700
WI	Milwaukee, Sector Engrg.	414-352-8280
Can	Dorval, Arritsu Wiltron Inst.	514-421-3737
Can	Mississauga, Arritsu Wiltron Inst.	416-890-7799
Can	Nepean, Arritsu Wiltron Inst.	613-828-4090
Can	Richmond, Arritsu Wiltron Inst.	604-244-3815

ENM COMPANY, 5617 Northwest Highway, Chicago, IL 60646, Tel: 312-775-8400, TELEX: 25-4068, FAX: 312-775-5968; Empl.: 100ò; *Sls. Mgr.:* Lee Bryant

ENNOVATION OF WISCONSIN, INC., 806 Elm St-P.O. Box 258, Watertown, WI 53094, Tel: 414-261-2996, FAX: 414-261-3432; Empl.: 5; *Sls. Mgr.:* Enno Knief; *Dist. Mgr.:* Enno Knief

ENPROTECH CORP., 445 West Michigan Ave., Kalamazoo, MI 49007, Tel: 616-381-0665, FAX: 616-381-9810; Empl.: 125

Ensign Corporation

CUSTOM & PRE-DESIGNED TRANSFORMERS

FAX: 708-789-3206

ENSIGN CORP., 7960 S. Madison Street, Burr Ridge, IL 60521, Tel: 708-325-9343; Empl.: 150; *Sls. Mgr.:* J. Darrel Ensign **A•2326-2328**

Local Sales Offices & Reps

AL	Huntsville, El Tech	205-464-0599
AZ	Tempe, Gassner-Clark	602-968-9037
CA	Campbell, Kingway	408-866-5010
CA	Huntington Bch., Kingway	714-846-3834
CA	Tarzana, Kingway	818-609-1974
CO	Denver, Donohue	303-455-1719
CT	Meriden, Gerber	203-630-3477
FL	Boynton Bch., D-Assocs., Inc.	305-492-8634
FL	Orlando, D-Assocs., Inc.	407-321-9594
FL	Tampa, D-Assocs., Inc.	813-960-0935
GA	Lilburn, El Tech	404-564-1236
IL	Godfrey, Crosslink	618-466-1118
IL	Mt. Prospect, Dombrow	708-253-3326
IN	Indianapolis, J.H. Weaver	317-849-1659
KS	Prairie Vlg., Crosslink	913-649-7100
KY	Ft. Wright, El Tech	606-331-3495
MA	Burlington, Gerber	617-229-1150
MA	Marlboro, Gerber	508-481-3130
MA	S. Dartmouth, Gerber	617-990-3454
MI	Bloomfield Hills, Mac Kellar	313-335-4440
MI	Grand Haven, Mac Kellar	616-846-7990
MN	Minneapolis, Tek Rep	612-832-0277
NH	Hudson, Gerber	603-882-1566
NY	Fairport, Promark	716-425-8100
NY	Franklin Sq., Cooper-Simon	516-489-0404
NY	Tonawanda, Promark	716-877-6300
NC	Charlotte, El Tech	704-342-3648
OH	Cleveland, L.H. Kaiser	216-461-4930
OK	Tulsa, Comptech	918-266-1966
OR	Beaverton, Luscombe	503-636-6664
PA	Horsham, Jacobsen	215-674-2937
TX	Austin, Comptech	512-343-0300
TX	El Paso, Comptech	915-566-1022
TX	Harlingen, Comptech	210-421-4501
TX	Houston, Comptech	713-492-0005
TX	Irving, Comptech	214-751-1181
TX	San Antonio, Comptech	210-525-9913
VA	Herndon, Metal Resources	703-318-8682
WA	Bellevue, Luscombe	206-223-1541
WI	Milwaukee, Dombrow	414-263-4116
Can	Dorval, Que., Weiss	514-685-6644
Can	Mississauga, Ont., Weiss	416-673-0011
Can	Nepean, Ont., Weiss	613-225-1810
Can	Vancouver, B.C., Weiss	604-873-1112
Can	Winnipeg, Man., Weiss	204-772-3665

ENTECH CORP. OF VOLUSIA COUNTY, 8 Tower Circle West, Ormond Beach, FL 32174-8761, Tel: 904-672-7335, FAX: 904-672-7233

ENTECH SYSTEMS, INC., 17B Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557, FAX: 203-658-2740; *Sls. Mgr.:* A. D. Jorczak

ENTERPRISE SYSTEMS CORP., PO Box 698, Dover, NH 03820, Tel: 603-742-7363, FAX: 603-742-7399; FSC No.: 79543; Empl.: 5; *Sls. Mgr.:* George Perrine

ENTRA CORPORATION, 8651 Castle Park Drive, Indianapolis, IN 46256, Tel: 317-849-8270, FAX: 317-849-7041; Empl.: 75; *Sls. Mgr.:* F. Paul McDonald; *Dist. Mgr.:* T.P. Wagner

ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07004, Tel: 201-227-1002, 800-635-0650, TELEX: 130-361, FAX: 201-227-6865; *Sls. Mgr.:* Robert L. Morrell **B•1936-1947**

ENTRELEC INC., 1950 Hurd Drive, Irving, TX 75038, Tel: 214-550-9025, FAX: 214-550-9215; Empl.: 50; *Sls. Mgr.:* F. D. Leynaert

ENVIRONMENTAL CONTAINER SYS., INC., See ECS Composites

ENVIRONMENTAL STRESS SYSTEMS, INC., 16310 N. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117; *Sls. Mgr.:* Mel Ainsworth; *Dist. Mgr.:* Mel Ainsworth

ENVIRONMENTAL TELESIS & CONTROLS, P.O. Box 180206, Austin, TX 78718, Tel: 512-835-0330, FAX: 512-832-1775; Empl.: 12; *Sls. Mgr.:* Anna Diaz

ENVIROPLAN, 3 Becker Farm Rd., Roseland, NJ 07068, Tel: 201-994-2300, FAX: 201-994-5100; Empl.: 50; *Sls. Mgr.:* Robert Mullowney

EOG, INC., OMX, INC., 10947 Golden West Drive, Hunt Valley, MD 21031, Tel: 410-785-3000, FAX: 410-771-5814; FSC No.: 17521; Empl.: 175; *Sls. Mgr.:* John D. Fabrizio

EPC IDENTIFICATION SYS., 505 Martin Ave., Rohnert Park, CA 94928, Tel: 707-585-8811, TWX: 910-3382-311, FAX: 707-585-8688; FSC No.: 67041; Empl.: 16; *Sls. Mgr.:* William Bolster; *Dist. Mgr.:* William Bolster

EPCO PRODUCTS INC., P.O. Box N. Cottage St., WAllkill, NY 12589, Tel: 914-895-2033, FAX: 914-895-2279; Empl.: 45; *Sls. Mgr.:* Mark Giegel

EPD ELECTRONICS, INC., 16921 S. Western Ave.-Bldg. 300, Gardena, CA 90247, Tel: 310-515-4996, FAX: 310-515-5011; Empl.: 6 **D•1073, 1688**

Local Sales Offices & Reps

IA	Burlington, JS Ridge Entprs., Inc.	319-754-8745
NJ	Bricktown, Bryan Elctrn. Sls. Co.	201-840-8487
OR	Portland, Dale G. Weber Co.	503-234-0686
TN	White House, Apple Sls. & Mktg.	615-672-4498

EPE TECHNOLOGIES, INC., Subsidiary of Square D, 1660 Scenic Avenue, Costa Mesa, CA 92627, Tel: 714-557-1636, FAX: 714-957-1103; Empl.: 300; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls.

Please call factory for sales representative and distributor information.

EPH ENGINEERING ASSOCIATES, INC., 21 East 400 South, Orem, UT 84058, Tel: 801-226-1383, FAX: 801-226-1437

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, FAX: 212-406-2508; Empl.: 8; *Sls. Mgr.:* Kelly Irwin

EPIC RESINS, General Fiberglass Supply, Inc., 1415 Ellis St., Waukesha, WI 53186, Tel: 414-521-2255, FAX: 414-521-1320; Empl.: 20; *Sls. Mgr.:* Daniel Veenhuis

EPM CORPORATION, 8866 Kelso Dr., Baltimore, MD 21221, Tel: 410-686-7800, TELEX: 87569, FAX: 410-686-4662; Empl.: 75

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., Billerica, MA 01821, Tel: 508-667-3805, 800-227-2201, FAX: 508-663-9782; FSC No.: 33246; Empl.: 26; *Sls. Mgr.:* Ann L Delmarsh

Local Sales Offices & Reps

AZ	Phoenix, Wadsworth/Pacific	602-994-4840
CA	Atherton, Wadsworth/Pacific	415-321-3619
CA	Fullerton, T.C. Rapp Co.	714-773-9350
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	Tampa, Florida Elctron. Assoc.	813-972-7992
IL	Palatine, Crimson Sls. Inc.	708-304-8250
MA	Newton, Normell Assoc.	617-969-5478
MN	Minneapolis, InterTec Assoc.	612-921-8443
NY	Fair Haven, Feikert Assoc.	315-433-1124
OH	Dayton, J. Stephenson & Assoc.	513-435-0745
OR	Hillsboro, Ryan Tech. Svcs.	503-681-0790
PA	Bethlehem, Microstar	215-867-0612

THE EPPLEY LABORATORY, INC., 12 Sheffield Avenue, Newport, RI 02840, Tel: 401-847-1020, FAX: 401-847-1031; Empl.: 25

EPSCO INCORPORATED, 1115 Hilltop Dr., Itasca, IL 60143-1120, Tel: 708-250-0410, FAX: 708-250-0521; FSC No.: 53003; Empl.: 8; *Sls. Mgr.:* Wendie Peters V.P. **D•1689**

Local Distributors

AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Santa Barbara, Abbeon Cal Inc.	805-966-0810
CO	Denver, Fisher Scientific	303-371-0888
CT	Stanford, Aero Quality Sls.	1-800-288-1954
IL	Chicago, Electro Inds.	312-736-0999
IL	Countryside, Inotek/Pacific Indicator	708-352-3500
IL	Elmhurst, McMaster-Carr Supp.	708-834-9600
IN	East Chicago, Acro Elctrns. Corp.	219-397-8681
LA	Lafayette, Ralph's Inc.	318-233-0105
LA	New Orleans, Radio Parts Inc.	504-581-5959
MA	Lynn, Land Elctrns.	617-592-2220
MI	Jackson, Fulton Radio Supp.	517-784-6106
MN	Minneapolis, Allied Elctrns.	612-881-0838
MO	Olivette, Fryer Co.	314-997-6807
NJ	Aberdeen, J.G. Elctrns.	908-583-5352
NJ	Bridgeport, VWR Scientific	609-467-2600
NJ	New Brunswick, McMaster-Carr Supp. Co.	908-329-3200
NM	Albuquerque, Southwest Metals & Supps.	505-247-2111
NY	Syracuse, Stewart Smith	315-437-7836
OH	Warren, Rem Elctrns. Supp.	216-373-1300
SC	Charleston, Wholesale Inds. Elec.	803-722-2634
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Houston, Angie Elctrns.	1-800-666-4616
WI	Milwaukee, Industrial Elctrns. Supp.	414-276-1212

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 708-232-9611, TELEX: 708-232-9613; Empl.: 20; *Sls. Mgr.:* R. Knox

EPSON®

FAX: 310-782-5350

EPSON AMERICA, INC./OEM DIV., 20770 Madrona Ave., Torrance, CA 90503, Tel: 310-787-6300; Empl.: 900; *Sls. Mgr.:* Walter Carlos, Dir. of Sls. **A•1388-1395; B•1050-1061; D•1088-1095**

Local Sales Offices & Reps

CA	Los Angeles, Epson America, Inc./OEM Div.	714-768-7474
CA	San Francisco, Epson America, Inc./OEM Div.	408-249-0710
IL	Chicago, Epson America, Inc./OEM Div.	815-455-7630
MA	Boston, Epson America, Inc./OEM Div.	617-245-8007

EPSON

FAX: 310-782-5320

EPSON AMERICA INC., Component Sales Dept., 20770 Madrona Ave., Torrance, CA 90503, Tel: 310-782-5318; *Sls. Mgr.:* Hideo Akiyama; *Dist. Mgr.:* Rob Turner **A•1388-1395; B•1050-1061; D•1088-1095**

Local Sales Offices & Reps

AL	Madison, Concord Comp Reps	205-772-8883, FAX:205-772-8262
AZ	Scottsdale, Fred Board Assocs.	602-994-9388, FAX:602-994-9477
AZ	Tucson, Fred Board Assocs.	602-299-1508, FAX:602-797-1683
CA	Cupertino, Costar, Inc.	408-446-9339, FAX:408-446-4885
CA	Encinitas, Bager Elctrns. Inc.	619-632-8816, FAX:619-632-8810
CA	Woodland Hills, Bager Elctrns.Inc.	818-712-0011, FAX:818-712-0160
CO	Colorado Springs, Western Region Mktg.	719-548-8282,FAX:719-548-0462
CO	Westminster, Western Region Mktg.	303-428-8088, FAX:303-426-8585
FL	Casselberry, Dyne-A-Mark	407-831-2822, FAX:407-834-4524
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501, FAX:305-772-0114
GA	Norcross, Concord Comp. Reps	404-416-9597, FAX:404-441-0790
IL	Itasca, LTD Technlgs.	708-773-2900, FAX:708-773-0358
IN	Indianapolis, C.C. Electro Sls.	317-921-5000, FAX:317-921-5005
KS	Shawnee Mission, Microtronics, Inc.	913-262-1444, FAX:913-262-1445
MD	Ellicott City, Technlg. Sls. Assocs.	301-461-7802, FAX:301-461-7888
MA	Needham Heights, Rosen Assocs. Inc.	617-449-4700,FAX:617-449-5245
MN	Eden Prairie, Electromark	612-944-5850, FAX:612-944-5855
NJ	Parlin, JMR Sls; Inc.	201-525-8000, FAX:201-525-8805
NY	Pittsford, Elcom Sls., Inc.	716-385-1400, FAX:716-248-8531
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967, FAX:315-685-6273
NY	Wading River, Niktronics	516-929-4671, FAX:516-929-1683
NC	Raleigh, WLA Assocs.	919-231-9939, FAX:919-231-9949
OH	Sheffield, J.D. Babb	216-934-4454, FAX:216-934-4454
OR	Tigard, Matrex Sls.	503-245-8080, FAX:503-246-1848
PA	Trevose, Omega Sls.	215-244-4000, FAX:215-244-4104
TX	Austin, Component Technlg. Sls.	512-250-2450, FAX:512-288-7328
TX	Dallas, Component Technlg. Sls.	214-783-8831, FAX:214-783-4801
TX	Houston, Component Technlg. Sls.	713-961-1262, FAX:713-462-9906
UT	Salt Lake City, Western Region Mktg.	801-268-9768,FAX:801-268-9796
WA	Bellevue, Matrex Sls.	206-643-0363, FAX:206-746-3672
WI	Milwaukee, LTD Technlgs.	414-774-1000, FAX:414-774-0593

Local Distributors

AL	Bell Inds., Inc.	205-837-1074,FAX:205-830-5598
AL	Huntsville, Nu Horizons Elctrns. Corp.	205-722-9330,FAX:205-722-9348
AZ	Tempe, Bell Inds., Inc.	602-966-7800, FAX:602-967-6584
CA	Agoura Hills, Bell Inds., Inc.	818-879-9494, FAX:818-991-7695
CA	Cypress, Bell Inds., Inc.	714-895-7801, FAX:714-891-4570
CA	Irvine, IEC Irvine	714-837-9960,FAX:714-837-8308
CA	Los Angeles, Bell Inds., Inc.	310-826-2355, FAX:310-820-8328
CA	Riverside, Elctrns. Supp.	714-683-7300, FAX:714-781-0453
CA	Rocklin, Bell Inds., Inc.	916-652-0414, FAX:916-652-0403
CA	Sacramento, Integrated Elctrns. (IEC)	916-363-6030,FAX:916-362-6926
CA	San Diego, Bell Inds., Inc.	619-268-1277, FAX:619-268-3733
CA	San Diego, Elctrns. Supp.	619-693-8222
CA	San Jose, Elctrns. Supp.	408-453-3770, FAX:408-453-0398
CA	San Jose, IEC San Jose	408-734-8500, FAX:408-435-8709
CA	San Jose, Merit Elctrns., Inc.	408-434-0800, FAX:408-434-0935
CA	Sunnyvale, Bell Inds., Inc.	408-734-8570, FAX:408-734-8875
CA	Vienna, Dove Elctrns.	703-893-1821, FAX:703-448-8598
CO	Denver, Bell Inds., Inc.	303-691-9010, FAX:303-691-9036
CO	Denver, Integrated Elctrns. (IEC)	303-292-5537, FAX:303-292-0114
CT	Wallingford, Bell Inds., Inc.	203-269-6801, FAX:203-269-6527
CT	Wallingford, Cronin Elctrns., Inc.	203-265-3134
CT	Wallingford, Nu Horizons Elctrns. Corp.	203-265-0162
FL	Altamonte Springs, Bell Inds., Inc.	407-339-0078, FAX:407-339-0139
FL	Ft. Lauderdale, Bell Inds., Inc.	305-421-1997, FAX:305-421-5706
FL	Ft. Lauderdale, Nu Horizons Elctrns. Corp.	305-735-2555,FAX:305-735-2880
FL	Melbourne, Pro-Formance Elctrns., Inc.	407-768-2866,FAX:407-768-2526
FL	Tampa, Bell Inds., Inc.	813-541-4434
GA	Norcross, Bell Inds., Inc.	404-446-7167, FAX:404-446-7264
GA	Norcross, Nu Horizons Elctrns. Corp.	404-416-8666,FAX:404-416-9060
IL	Bensenville, Voyager Elctrns.	708-860-1300, FAX:708-860-1573
IL	Elk Grove Village, Bell Inds., Inc.	708-640-1910, FAX:708-640-0474
IL	Hoffman Estates, IEC IL (Hoffman Estates)	708-843-2040,FAX:708-843-2320
IL	Urbana, Bell Inds., Inc.	217-328-1077, FAX:217-328-1148
IN	Ft. Wayne, Bell Inds., Inc.	219-423-3422, FAX:219-424-2433
IN	Indianapolis, Bell Inds., Inc.	317-875-8200, FAX:317-875-8219
IN	Indianapolis, Custom Svc. Elect.	317-879-9119, FAX:317-879-9136
IA	Bell Inds., Inc.	319-395-0730,FAX:317-875-8219
KS	Olathe, ECS Inc.	913-782-7787,FAX:913-782-6991
KY	East, Bell Inds., Inc.	800-582-7492
KY	West, Bell Inds., Inc.	800-445-8795
MD	Columbia, Nu Horizons Elctrns. Corp.	410-995-6330,FAX:410-995-6332
MD	Jessup, Bell Inds., Inc.	301-290-5100, FAX:301-953-0039
MA	Andover, Bell Inds., Inc.	508-474-8880, FAX:508-474-8902
MA	Needham, Cronin Elctrns., Inc.	617-449-5000, FAX:617-444-8395
MA	Wakefield, Nu Horizons Elctrns. Corp.	617-246-4442,FAX:617-246-4462
MI	Wixon, Bell Inds., Inc.	800-937-2355, FAX:513-435-6765
MN	Bell Inds., Inc.	612-941-1493,FAX:612-938-7410
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766, FAX:612-571-9519
MN	Thief River Falls, Digi-Key Corp.	612-944-5855, FAX:612-344-4539
MO	Bell Inds., Inc.	314-647-2355,FAX:317-875-8219
NJ	Edison, Dove Elctrns.	908-738-0321, FAX:908-738-0507
NJ	Fairfield, Bell Inds., Inc.	201-227-6060, FAX:201-227-2626
NJ	Flanders, Dove Elctrns.	201-927-6339
NJ	Mt. Laurel, Nu Horizons Elctrns. Corp.	609-231-0900,FAX:609-231-9510
NJ	Pine Brook, Nu Horizons Elctrns. Corp.	201-882-8300,FAX:201-882-8398
NJ	West berlin, G.C.I. Corp.	609-768-6767, FAX:609-768-4289
NM	Albuquerque, Bell Inds., Inc.	505-292-2700, FAX:505-275-2819
NY	Amityville, Nu Horizons Elctrns. Corp.	516-226-6000,FAX:516-227-0082
NY	E. Setauket, Dove Elctrns.	516-689-7733, FAX:516-689-7362
NY	Rochester, Nu Horizons Elctrns. Corp.	716-292-0777,FAX:716-292-0750
NC	Bell Inds., Inc.	919-821-4041,FAX:919-821-4953
OH	Dayton, Bell Inds., Inc. (Industrial)	513-435-8660, FAX:513-435-6765
OH	Dayton, Bell Inds., Inc. (Military)	513-434-8231, FAX:513-434-8103
OR	Beaverton, IEC Beaverton (OR)	503-641-1690, FAX:503-646-3737
OR	Lake Oswego, Bell Inds., Inc.	503-635-6500, FAX:503-635-4095
PA	Pittsburgh, Bell Inds., Inc.	412-787-3883, FAX:412-788-4035
PA	Trevose, Bell Inds., Inc.	215-953-2800, FAX:215-364-4928
SC	Bell Inds., Inc.	800-322-7908,FAX:407-339-0139
TN	Bell Inds., Inc.	615-367-4400,FAX:205-837-1074
TX	Austin, Norvell Austin	512-343-2900, FAX:512-343-9602
TX	Austin, Omni Pro Elctrns.	512-794-9200, FAX:512-338-9576
TX	Dallas, Norvell Elctrns., Inc.	214-233-0020, FAX:214-490-7245
TX	Dallas, Omni Pro Elctrns.	214-713-9000, FAX:214-732-8743
TX	Houston, Norvell Houston	713-462-1666, FAX:713-462-3210
TX	Houston, Omni-Pro Elctrns.	713-270-1700, FAX:713-270-8020
TX	Richardson, Bell Inds., Inc.	214-690-0466, FAX:214-690-0822
UT	Midvale, Bell Inds., Inc.	801-255-9611, FAX:801-255-2477
UT	West Valley City, IEC Utah (Salt Lake)	801-977-9750,FAX:801-975-1207
WA	Bell Inds., Inc.	206-867-5410,FAX:206-867-5159
WA	Bellevue (WA), IEC Bellevue (MA)	206-455-2727, FAX:206-453-2963
WI	Waukesha, Bell Inds., Inc.	414-547-8879, FAX:414-547-6547

EQUIPMENT REMARKETING COMPANY, Boston Financial & Equity Corporation, 20 Overland Street, Boston, MA 02215, Tel: 617-267-8600, FAX: 617-267-2370

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60506, Tel: 708-859-1000, 800-323-0801, TWX: 910-232-0845, FAX: 708-859-3255; Empl.: 300; *Sls. Mgr.:* Tom Nilles; *Dist. Mgr.:* Jerry Reidy

EQUIPTO ELECTRONICS CORP., 351 Woodlawn Ave., Aurora, IL 60506-9988, Tel: 708-897-4691, FAX: 708-897-5314; FSC No.: 14002;Multiple; Empl.: 78; *Sls. Mgr.:* Robert Golz .... **C•1038-1041**

ERA POLY-PLANAR DIV., See Poly-Planar, Inc.

ERASER CO., Box 4961, Syracuse, NY 13221, Tel: 315-454-3237, TELEX: 93-7442, FAX: 315-454-3090; Empl.: 45; *Sls. Mgr.:* Linda S. Cahill

ERC, See Electronic Research Co.

ERCONA, 979 North Ocean Ave., Patchogue, NY 11772, Tel: 516-758-0700, FAX: 516-758-0422; Empl.: 10; *Sls. Mgr.:* G. Moore; *Dist. Mgr.:* L. Mills

ERCON INCORPORATED, 26 Emerson Road, Waltham, MA 02154, Tel: 617-899-1497, FAX: 617-899-2650; *Sls. Mgr.:* Dennis Ehrreich

ERGOTRON, INC., 3450 Yankee Dr., Eagan, MN 55121, Tel: 612-452-8135, TELEX: 4310015, FAX: 612-452-8346; Empl.: 24; *Sls. Mgr.:* Harry C. Sweere

ERICSSON

FAX: 214-680-1059

ERICSSON COMPONENTS, INC., 403 International Parkway, Richardson, TX 75081, Tel: 214-997-6561, TELEX: 735389 ERICS RCHN .... **D•1691-1697**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.,Inc.	205-534-0044
AZ	Scottsdale, Sun Tech Sls.	602-860-8262
CA	Cupertino, PEI Assocs. Inc.	408-253-1960
CA	Garden Grove, Elsco Elctrns.	714-891-4621
CA	San Diego, Elsco Elctrns.	619-292-1771
CO	Denver, AKI	303-388-4488
GT	Greenwich, Ericsson Comps. Inc.	203-625-7300
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
GA	Norcross, The Novus Grp., Inc.	404-263-0320
IL	Elk Grove Village, Carlson Elctrns. Sls.	708-956-8240
KS	Lenexa, Web Assoc./Elctrns., Inc	913-541-8585
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	Florissant, Web Assoc./Elctrns., Inc.	314-921-5720
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NJ	Parlin, JMR Sls., Inc.	201-525-8000
NY	Wading River, Niktronics	516-929-4671
NC	Cary, The Novus Grp., Inc.	919-460-7771
OH	Cleveland, RK Comp. Sls., Inc.	216-642-9312
TX	Dallas, Dynamark	214-437-3333
VA	Herndon, Stinson Assocs.	703-620-1331
WA	Redmond, EMG-Elec. Mktg. Grp.	206-882-0962
WA	Vancouver, EMG Elec. Mktg. Grp.	206-944-0761
WI	Milwaukee, Carlson Elctrns., Sls.	414-476-2790

Local Distributors

Can	Markham, Ont., Deskin Inc.	416-475-1412

ERICSON MANUFACTURING CO., 4215 Hamann Pkwy., Willoughby, OH 44094, Tel: 216-951-8000, TELEX: 98-5390, FAX: 216-951-1867; Empl.: 110; *Sls. Mgr.:* Dave Hardy

ERIE TECHN. PRODS., See Murata Erie No. Amer., Inc.

ERNI COMPONENTS, 520 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-6367, FAX: 804-379-2109; Empl.: 700; *Sls. Mgr.:* Thomas Noack

ESC ELECTRONICS CORPORATION

FAX: 201-947-0406

ESC ELECTRONICS CORP., 534 Bergen Blvd., Palisades Pk., NJ 07650, Tel: 201-947-0400; Empl.: 120 .... **A•1552-1565, 2329**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Mesa, Sedco Sls.	602-461-9069
CA	Newbury Pk., Westaironics	805-499-9844
CA	Santa Clara, Rodgers Assocs.	408-984-8110
CO	Denver, Donohue Sls. Co.	303-455-1719
FL	Palm Harbor, Sigma Tech. Assocs.	813-789-5522
IL	Elk Grove, Carlson Elctrn. Sls. Co.	312-956-8240
IA	Cedar Rapids, Carlson Elctrn. Sls. Co.	319-378-1450
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Ellicott City, Saltech	410-461-7350
MA	Swansea, Poisson Assocs., Inc.	508-677-3655
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NC	Winston-Salem, Murcota Corp.	919-722-9445
OR	Beaverton, Ravencraft	503-579-9261
TX	Plano, Zeus Engrg.	214-423-2027
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790
EXP	NJ, Palisades Pk., ESC Elctrns. Corp.	201-947-0400
Can	Toronto, Ont., CEA Assocs.	416-231-9717

ESCOD INDUSTRIES, Insilco, 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, FAX: 413-536-8425; Empl.: 875

ESC TECHNOLOGIES, INC., 14115 Chadron Ave., Hawthorne, CA 90250, Tel: 310-970-4090, FAX: 310-970-0820; Empl.: 35; *Sls. Mgr.:* Gary L. Peterson; *Dist. Mgr.:* Gary L. Peterson

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 310-322-2136, FAX: 310-322-8127; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* Brian Way; *Dist. Mgr.:* Brian Way

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195

ESP SOLDER PLUS, 14 Blackstone Valley Pl., Lincoln, RI 02865, Tel: 800-338-4353, 401-333-3800, FAX: 401-333-4954; Empl.: 40; *Sls. Mgr.:* Ms. Kim Ranallo

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct #9, Ventura, CA 93003, Tel: 805-644-9544, FAX: 805-644-9584; Empl.: 19; *Sls. Mgr.:* Larry D. Emery, Pres. & G.M.

ESS, INC., 16310 No. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117

E-SWITCH, Electronic Components Groupe, 26 North Fifth St., Minneapolis, MN 55403, Tel: 612-375-9639, FAX: 612-375-1900; *Sls. Mgr.:* Rick Hampton; *Dist. Mgr.:* Rick Hampton .... **B•1722-1723**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Tempe, ACS of Arizona	602-731-9711
CA	Orange, RD & D Sls., Engrg., Inc.	714-771-6110
CA	San Jose, Westron Assocs.	408-264-4070
CO	Littleton, Romulus Elctrns., Inc.	303-770-4888
FL	Melbourne, Phoenix Comps., Inc.	407-723-4414
GA	Duluth, New Age Elctrns.	404-476-0079
IL	Palatine, Golbeck Milota	708-705-0602
IN	Fishers, Connect 21, Inc.	317-578-2121
KS	Lenexa, Midtec Assocs.	913-541-0505
MI	Madison Hgts., D.E.M. Sls., Inc.	313-583-1500
MN	Oakdale, Complete Sls.	612-731-2923
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashau, Bennetron	603-880-7008
NY	Syracuse, ADR Technlgs., Inc.	315-437-7087
OH	Cleveland, Comps. Inc.	216-243-9200
OK	Atoka, AID Elctrns., Inc.	405-889-7638
OR	Aloha, Turn-A-Round Sls.	503-649-1007
PA	Ft. Washington, SMC, Inc.	215-628-3394
TX	Irving, AID Elctrns.	214-790-4761

VA	Sterling, Beacon North Inc.	703-470-2480
WA	Kirkland, Turn-A-Round Sls.	206-822-4634
WI	Madison, Golbeck Milota	608-222-7037
Can	Burlington, Ont., White Radio, Ltd.	416-632-6894

E-SYSTEMS, Greenville Div., P.O. Box 6056, Greenville, TX 75403-6056, Tel: 903-455-3450, FAX: 903-457-4413; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046, Tel: 703-560-5000, FAX: 703-280-4627; Empl.: 2,180

E-SYSTEMS, See Memcor-Truohm, Inc.

E-T-A®

FAX: 708-647-7494

E-T-A CIRCUIT BREAKERS, 7400 N. Croname Rd., Niles, IL 60714, Tel: 708-647-8303; FSC No.: CAGE 06402; *Sls. Mgr.:* John Palsir; *Dist. Mgr.:* John Palsir .... **B•1353-1357, 1721**

Local Sales Offices & Reps

AL	Huntsville, South Tech Sls.	205-880-8200
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
CA	Los Angeles, Sierra-Pacific Eng.	714-731-3411
CA	Oceanside, Sierra-Pacific Engrg.	619-945-5917
CA	San Francisco, Ross Mktg.	408-988-8111
CA	Santa Clara, Ross Mktg. Assocs.	408-988-8111
CA	Tustin, Sierra-Pacific Engrg.	714-731-3411
CO	Denver, Promo Tech	303-692-8484
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Winter Springs, Sunland Assocs.	407-365-9533
GA	Atlanta, South Tech	404-822-1764
GA	Lilburn, South Tech Sls.	404-381-2088
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
KS	Lenexa, Midtec Assoc.	913-541-0505
MA	Boston, Eagle Assocs.	617-444-3446
MI	Grand Rapids, Hilltronics, Inc.	616-364-0010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Eden Prairie, PWC, Inc.	612-934-1409
MO	St. Louis, Midtec Assoc.	314-275-8666
NH	Raymond, Eagle Assocs.	617-444-3446
NM	Albuquerque, Chaparral Elctrns.	505-271-2266
NY	Hauppauge, Aurora-Schmitt Assocs.	516-434-1313
NY	Rochester, Lamb Comps.	716-328-6350
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Beachwood, Thompson & Assoc., Inc.	216-831-6277
OH	Dayton, Thompson & Assoc., Inc.	513-435-7733
OH	Orient, Thompson & Assoc., Inc.	614-877-4304
OR	Tigard, Eltech	503-684-3458
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Pittsburgh, Del Steffen & Assoc.	412-276-7366
TX	Seagoville, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
VA	Sterling, Beacon North Inc.	703-478-2480
WA	Bellevue, Eltech	206-643-4330
WI	Milwaukee, Star Engineering	414-645-3680
Can	Dartmouth, N.S., Reptronics	902-465-4400
Can	Montreal, Que., Cana Rep Grp., Inc.	514-276-4477
Can	Oakville, Ont., Cana Rep Grp., Inc.	416-338-3399
Can	Ottawa,Ont., Cana Rep Grp., Inc.	613-692-4682
Can	Surrey, B.C., Cana Rep Grp., Inc.	604-599-1232

Local Distributors

CA	Van Nuys, Wes-Garde	1-800-275-7101
CT	Hartford, Wes-Garde	1-800-275-7091
FL	Lakeland, Wes-Garde	1-800-275-7102
IL	Carol Stream, Wes-Garde	1-800-275-7095
KS	Overland Park, Wes-Garde	1-800-275-7099
MO	St. Louis, Wes-Garde	1-800-275-7097
NH	Nashua, Wes-Garde	1-800-275-7093
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Can	Calgary, Alb., R.L. Brews & Sons Ltd.	403-243-1144
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TX	Houston, Allied Elctrns.	713-455-3993
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FL	Largo, Electrocraft	813-544-1766
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IL	Glen Ellyn, Lincoln, Hodges	708-469-6750
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Pasadena, EES	410-255-9686
MI	Chelsea, Sean T. Sls.	313-475-2021
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Florissant, Spectrum Sls.	314-921-1313
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PA	Valley Forge, McCoy Grp.	215-783-1919
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EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781, FAX: 312-262-1330; Empl.: 50

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FALCON ELECTRIC, 1960 Walker Ave., Monrovia, CA 91016, Tel: 800-842-6940, FAX: 818-285-0102; Empl.: 100; *Sls. Mgr.:* Ron Seredian, Acct. Mgr.; *Dist. Mgr.:* Ron Seredian, Acct. Mgr.

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FL	Orlando, Aurora-Schmitt Assocs.	407-297-6039
IL	Elk Grove, Carlson Elctrns.	708-956-8240, FAX:708-956-8289
MD	Baltimore, Herman K. Kramer	410-528-9120, FAX:410-528-9116
MD	Monkton, Imagitron Sls. Co; Inc.	301-374-5600, FAX:301-372-5888
MN	Minneapolis, Comps. Grp. Corp.	612-374-1250, FAX:612-374-5434
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PA	Drexel Hill, DNE Sls. Co.	215-789-6822, FAX:215-789-3508
SC	Walhalla, Overton Assocs.	803-638-7101, FAX:803-638-2830
TX	Dallas, Blair Engrg., Inc.	214-241-5655, FAX:214-241-3642

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FEE FIL-MAG, 9445 Farnham Street, San Diego, CA 92123, Tel: 619-569-6577, FAX: 619-569-6073; Empl.: 1200; *Sls. Mgr.:* Marc Jay Lampert; *Dist. Mgr.:* Jim Seifert .... **A•1634-1637, 2349-2351; D•2109**

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GA	Cummings, FEE Fil-Mag	404-889-8231
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MA	Medfield, FEE Fil-Mag	508-359-9691
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Can	Don Mills, Ont., Canadian Source Corp.	416-445-0211

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MA	Wilmington, CAPSTONE	508-657-5874
NJ	Marlton, CAPSTONE	609-596-7500
NM	Los Alamos, CAPSTONE	505-662-0745
NC	Raleigh, CAPSTONE	919-954-0600
TX	Carrollton, CAPSTONE	214-380-9049
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FEL-PRO CHEMICAL PRODUCTS L.P., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* James R. Hallstrom

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FENWAL ELECTRONICS INCORPORATED

FAX: 508-473-6035

FENWAL ELECTRONICS, INC., 450 Fortune Blvd., Milford, MA 01757, Tel: 508-478-6000, TELEX: 299550; Empl.: 450; *Sls. Mgr.:* Herb Holmstedt; *Dist. Mgr.:* Herb Holmstedt .... **B•1875**

Local Sales Offices & Reps

CA	Garden Grove, Elsco Elctrns., Inc.	714-891-4621
CO	Denver, Spectrum Mktg. Assocs., Inc.	303-480-9991
FL	Palm Beach Gardens, Graham Assoc., Inc.	407-622-4049
IL	Itasca, Janus Inc.	708-250-9650
IN	Indianapolis, CC Electro Sales, Inc.	317-921-5000
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
MD	Gaithersburg, Naudain Assoc. So., Inc.	301-258-5040
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	So. St. Paul, Northport Engrg., Inc.	612-457-8000
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
NY	Huntington, CDB Entprs.	516-692-5200
NY	Penfield, Upstate Comps. Sls., Inc.	716-381-6070
NC	Raleigh, Prime Comps., Inc.	919-850-9866
PA	Allison Park, Bear Mktg., Inc.	412-492-1150
PA	Wynnewood, Metz-Jade Assoc.	215-896-7300
TX	Austin, W. Pat Fralia Co. & Assoc., Inc.	817-354-1144
TX	Euless, W. Pat Fralia Co. & Assoc., Inc.	817-267-3577
TX	Houston, W. Pat Fralia Co. & Assoc., Inc.	817-354-1144
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
EXP	MA, Milford, Fenwal Elctrns.	508-478-5255
Can	Que., John G. Weiss Co., Ltd.	514-685-6644

Local Distributors

CA	Chatsworth, Mil-Comm Distr.	818-998-3111
CA	San Jose, Rose Elctrn. Distr.	408-943-0200
CO	Denver, Newark-Denver Elctrn. Supp.	303-757-3351
FL	Clearwater, Newark Elctrns.	813-443-0661
GA	Norcross, Newark Elctrns.	404-448-1300
IL	Chicago, Newark Elctrns. Corp.	312-784-5100
MD	Ellicott City, Newark Elctrns.	301-461-2300
MA	Woburn, Newark Elctrns.	617-935-8350
MI	Oak Park, Newark Elctrns.	313-967-0600
NJ	Pennsauken, Newark Elctrns.	609-663-9490
NY	Buffalo, Summit Dists.	716-887-2800
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Newark Elctrns.	216-391-9330
PA	Wynnewood, Metz-Benham Assoc., Inc.	215-896-7300
TX	Fort Worth, Patco Supply	817-429-8596
TX	Garland, Newark Elctrns.	214-494-5911
Can	Que., John G. Weiss Co., Ltd.	514-337-5022

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Weil Way, Wilmington, OH 45177, Tel: 513-382-1451, TELEX: 214282, FAX: 513-383-1157; Empl.: 600

FERNWOOD TRANSFORMER CO., Transistor Devices Inc., 560 Independence St., Belvidere, NJ 07823, Tel: 908-475-3207, FAX: 908-475-3242; FSC No.: 3S657; Empl.: 90 .... **A•2355**

FERRANTI-PACKARD, See F-P Electronics

FERRANTI VENUS, INC., Ferranti International, 399 Smith St., Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492, FAX: 516-752-7976; Empl.: 400; *Sls. Mgr.:* Thomas White

FERRAZ CORPORATION, 14 Eastmans Rd., Parsippany, NJ 07054, Tel: 201-428-8400, 800-526-9067, TELEX: 136045, FAX: 201-428-0599; Empl.: 100; *Sls. Mgr.:* Douglas L. Bennett; *Dist. Mgr.:* Douglas L. Bennett

FERRETEC INC., 3342 Gateway Blvd., Fremont, CA 94538-6525, Tel: 510-226-1216, FAX: 510-651-8771; FSC No.: 7W279; Empl.: 65; *Sls. Mgr.:* Dirk Hoekstra

FERRITE INTERNATIONAL, 15280 Wadsworth Rd., Wadsworth, IL 60083, Tel: 708-249-4900, FAX: 708-249-4988; Empl.: 60; *Sls. Mgr.:* George Orenchak

FERRO CORPORATION, Filled & Reinforced Plastics Div., 5001 O'Hara Dr., Evansville, IN 47711, Tel: 812-423-5218, FAX: 812-423-1864; *Sls. Mgr.:* J. C. Vaughn

FERRO CORPORATION, Electronic Glass Department, 4150 East 56th Street, Cleveland, OH 44101, Tel: 216-641-8580, FAX: 216-641-8857; *Sls. Mgr.:* Tack Whang, Bus. Mgr.

FERRO CORPORATION, Electronic Materials Div., 27 Castilian Dr., Santa Barbara, CA 93117-3092, Tel: 805-968-5000, TELEX: 98-0165, FAX: 805-968-8624; *Sls. Mgr.:* William T. Faix, Nat. Sls. Mgr.

FERRO CORPORATION, Frit Division, 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-2049; *Sls. Mgr.:* James Stalder

FERRO CORPORATION, Powder Coatings Div., 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-8596; Empl.: 300 ò

FERRO CORPORATION, Plastic Colorants & Dispersions, 3 Railroad Ave., P.O. Box 603, Stryker, OH 43557, Tel: 419-682-3311, TELEX: 419-682-4924; *Sls. Mgr.:* Robert T. Schneider

FERRO CORPORATION, Transelco Div., P.O. Box 217, Penn Yan, NY 14527-0127, Tel: 315-536-3357, FAX: 315-536-8091; *Sls. Mgr.:* J. F. Arthur/W. Germond

FERROFLUIDICS CORP., 40 Simon St., Nashua, NH 03061, Tel: 603-883-9800, FAX: 603-883-2308; Empl.: 221; *Dist. Mgr.:* Kurt J. Lesker Company

FERRONICS, 45 O'Connor Rd., Fairport, NY 14450, Tel: 716-388-1020, FAX: 716-388-0036; FSC No.: 33062; Empl.: 49; *Sls. Mgr.:* Tim Reeder

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Tempe, Gassner & Clark	602-968-9037
CA	San Diego, Texel	619-576-2162
CA	San Jose, Texel/North	408-272-6836
CA	Seal Beach, Texel	213-596-9411
FL	Oviedo, Comps. Co.	407-366-7399
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, John H. Weaver Co. Inc.	317-257-7661
IA	Cedar Rapids, Dytronix Inc.	319-377-8275
KS	Leawood, Dytronix Inc.	913-339-6333
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	St. Paul, Countryman Assoc.	612-645-9151
MO	Bridgeton, Dytronix Inc.	314-291-4777
NC	Raleigh, L & D	919-876-5301
NC	Wilmington, L & D	919-256-8110
OH	Cleveland, C. J. Voneman Co.	216-226-8000
OR	Portland, General Elctrns.	503-297-8500
TX	Dallas, Comp. Tech.	214-783-8831
TX	Houston, Comp. Tech.	713-690-3011
WA	Stanwood, General Elctrns.	503-297-8500
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Don Mills, Ont., R.D. Assocs.	416-444-0959

Local Distributors

CA	Los Alamitos, Dexter Magnetic Materials	714-952-2091
CA	Sunnyvale, Dexter Magnetic Materials	408-738-1080
GA	Norcross, Dexter Magnetic Materials	404-448-4998
IL	Chicago, Dexter Magnetic Materials	708-956-1140
MA	Billerica, Dexter Magnetic Materials	508-663-7500
MN	Chanhassen, Dexter Magnetic Materials	612-934-4635
NY	Hicksville, Dexter Magnetic Materials	516-822-3311
OH	Toledo, Dexter Magnetic Materials	419-385-4621
TX	Richardson, Dexter Magnetic Materials	214-699-1121

FERROXCUBE, See Philips Components Discrete Products Division

FETCO, 421 Cornwall Rd., Sanford, FL 32773, Tel: 407-321-3800 .... **A•2352-2354**

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 908-647-6601, FAX: 908-647-8464; Empl.: 65; *Sls. Mgr.:* Allan Kreutzer; *Dist. Mgr.:* James Murray

FIBERLIGN, Preform Line Products, 24 Colonnade Rd., Nepean, ON, Canada K2E 7J6, Tel: 613-226-4000, FAX: 613-226-4602; Empl.: 55; *Sls. Mgr.:* Jean Paul Clermont

FIBEROPTICS TECHNOLOGY, INC., Quassett Rd., Pomfret, CT 06258, Tel: 203-928-0443, 800-433-5248, FAX: 203-928-7664, 800-543-2558

FIBEROPTIC SYSTEMS, INC., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, Tel: 805-583-2088, FAX: 805-583-4018; Empl.: 30; *Sls. Mgr.:* Richard Lockett

FIBERTEK INC., P.O. Box 4000, 305 Beasley Dr., Franklin, TN 37065, Tel: 615-794-1400, FAX: 615-790-8289; Empl.: 30; *Sls. Mgr.:* Pete Kutz; *Dist. Mgr.:* Jim Friel

FIBRONICS INTERNATIONAL INC., Communications Way, 33 Riverside Dr., Pembroke, MA 02359, Tel: 617-826-0099, FAX: 617-826-7745; Empl.: 500; *Sls. Mgr.:* Bruce Gilliat; *Dist. Mgr.:* Don Dorchester

FAX: 301-881-0530

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye, V.P.; *Dist. Mgr.:* Raymond Vernon .... **B•1359**

FIDELITY CHEMICAL PRODUCTS CORP., 472 Frelinqhuysen Ave., Newark, NJ 07114, Tel: 201-242-4110, FAX: 201-242-5796; Empl.: 55; *Sls. Mgr.:* Michael Aleksinas

FIELDPIECE INSTRUMENTS, 8322 B Artesia, Buena Park, CA 90621, Tel: 714-992-1239, FAX: 714-992-1239; Empl.: 5; *Sls. Mgr.:* Jan Nall; *Dist. Mgr.:* Rey Harju

FAX: 609-599-9508

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350; Empl.: 75; *Sls. Mgr.:* Mike Cioppi, Mktg. Mgr. .... **B•1260-1261, 1486-1487, 1726-1727**

Local Sales Offices & Reps

NJ	Trenton, Fifth Dimension	609-393-8350

FILM MICROELECTRONICS, See General Microcircuits

FILM MICROELECTRONICS INC., 10 B Centennial Drive, Peabody, MA 01960, Tel: 508-532-9913, FAX: 508-532-9954; FSC No.: 27851; Empl.: 101; *Sls. Mgr.:* Karl Cyr

FILTER CONCEPTS INC., 2624 S. Rousselle, Santa Ana, CA 92707, Tel: 714-545-7003, FAX: 714-545-4607; *Sls. Mgr.:* Les Edelberg .... **A•1592-1595**

FILTER PRODUCTS, Rockwell International, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532(COLLINS CSMA), FAX: 714-641-5320; FSC No.: 2X491; Empl.: 60; *Sls. Mgr.:* Bob Johnson

FILTRON, RFI Corporation, 100 Pine Aire Dr., Bayshore, NY 11706, Tel: 516-231-6400, FAX: 516-231-6465; FSC No.: 81831; Empl.: 90; *Sls. Mgr.:* Richard Michelson

FILTRONETICS, INC., 6010 Parretta, Kansas City, MO 64120, Tel: 816-231-7375, FAX: 816-241-0368; FSC No.: 53733; Empl.: 70; *Sls. Mgr.:* Brenda Gabbert

FINETECH ENGINEERING, INC., 119 Northrup St., Bridgewater, CT 06752, Tel: 203-350-2882, FAX: 203-350-2878; Empl.: 3; *Sls. Mgr.:* John Porter

THE FIRST ELECTRONICS CORP., 71 Von Hillern St., Boston, MA 02125, Tel: 617-288-2430, FAX: 617-288-0332; FSC No.: 14532; Empl.: 70; *Sls. Mgr.:* Chris Nastopoulos

W.W. FISCHER INC
ELECTRONIC CONNECTORS

FAX: 404-551-6969

W.W. FISCHER ELECTRONIC CONNECTORS, 1040 Crown Pointe Pky., Ste. 560, Atlanta, GA 30338, Tel: 1-800-551-0121 .... **C•1322-1329**

Local Sales Offices & Reps

CA	Los Angeles, W.W. Fischer	818-727-0277
CA	San Fransisco, W.W. Fischer	408-970-0631
MA	Boston, M.A. Olson Assocs.	617-244-4030

FISHERCAST, Fisher Gauge Limited, 194 Sophia St., Peterborough, Ont., Canada K9J 6Y9, Tel: 705-748-9522, FAX: 705-745-8818; Empl.: 400; *Sls. Mgr.:* Larry Hatfield

FISHERTECH, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962838, FAX: 705-748-6312; Empl.: 200ò; *Sls. Mgr.:* Greg Patterson

FITCHBURG COATED PRODUCTS, Technographics, Inc., P.O. Box 1106, Scranton, PA 18501, Tel: 717-347-2035, FAX: 717-347-2507; Empl.: 300

FJA INDUSTRIES, P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; *Sls. Mgr.:* Frank J. Ardezzone

FLANN MICROWAVE INC., Ste. 2200, One Kendall Square, Cambridge, MA 02139, Tel: 1-800-937-3772, FAX: 617-577-8234; Empl.: 80; *Sls. Mgr.:* Lawrie Lansdell

FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, Tel: 614-889-6152, FAX: 614-876-8538; Empl.: 11; *Sls. Mgr.:* D. Morlan .... **A•2357**

MCi
FLEXIBLE FURNITURE DIVISION
METAL COMPONENTS INC.

FAX: 616-685-9195

FLEXIBLE FURNITURE DIVISION, Metal Components, Inc., 323 Acorn Street, Plainwell, MI 49080, Tel: 616-685-6831, 800-875-6836; Empl.: 32; *Sls. Mgr.:* Lynn D. Middlebrook .... **C•1044**

Local Sales Offices & Reps

CO	Manhattan Beach, Fore Tec	1-800-344-3832
FL	Orlando, Imhoof & Assocs.	407-658-0807
IL	Bensenville, ESI	708-766-3667
KS	Overland Park, Corporate Environments	913-677-0603
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
NJ	Ringwood, Eastern Scientific Prods.	201-728-7200
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
VA	Vienna, Morgan Scientific	703-893-4306
WA	Bellevue, The Western Rep.	206-637-0945

FLEXIBLE TECHNOLOGIES, Arlon, P. O. Box 4305, 199 Amaral St., E. Providence, RI 02914, Tel: 401-434-2340, TELEX: 6972602, FAX: 401-434-2557; Empl.: 65; *Sls. Mgr.:* Herb Howard

For sales offices and reps. in the Northeastern region, call Ron Sencer- 401-434-2340 For sale offices and reps. in California, call Rick Kirchhoff- 714-540-2811 For sales offices and reps. in Michigan, Ohio, and Indiana, call STAFFCO- 216-331-5100 For sales offices and reps in Chicago, Minnesota, and Colorado, call Phil Hansen-612-942-9902

FLEX-KEY CORPORATION, Emerson Ave., Gloucester, MA 01930, Tel: 508-281-2040, FAX: 508-281-4730; FSC No.: 51163; Empl.: 50; *Sls. Mgr.:* Robert Keane .... **B•1829**

Local Sales Offices & Reps

AZ	Scottsdale, DGI	602-947-3724
CA	Santa Clara, Detomasi & Grupp	408-492-9266
CO	Denver, Advent Corp.	303-455-1985
DC	Rockville, Marktron	301-251-8990
IA	Cedar Rapids, Tech. Elctrns. Inc.	319-366-5443
MD	Hunt Valley, Marktron	301-628-1111
NY	Huntington, J. A. Keeneth Co.	516-351-7008

FLEX-LINK PRODUCTS, INC., 599 Fourth St, San Fernando, CA 91340, Tel: 818-898-1451, FAX: 818-365-3022; FSC No.: 6Z867; Empl.: 80; *Sls. Mgr.:* Al Wasserzug

FLEXSTAR TECHNOLOGY, 213 Hammond Ave., Fremont, CA 94539, Tel: 510-440-0170, TELEX: 510-440-0177; Empl.: 17; *Sls. Mgr.:* Jim Yasueda, VP Sls.

FLEXTRONICS INTERNATIONAL, 48001 Fremont Blvd, Fremont, CA 94538, Tel: 510-226-3539, FAX: 510-226-3535; Empl.: 1800

FLIGHT CONNECTOR, See Transtechnology Electronics

FLUID COMPONENTS, INC., 1755 La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-744-6950, TELEX: 695092, FAX: 619-736-6250; Empl.: 160; *Sls. Mgr.:* Glen Fishman

FLUKE®

FAX: 206-356-5962

JOHN FLUKE MFG. CO., INC., 6920 Seaway Blvd., Everett, WA 98203, Tel: 206-347-6100, TELEX: 185102, TWX: 810-445-2943; Empl.: 1925; *Sls. Mgr.:* R. Wambolt; *Dist. Mgr.:* R. Mewett .... **D•1259, 1403**

Local Sales Offices & Reps

AZ	Phoenix, John Fluke Mfg. Inc.	602-438-8314
CA	Fremont, John Fluke Mfg. Co., Inc.	510-651-5112
CA	Irvine, John Fluke Mfg. Co., Inc.	714-863-9031
DC	Washington, John Fluke Mfg. Co., Inc.	301-770-1570
FL	Orlando, John Fluke Mfg. Co., Inc.	407-331-4881
GA	Atlanta, John Fluke Mfg. Co., Inc.	404-953-4747
IL	Chicago, John Fluke Mfg. Co., Inc.	708-705-0500
IN	Indianapolis, John Fluke Mfg. Co., Inc.	317-875-7870
MA	Boston, John Fluke Mfg. Co., Inc.	508-663-2400
NJ	Paramus, John Fluke Mfg. Co., Inc.	201-262-9550
NY	Rochester, John Fluke Mfg. Co., Inc.	716-323-1400
PA	Philadelphia, John Fluke Mfg. Co.,Inc.	215-647-9550
TX	Dallas, John Fluke Mfg. Co., Inc.	214-406-1000
WA	Seattle, Fluke Elctrns. Canada Inc.	206-356-5512
WA	Seattle, John Fluke Mfg. Co., Inc.	206-881-6966
Can	Mississauga, Ont., Fluke Elctrns. Canada Inc.	416-890-7600

Fluke Dist. Prods. are available from Fluke authorized dist. Call 800-443-5853 for your nearest dist.

FORCE, INC., 825 Park St, Christiansburg, VA 24073, Tel: 703-382-0462, FAX: 703-381-0392; FSC No.: 64871; Empl.: 52; *Sls. Mgr.:* James W. Vanhoozier

Local Sales Offices & Reps

CA	San Mateo, Epic Mktg.	1-800-727-9066
FL	Boca Raton, D & V Concepts, Inc.	407-451-4641
IL	South Holland, Fiber Specs., Inc.	708-339-2500
MA	Southbridge, Northern Fibercom	508-765-5131
NJ	Ho-Ho-Kus, D.J. Fisher Co., Inc.	201-652-0090
WA	Everett, Cunningham Sls., Inc.	206-348-4800
Can	Markham, Ont., Deskin, Inc.	1-800-268-9832

FOREDOM ELEC. CO., Blackstone Inds. Inc., 16 Stony Hill Rd., Bethel, CT 06801, Tel: 203-792-8622, FAX: 203-790-9832; Empl.: 80

FORMA SCIENTIFIC, INC., Box 649, Marietta, OH 45750, Tel: 614-373-4763, FAX: 614-373-6770; Empl.: 425; *Sls. Mgr.:* Art Fad, VP of Domestic Sls.

FORMAX, 1120 Federal Road, Brookfield, CT 06804, Tel: 203-775-9492, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

FORSTER ENTERPRISES, INC., 57 Bristol St, Waterbury, CT 06708, Tel: 203-574-3832, FAX: 203-755-2973; FSC No.: 3621; Empl.: 64; *Sls. Mgr.:* C. M. Colt

FORTE TECHNOLOGY, INC., 201 Carnegie Row, Norwood, MA 02062, Tel: 617-769-9150, FAX: 617-769-5308; Empl.: 20

FORTRON/SOURCE CORP., Power Supplies, 6818-G Patterson Pass Rd., Livermore, CA 94550, Tel: 415-373-1008, TELEX: 559291 FORTRON UD, FAX: 415-373-1168; Empl.: 150; *Sls. Mgr.:* Louie Aldama

FOURJAY INDUSTRIES, Box 14617 Northridge Br., Dayton, OH 45413-0617, Tel: 513-890-6444, FAX: 513-890-1692; Empl.: 42; *Sls. Mgr.:* M. W. Frawley

FOXCONN INTERNATIONAL, Hon Hai, 930 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-749-1228, FAX: 408-749-1266; Empl.: 120; *Sls. Mgr.:* S.C. Huang; *Dist. Mgr.:* Ted Ho

FOX ELECTRONICS

FAX: 813-693-1554

FOX ELECTRONICS, 5570 Enterprise Pkwy., Ft. Myers, FL 33905, Tel: 813-693-0099, TWX: 510-951-7386; FSC No.: 61429; Empl.: 75; *Sls. Mgr.:* Mike Huennekens/West; *Dist. Mgr.:* Ann Clark .... **A•1397-1401**

Local Sales Offices & Reps

AL	Huntsville, Southeast Tech. Grp.	205-534-2376
AZ	Chandler, Techni-Source	602-497-0711
AZ	Conway, Design Mktg.	501-327-9303
CA	Fair Oaks, Brooks Tech. Grp.	916-965-3255
CA	Irvine, Groh Assocs.	714-837-9871
CA	Mt View, Brooks Tech. Grp.	415-960-3880
CA	Newbury Park, Groh Assocs.	805-499-8856
CA	Poway, Groh Assocs.	619-451-9544
CO	Littleton, Megatronix	303-730-6262
CO	Williamsville, Pi Tronics	303-292-5537
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Spring, Semtronic Assocs.	407-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Lawrenceville, Southeast Tech. Grp.	404-979-2055
IL	Itaska, Janus Inc.	708-250-9650
IN	Indianapolis, Wilson Tech. Sls. Inc.	317-872-2513
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
MD	Ellicott City, Beacon North Inc.	800-877-3747
MD	Randallstown, Beacon North Inc.	800-877-3747
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Grosse Pointe, Greiner	313-499-0188
MN	Edina, Gibb Elctrn. Sls.	612-835-3370
MS	Meridian, Southeast Tech. Grp.	601-485-7055
MO	Florissant, Spectrum Sls.	314-921-1313
NC	Zebulon, Southeast Tech. Grp.	919-269-5589
NJ	Medford, Component Consultants	609-654-5300
NJ	Parsippany, HLM	201-263-1535
NM	Alburquerque, Techni-Source	505-268-4232
NY	Northport, HLM	516-757-1606
NY	Syracruse, Pi Tronics	315-455-7346
OK	Bethany, Design Mktg.	405-789-5911
OH	Centerville, Bear Mktg. Inc.	513-436-2061
OH	Richfield, Bear Mktg. Inc.	216-659-3131
OR	Portland, E.S. Chase	503-292-8840
PA	Allison Park, Bear Mktg. Inc.	412-492-1150
TX	Austin, Design Mktg.	512-263-9151
TX	Dallas, Design Mktg.	214-247-4745
TX	Houston, Design Mktg.	713-469-7949
UT	Salt Lake City, Luscombe Engrg. Co.	801-268-3434
VA	Sterling, Beacon North Inc.	703-478-2480
WA	Kirkland, E.S. Chase	206-823-9535
WI	Delafield, Janus Inc.	414-646-5421
PR	Hato Rey, Semtronic Assocs.	809-766-0700
Can	Kanata, ON, Electro Source, Inc.	613-592-3214
Can	Pointe Claire, PQ, Electro Source, Inc.	514-630-7486
Can	Rexdale, ON, Electro Source, Inc.	416-675-4490
Can	Vancouver, BC, Electro Source, Inc.	604-275-2734

Local Distributors

CA	El Monte (for all locations), Marshall Inds. (Corp.)	818-307-6313
CA	Reseda (for all locations), Jan Devices (Corp.)	818-708-1100
CA	Santa Clara (for all locations, Cypress Elctrns. (Corp.)	408-980-8400
CO	Denver (for all locations), Integrated Elctrns. (Corp.)	303-292-5537
FL	Tampa (for all locations), Reptron Elctrns. Inc. (Corp.)	813-855-4656
IN	Carmel, Altex Elctrns. Inc. (Corp.)	317-848-1323
IA	Cedar Rapids, Dee Elctrns. (Corp.)	319-365-7551
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MN	Minneapolis, Dataport Technlgs.	612-546-0273
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FUTURETECH, 525 Auburn St., Auburndale, MA 02166, Tel: 617-965-3834, TWX: 510-600-6663, FAX: 617-332-4760; Empl.: 2

F. W. CAPACITORS INC., 98 Toledo Rd.Hwy. 301 South, Florence, SC 29504-0636, Tel: 803-662-4728, 803-662-4844, FAX: 803-667-6142; FSC No.: 58368; Empl.: 12; *Sls. Mgr.:* Joseph A. (Jay) Falcone Jr.

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GANDALF TECHNOLOGIES, INC, See Gandalf Data, Inc.

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GAR ENTERPRISES DBA KGS ELECTRONICS, 418-A E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-574-1175, FAX: 818-574-0553; FSC No.: 16017; Empl.: 60; *Sls. Mgr.:* Nathan Sugimoto

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 909-624-5071, FAX: 909-624-7212; FSC No.: 53101; Empl.: 35; *Sls. Mgr.:* Hal Wolverton, Sls. Mgr.

GARRY ELECTRONICS, WPI, 23 Front Street, Salem, NJ 08079, Tel: 609-935-7603, FAX: 609-935-7555; Empl.: 100; *Sls. Mgr.:* Russ Morgan; *Dist. Mgr.:* Ryon Waddington

GASKET DYNAMICS, INC., 14 King St., P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, 215-922-6046, FAX: 609-261-7300; Empl.: 19; *Sls. Mgr.:* William Ivey

GATES, GEO. W., & CO., INC., 1209 Hempstead Tpke., Franklin Sq., NY 11010, Tel: 516-352-2904, FAX: 516-352-2906; Empl.: 5; *Sls. Mgr.:* T. E. Schulz, Jr

GATES ENERGY PRODUCTS, Portable Battery Division, P.O. Box 147114, Gainesville, FL 32614-7114, Tel: 904-462-3911, TWX: 810-836-8500, FAX: 904-462-4726; Empl.: 2500; *Sls. Mgr.:* Don Stucker; *Dist. Mgr.:* Jeff Becker

GATES ENERGY PRODUCTS, Industrial Battery Division, 617 N. Ridgeview Dr., Warrensburg, MO 64093, Tel: 816-429-2165, FAX: 816-429-1758; Empl.: 475; *Sls. Mgr.:* Pat Harvey; *Dist. Mgr.:* Jeff Becker .... **D•1452-1453**

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CA	Brea, Gates Energy Prods.	714-529-2117
IL	Itasca, Gates Energy Prods.	708-250-0156
MA	Stow, Gates Energy Prods.	508-897-6991
NJ	Belle Mead, Gates Energy Prods.	908-281-9707

Local Distributors

CA	Costa Mesa, Battery Specialties	714-755-0888, FAX:714-755-0889
CA	San Diego, Tauber Elctrns., Inc.	619-274-7242, FAX:619-274-2220
CA	San Jose, Rose Elctrns.	408-943-0440, FAX:408-943-0360
CO	Englewood, Kent Elctrns.	303-792-9100, FAX:303-792-3009
GA	Norcross, Engineered Assemblies	404-446-3135, FAX:404-446-3241
IL	Downers Grove, TDI Batteries	708-971-3460, FAX:708-971-3903
IL	Lisle, JaBro Batteries	708-964-9358, FAX:708-964-9081
MA	Sutton, Engineered Assemblies	508-865-0722, FAX:508-865-0723
MN	St. Paul, Kent Elctrns.	612-642-2828, FAX:612-642-1990
NJ	Teterboro, Engineered Assemblies	201-288-4477, FAX:201-288-1515
NC	Raleigh, Engineered Assemblies	919-790-9700, FAX:919-790-0223
OH	Columbus, Promark Elctrns.	614-351-2191, FAX:614-351-2180
OR	Beaverton, Micro Power Elctrns.	503-626-7086, FAX:503-643-1556
TX	Houston, Kent Elctrns.	713-780-7770, FAX:713-978-5892
TX	Stafford, Southwest Elctrns.	713-240-4000, FAX:713-240-5672
Can	Ottawa, Ont., Cantec Sys., Ltd.	613-725-3704, FAX:613-725-0490
Can	Vancouver, B.C., Enercell Technlgs., Inc.	604-298-1181,FAX:604-298-1518

GAVAGAN ELECTRONICS, 121 Old Brookfield Rd., Danbury, CT 06810, Tel: 203-748-5248, FAX: 203-730-9410; Empl.: 11

GAVITT WIRE & CABLE, 20 Central St., Brookfield, MA 01506, Tel: 508-867-6476, FAX: 508-867-5126; Empl.: 75

GAYNOR ELECTRIC CO., 135 South Main St., P.O. Box 316, Thomaston, CT 06787-0316, Tel: 203-283-4388, FAX: 203-283-4107; Empl.: 40; *Sls. Mgr.:* Robert Heche; *Dist. Mgr.:* Robert Heche

GBC, INC., Lamp Division, P.O. Box 2205, Ocean, NJ 07712, Tel: 908-774-8502, FAX: 908-774-8041; Empl.: 5; *Sls. Mgr.:* C. Applegate

G.C. INDUSTRIES, SafetyTek Corporation, 49050 Milmont Drive, Fremont, CA 94538, Tel: 510-226-1329, FAX: 510-226-1112; Empl.: 12; *Sls. Mgr.:* Bryan Bates; *Dist. Mgr.:* Bryan Bates

GC INTERNATIONAL INC., 1301 Precision Dr., Plano, TX 75074, Tel: 214-423-8411, FAX: 214-423-4550; *Sls. Mgr.:* Hinkki Chen

GC-THORSEN, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209, Tel: 815-968-9661, FAX: 815-968-9731; Empl.: 260; *Sls. Mgr.:* Alan Walter, VP Mktg.; *Dist. Mgr.:* Vito Giovingo

GEC-MARCONI ELECTRONIC SYSTEMS CORP., 164 Totowa Rd., P.O.Box 975, Wayne, NJ 07474-0975, Tel: 201-633-6000, FAX: 201-633-6167; FSC No.: 0D0D0; Empl.: 2041; *Sls. Mgr.:* G. Solowey, Dir. Business Dev.; *Dist. Mgr.:* M. Gordon, Dir. Business Dev.

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5555, FAX: 814-349-5657; Empl.: 13

GEC PLESSEY SEMICONDUCTORS, 1500 Green Hills Road, Scotts Valley, CA 95066, Tel: 408-438-2900, FAX: 408-438-5576

GE FANUC AUTOMATION NORTH AMERICA INC., P.O. Box 8106, Charlottesville, VA 22906, Tel: 804-978-5000, 800-648-2001, FAX: 804-978-5205

GEIGER ELECTRONICS, INC., 42A Sandy Hollow Rd., Port Washington, NY 11050, Tel: 516-767-0700, FAX: 516-767-0700; FSC No.: 0JP62

GEMINI INC., 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957, 800-533-3631, FAX: 507-263-4887; *Sls. Mgr.:* John Weinel .... **C•1046-1047**

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IL	Palatine, JRS Assocs.	708-991-6626
IN	Noblesville, R & D Elctrns.	317-849-2026
IA	Cannon Falls, Gemini Inc.	800-533-3631
KS	Lenexa, Gemini Inc.	913-492-8267
MA	Brookline, Harman Assocs.	617-232-6687
MI	Dearborn, Pitcher-Poulin, Inc.	315-582-5450
MN	Cannon Falls, Gemini Inc.	507-263-3957
NY	Rochester, Gemini Inc.	716-254-0397
NC	Kernersville, Wallace ELctrns. Sls.	800-334-3518
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Plymouth Meeting, Gemini Inc.	215-825-6736
TX	Taylor, Gemini, Inc.	512-352-5207
WI	Wauwatosa, Larsen Assocs.	414-258-0529

GEMS SENSORS DIVISION, Div. of IMO Industries Inc., Cowles Rd, Plainville, CT 06062-1198, Tel: 203-747-3000, FAX: 203-747-4244; FSC No.: 04034; Empl.: 254; *Sls. Mgr.:* Edmund Beldowski; *Dist. Mgr.:* Edmund Beldowski

Local Sales Offices & Reps

CA	Sante Fe Springs, IMO Inds. Inc.	310-868-2268
CT	Rocky Hill, IMO Inds. Inc.	203-563-3737
GA	Atlanta, IMO Inds.Inc.	404-441-1210
OH	Cleveland, IMO Inds. Inc.	216-333-1805
Can	Mississauga, Ont., IMO Inds. (Canada) Inc.	416-564-3344

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENELCO, Division of Bindicator, P.O. Box 610286, 1915 Dove St., Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 GENELCO P THY, FAX: 313-987-4476; Empl.: 60; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

GENERAL AUTOMATION, A Div. of 769442 Ont. Ltd., RR No. 4 McMullen Rd., Kemptville, Ont., Canada KOG 1JO, Tel: 613-724-1993, FAX: 613-258-4701; FSC No.: 1429-1592; Empl.: 4-6; *Sls. Mgr.:* Bruce Murison

GENERAL CABLE CO., Fiber Optics Div., 1 Cragwood Rd., S. Plainfield, NJ 07080, Tel: 201-769-3200, TELEX: 642892; *Sls. Mgr.:* Pieter deBruijn

GENERAL CABLE CO., 4 Tesseneer Dr., Highland Hts., KY 41076, Tel: 606-572-8616, FAX: 606-572-9634; *Sls. Mgr.:* Dee Stinnette

GENERAL CHEMICAL CORPORATION, 400 Nichols Road, Pittsburg, CA 94565, Tel: 510-685-1450, FAX: 510-458-9271

GENERAL CONTROLS ELECTRONICS INC., 2350 Brickvale Ave., Elk Grove Village, IL 60007, Tel: 708-595-2152, FAX: 708-595-2271; Empl.: 200; *Sls. Mgr.:* Fritz von Mering

GENERAL DEVICES CO., INC., Box 39100, Indianapolis, IN 46239-0100, Tel: 317-897-7000,1-800-626-9484, FAX: 317-898-2917; Empl.: 275; *Sls. Mgr.:* Jack Bradford; *Dist. Mgr.:* Dan McCauley .... **C•1048**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg., Inc.	205-539-8059
AZ	Phoenix, Snyder Engrg.	602-279-2010
CA	Irvine, Groh Assoc.	714-837-9871
CA	Poway, Groh Assocs.	619-673-4321
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CO	Broomfield, Summit West Mktg.	303-460-9600
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Lighthouse Point, Krutek & Assoc.	305-783-2501
FL	Maitland, Krutek & Assoc.	407-628-4837
GA	Duluth, Dixie Tech. Mktg., Inc.	404-381-5592
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Fishers, R & D Elctrns., Inc.	317-849-2026
IA	Cedar Rapids, Thomas Li Dowell & Assocs.	319-393-7920
KS	Overland Pk., Thomas Li Dowell & Assocs.	913-722-4242
MD	Marriotsville, Carr Assocs., Inc.	410-290-9781
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MA	West Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MI	Grand Rapids, Hilltronics, Inc.	616-364-0010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	South St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, Thomas Dowell & Assocs.	314-849-4234
NJ	Mountainside, Henry G. Ritcher, Inc.	908-233-4615
NY	Fairport, Henry G. Ritcher, Inc.	716-223-6010
NC	Raleigh, Dixie Tech. Mktg., Inc.	919-859-0025
OH	Cleveland, Electronic Comps., Inc.	216-331-5330
OH	Columbus, Electronic Comps.,Inc.	614-231-2318
OH	Miamisburg, Electronic Comps., Inc.	513-866-3340
OH	Westlake, Electronic Comps.,Inc.	216-835-4856
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TX	Austin, Advance Tech. Sls.	512-467-9209
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford & Assocs.	206-866-2001
Can	Kanata, Ontario, Birde Mktg.,Inc.	613-592-5411
Can	Markham, Ontario, Birde Mktg.,Inc.	416-477-7722
Can	Saint Laurent, Quebec, Birde Mktg.,Inc.	514-335-4050
Can	Vancouver, B.C., Birde Mktg., Inc.	604-431-0426

Local Distributors

AZ	Tempe, Acacia/Deanco	602-894-2874
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Livermore, Quail Elctrns., Inc.	510-373-6700
CA	San Diego, Acacia/Deanco	619-597-0577
CO	Wheatridge, Acacia/Deanco, Inc.	303-421-7004
IL	Chicago, Newark Elctrns.	312-784-5100
MA	Westborough, In-Stock Products Co.	508-870-5750
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
TX	Dallas, The Power Connection, Inc.	214-401-3490
Can	Markham,Ontario, Birde Mktg.,Inc.	416-477-7722

GENERAL DIGITAL CORP., 198 Freshwater Blvd., Enfield, CT 06082, Tel: 203-741-7171, FAX: 203-741-7071; Empl.: 50

GENERAL ELECTRIC CO., Accessory Equipment Plant, 1285 Boston Ave., Bldg. 25BE, Bridgeport, CT 06602, Tel: 203-382-3023, FAX: 203-382-2739; Empl.: 250; *Sls. Mgr.:* J. M. Collins

GENERAL ELEC. CO., Electromaterials Dept., 1350 South Second Street, Coshocton, OH 43812, Tel: 614-622-5310, TELEX: 810-255-2921; Empl.: 600; *Sls. Mgr.:* D.E. Allen

GE MICROELECTRONICS CENTER, GE Aerospace, P.O. Box 13049, Research Triangle Park, NC 27709, Tel: 919-549-3100, FAX: 919-549-3598; FSC No.: 1HL38; Empl.: 400; *Sls. Mgr.:* Donald B. Dickerman, Jr.

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL ELECTRONIC MATERIALS TECHNOLOGY, 4431 Corporate Ctr. Dr., Ste. 117, Los Alamitos, CA 90720, Tel: 714-761-5684, FAX: 714-761-8257; Empl.: 12; *Sls. Mgr.:* Jerry Wang; *Dist. Mgr.:* George Olenczuk

GENERAL FIBER OPTICS, INC., 98 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-3400, FAX: 201-239-4258; *Dist. Mgr.:* William W. Lentz

GENERAL INSTRUMENT, Govt. Systems, 600 W. John St., C. S. 710, Hicksville, NY 11802-0709, Tel: 516-933-3000, TELEX: 311512, TWX: 510-221-1865, FAX: 516-933-3432; Empl.: 548; *Sls. Mgr.:* T.Turco/J.Zielezienski

GENERAL INSTRUMENT, Power Semiconductor Div., 600 W. John St., Hicksville, NY 11802, Tel: 516-933-3333, FAX: 516-933-3881; *Sls. Mgr.:* Tony Solla, Natl. Sls. Mgr.; *Dist. Mgr.:* Robert Graziano

GENERAL LASER, INC., 7950 E. Redfield Rd., Scottsdale, AZ 85260, Tel: 602-991-0674, FAX: 602-991-1462

GENERAL MANUFACTURING, 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MIRCOCIRCUITS, 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-9101, FAX: 508-663-9132; Empl.: 30; *Sls. Mgr.:* Michael Lioz

GENERAL MICROWAVE CORPORATION, 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8900, TELEX: 310-287-780, FAX: 516-226-8966; FSC No.: 11332; Empl.: 180

GENERAL POWER CORPORATION, 955 E. Ball Road, P.O. Box 65008, Anaheim, CA 92815, Tel: 714-956-9321, FAX: 714-491-8644; FSC No.: 04801; Empl.: 50; *Sls. Mgr.:* Ernest R. Murillo

GENERAL PROTECTION CO., INC., Circuit Protection Group, 6149 N. Talman Ave., Chicago, IL 60659, Tel: 312-761-0403, FAX: 312-262-9605; Empl.: 15; *Sls. Mgr.:* N.Pierson; *Dist. Mgr.:* N.Pierson

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All States Not Listed Consult Factory, N. Branford, NJ 203-481-5721

Local Sales Offices & Reps

CA	Mountain View, Saber Entprs.	415-968-0427
NV	Clark County, Dick Cunningham	602-964-8594
TX	Dallas, Inotek	214-243-7000
EXP	Rajajinagar, Banaglore, Elctrns. Continental	366665

Instruments

AZ	Tempe, Dick Cunningham	602-964-8594
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mountain View, Saber Entprs.	415-968-0427
CO	Littleton, Radco	303-794-4279
CT	Watertown, May Technlg.	203-274-3777
IL	Des Plaines, Marsland Assocs.	708-298-2620
LA	Baton Rouge, Inotek	214-243-7000
MD	Joppa, Please Consult Factory	203-481-5721
MA	Reading, May Technlg.	617-942-7135
MO	St. Louis, Marsland Assocs.	708-298-2620
NJ	Branchville, Consult Factory	203-481-5721
NY	Schenectady, Consult Factory	203-481-5721
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
OH	Dayton, RIXAN Assocs.	513-278-4216
TN	Hixson, Inotek	214-243-7000
TX	Dallas, Inotek	214-243-7000
TX	Plano, Dick Cunningham	602-964-8594
VA	Dumfries, Consult Factory	203-481-5721
WA	Seattle, Datacom Assocs.	206-285-2525
WI	New Berlin, Marsland Assocs.	708-298-2620
Can	Scarborough, Ont., Multitest Elctrns.	416-609-8396

Components

AZ	Tempe, Dick Cunningham	602-964-8594
CA	Saratoga (North), TESTCO	408-253-1900
CO	Golden, J. F. Hurlbut Co.	303-279-7796
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Brighton, W. R. Hummon & Assoc.	313-486-5333
OH	Dayton, RIXAN Assocs.	513-278-4216
TX	Richardson, Blackburn Assocs.	214-238-8181
VA	Sterling, Beacon North, Inc.	703-478-2480

Local Distributors

CA	Saratoga, TESTCO	408-253-1900
OH	Dayton, RIXAN Assocs.	513-278-4216

GENERAL SCANNING RECORDER PRODUCTS DIVISION, 37 Broadway, Arlington, MA 02174, Tel: 617-641-2702, TELEX: 212838, FAX: 617-648-4906; *Sls. Mgr.:* Patrick Cooney .... **D•1413**

GENERAL SECURITY INC., 3677 23rd Ave. South, Lake Worth, FL 33461, Tel: 407-533-0064, ESYLNK: 800-572-8989, FAX: 407-547-2844; Empl.: 10; *Sls. Mgr.:* J.N. Benjamin

GENERAL TECHNOLOGY CORP., 6816 Washington Avenue, NE, Albuquerque, NM 87109, Tel: 505-345-5591, FAX: 505-344-3227; FSC No.: 61666; Empl.: 150; *Sls. Mgr.:* Ralph H. Anderson

GENERAL TRANSISTOR CORP., GTC, 216 W. Florence Av., Inglewood, CA 90301, Tel: 310-673-8422, FAX: 310-672-2905; FSC No.: IT853; Empl.: 66; *Sls. Mgr.:* Jack Hobb

GENERAL VIBRATIONS MFG. CO., 77 Hilliard St., Manchester, CT 06040, Tel: 203-646-0090, FAX: 203-646-0090; Empl.: 4

GENERAL WIRE PRODUCTS, INC., 425 Shrewsbury Street, Worcester, MA 01604, Tel: 617-752-8260, FAX: 617-753-2173; FSC No.: 5F262; Empl.: 58; *Sls. Mgr.:* Thomas P. Andrews, Jr.

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CA	Santa Ana, Genicom Corp.	714-549-5101
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VA	Waynesboro, Genicom Corp.	703-949-1666

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AL	Montgomery, Southern Controls Inc.	800-392-5770
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CA	Santa Ana, Norstan	800-854-8344
CA	Tustin, JACO/Distel Inc.	714-258-9003

CA	Westlake Village, JACO/Distel Inc.	800-824-0151
FL	Boca Raton, JACO/QC	407-241-7950
FL	Orlando, T & T Prods., Inc.	305-857-2282
GA	Norcross, JACO/QC	404-449-9508
ID	Coeur d'Alene, A-I Consolidated	800-635-1545
MD	Baltimore, Elctrn. Comp. Sls.	301-728-2772
MA	Columbia, JACO Elctrns. Inc.	301-995-6620
MA	Tewksbury, JACO Elctrns. Inc.	508-640-0010
NY	Hauppauge, JACO/Elctrns. Inc.	516-273-5500
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Raleigh, JACO/QC	919-876-7767
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Electronics Mktg. Corp.	513-439-4711
OH	Highland Heights, Electronics Mktg. Corp.	216-442-3441
TX	Addison, JACO/QC	214-733-4300
TX	Austin, JACO/QC	512-835-0220
TX	Dallas, Associated Aircraft Supp. Co.	214-331-4381
TX	Sugarland, JACO/QC	713-240-2255
WA	Redmond, Pan Pacific Elctrns., Inc.	206-881-7252

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GENISCO ELECTRONICS, A Division of GTC, 1230 South Lewis Street, Anaheim, CA 92805, Tel: 714-563-4300; FSC No.: 07294; Empl.: 200; *Sls. Mgr.:* Doug Chapman/Tom Hudson .... **A•1641; B•1151**

Local Sales Offices & Reps

AL	Birmingham, Electro-South Inc.	205-822-5713
AL	Huntsville, EMA	205-830-4030
AZ	Phoenix, Mayco	602-867-3076
CA	Claremont, Cook Entprs.	714-626-3997
CA	San Jose, Kottmeier Assoc. Inc.	408-371-8700
CA	Sunnyvale, DJM Elctrns.	408-749-8936
CA	Valencia, DJM Elctrns.	805-254-2677
CA	Vista, DJM Elctrns.	619-726-1266
CO	Englewood, R.A. Mays Co.	303-761-9447
GA	Roswell, E M A	404-992-7240
KS	Lenexa, Midtech Assoc.	913-541-0505
MD	Rockville, Computer Power Techlg.	301-251-4717
NH	Brookline, EMC Sls.	603-672-4455
NM	Albuquerque, Mayco	505-299-4002
NY	Roslyn Hgts., November Elctrn. Sls.	516-621-6378
OH	Dayton, Jay Engrg.	513-253-2151
WA	Bellevue, Underwood-Hanify Inc.	206-643-1793

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GENRAD, INC., 300 Baker Ave., Concord, MA 01742-2174, Tel: 508-369-4400, TELEX: 200272, TWX: 95-1037, FAX: 508-369-6974; Empl.: 1,370; *Sls. Mgr.:* John Bulman, VP. World Sls. Brd. Test

GENROCO, INC., 205 Kettle Moraine Drive North, Slinger, WI 53086-9501, Tel: 414-644-8700, FAX: 414-644-6667; *Sls. Mgr.:* Donald D. Woelz; *Dist. Mgr.:* Barbara Pick

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GENTRAN, Safetytek Corp., 49050 Milmont Dr., Fremont, CA 94538, Tel: 510-226-9343, FAX: 510-226-1112; Empl.: 12

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FAX: 602-443-1408

GENTRON CORPORATION, 7345 E. Acoma, Ste. 101, Scottsdale, AZ 85260, Tel: 602-443-1288; Empl.: 50; *Sls. Mgr.:* Rick Heinz .... **B•1504-1506**

GEOPHYSICAL SURVEY SYSTEMS, INC., 13 Klein Dr., North Salem, NH 03073-0097, Tel: 603-893-1109, FAX: 603-889-3984; FSC No.: 02-0278634; Empl.: 55; *Sls. Mgr.:* Thomas J. Fenner

GEOPOWER INC., 50 Spring St., Ramsey, NJ 07446, Tel: TEL:201-236-0156, FAX: 201-236-0224 .... **D•1858**

GEORATOR CORP., 9617 Center Street, Manassas, VA 22110-5512, Tel: 800-523-9938, FAX: 703-368-1078; FSC No.: 91723; *Sls. Mgr.:* Steve Hylton ...... **D•2261-2263**

Local Sales Offices & Reps

AL	Birmingham, Simpson, Kiritsy & Assoc.	205-951-0850,FAX:205-951-0358
CA	Downey, Sierra Indl. Eng. Co.	310-803-6330, FAX:310-803-0617
CA	Fremont, Coherent Automation	510-657-2100, FAX:510-657-2511
CT	Hamden, IMAC Engrg. Sls. Inc.	203-879-3555, FAX:203-879-9137
FL	Altemonte Springs, Machine Controls, Inc.	407-788-6606,FAX:407-862-9380
IL	Arlington Heights, Hill Sls. Corp.	708-255-4400,FX, 708-255-0192
NY	Victor, Controlled Motion Prods. Co.	716-924-3830, FAX:716-924-5458
OH	Dublin, Robert S. Howley Co., Inc.	614-889-1123, FAX:614-889-1146
PA	Jim Thorpe, Brisbane Indl. Dr. Co.	717-325-3684, FAX:717-325-3870
TX	Houston, King Mktg. Assocs. Co.	713-621-6915, FAX:713-621-7917
Can	Waterloo, Ont., Mfrs. Automation Peripheral Prods.	519-746-0401,FAX:519-746-3047

GRI

FAX: 308-235-2609

GEORGE RISK INDUSTRIES, INC., 802 S. Elm St., Kimball, NE 69145, Tel: 308-235-4645; FSC No.: 24229; Empl.: 180; *Sls. Mgr.:* Mary Ann Brothers; *Dist. Mgr.:* Mary Ann Brothers .... **B•1832**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-997-7285
VA	Alexandria, Tech-Reps, Inc.	703-370-2600
CA	Los Altos, W.W. Posey Co.	415-969-7635
CO	Golden, F.J. Hurlbut Co.	303-279-7796
GA	Duluth, Stelmack Comps.	404-441-7927
MA	Lexington, Jodan Technlg.	617-863-8898
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Eden Prairie, O'Reilly Assocs.	612-941-6480
NY	Huntington Station, Morgan Elctrns.	516-549-5180
PA	Horsham, Jacobsen Assocs.	215-674-2937

GERMANIUM POWER DEVICES, Box 3065, Shawsheen Village Sta., Andover, MA 01810-3065, Tel: 508-475-5982, TELEX: 94-7150, FAX: 508-470-1512; FSC No.: 53399; Empl.: 100; *Sls. Mgr.:* R. W. Kassiotis

GERTSCH INSTRUMENTATION DIV., Tegam, Inc., 7230 North Ridge Rd., Madison, OH 44057, Tel: 216-428-7505, FAX: 216-428-1068

GETTYS CORPORATION, an AEG Company, 2701 N. Green Bay Rd., Racine, WI 53404, Tel: 414-637-6591, TELEX: 201-309, FAX: 414-637-8400; Empl.: 173; *Sls. Mgr.:* Jim Vojtko

GETTYSBURG TRANSFORMER CORPORATION, 1380 Old Harrisburg Rd., PO Box 4356, Gettysburg, PA 17325, Tel: 717-334-2191, FAX: 717-334-4961; Empl.: 50; *Sls. Mgr.:* Charles A. Ritter

GEYER SYSTEMS, See GSI Corp.

GGB INDUSTRIES, INC., Picoprobe Division, PO Box 10958, Naples, FL 33941, Tel: 813-643-4400, FAX: 813-643-4403; *Sls. Mgr.:* Greg Boll

GHIELMETTI, INC., 30961 Agoura Rd, Ste 311, Westlake Village, CA 91361, Tel: 800-228-1097, FAX: 818-707-1754; Empl.: 4; *Sls. Mgr.:* Rick Odorfer

GIANNINI INSTITUTE, 51-555 Madison St., Indio, CA 92201, Tel: 619-347-2833, FAX: 619-342-4006; FSC No.: 24727; Empl.: 10; *Sls. Mgr.:* Fred P. Ciambrone

GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, FAX: 313-280-0998; Empl.: 20; *Sls. Mgr.:* Denny Desmond

GIDDINGS & LEWIS-NEXES AUTOMATION, Giddings & Lewis, Inc., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54936-1658, Tel: 414-921-7100, TELEX: 26-2722, TWX: 910-275-1100; FSC No.: 8P681; Empl.: 175

GIGA-TRONICS, INC., 488 Tasman Dr., Sunnyvale, CA 94089, Tel: 408-734-5780, FAX: 408-747-1265; *Sls. Mgr.:* Dean Armann, Div. Sls. Mgr.

For sales offices and representatives, Giga-tronics, Pleasant Hill 1-800-726-GIGA

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GILWAY TECHNICAL LAMP, 800 W. Cummings Pk., Woburn, MA 01801, Tel: 617-935-4442; FSC No.: 3T059; Empl.: 17; *Sls. Mgr.:* Clark Benjamin III; *Dist. Mgr.:* Erin Hurley .... **B•1152-1161**

GIMIX, INC., 3223 Arnold Lane, Northbrook, IL 60062-2406, Tel: 708-559-0909, FAX: 708-559-0942; Empl.: 14; *Sls. Mgr.:* Robert Phillips

GLASGAL COMMUNICATIONS, INC., 151 Veterans Dr., Northvale, NJ 07647, Tel: 201-768-8082, FAX: 201-768-2947; FSC No.: 22-2209693; Empl.: 130; *Sls. Mgr.:* Gerald C. Walsh

GLASSMAN EUROPE LIMITED, Studio 4 Intec 2 Wade Rd., Basingstoke, Hampshire RG24 0NE, Tel: (0256) 810808, FAX: (0256) 810815; *Sls. Mgr.:* J. Ellis

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GLASSMAN JAPAN HIGH VOLTAGE LTD., Taira Bldg., 1-17, Taira 1-Chome, Miyamae-Ku, Kawasaki 216, Japan, Tel: (044) 877-4546, FAX: (044) 877-3395

GLATZER INDUSTRIES CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-576-2700, FAX: 914-576-7075; Empl.: 25; *Sls. Mgr.:* Patricia M. Wyllie

GLENAIR INC., 1211 Air Way, Glendale, CA 91201-2497, Tel: 818-247-6000, TELEX: 67-3485, TWX: 910-437-2066, FAX: 818-500-9912; FSC No.: 06324; Empl.: 485; *Sls. Mgr.:* Ronald E. Platz

GLENMARC MANUFACTURING INC., 970 Woodlands Pkwy., Vernon Hills, IL 60061, Tel: 708-634-6080, 800-323-5350, FAX: 708-634-9527; Empl.: 13; *Sls. Mgr.:* David Greenwood

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GLENTEK, INC., 208 Standard St., El Segundo, CA 90245, Tel: 310-322-3026 **B•1262-1264**

GLOBAL COMPONENTS & CONTROLS, 3301-B Fairmont Ave., Wanamassa, NJ 07712-4010, Tel: 908-389-1470, FAX: 908-389-5284; Empl.: 4; *Sls. Mgr.:* John M. Chapski

GLOBAL SPECIALTIES, Interplex Electronics, Inc., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 50; *Sls. Mgr.:* Rachael Fernicola; *Dist. Mgr.:* Rachael Fernicola

GLOBE BATTERY DIV., See Johnson Controls, Globe Battery Div.

GLOBE MOTORS, 2275 Stanley Avenue, Dayton, OH 45404, Tel: 513-228-3171, FAX: 513-229-8531; Empl.: 580; *Dist. Mgr.:* Derek Keegan

GLOBETRON ELECTRONICS CORP., 3175 Dundas St. West, Oakville, Ont., Can L6J 4Z3, Tel: 416-825-1335, 1-800-800-4606, FAX: 416-825-0475; Empl.: 4; *Sls. Mgr.:* Alan Montgomery

GLOBE UNION, See Johnson Controls, Globe Battery Div.

GLOBTEK, INC., 186 Veterans Drive, Northvale, NJ 07647, Tel: 201-784-1000, FAX: 201-784-0111; Empl.: 20; *Sls. Mgr.:* Tom Devaney; *Dist. Mgr.:* Bob Siepmann **C•1340, 1748; D•1730-1732**

Local Sales Offices & Reps

CA	La Mesa, Tektris Electro Corp.	619-697-4563
CO	Boulder, The Stratford Grp.	303-530-3194
CT	Ridgefield, Harbor Elctrns.	203-438-9625
FL	Valrico, Unirep, Inc.	813-681-3477
GA	Suwanee, Overton Assocs.	404-497-0166
IL	Chicago, Meca Sls.	312-334-4020
MD	Lisbon, S. K. MacDonald	301-982-1088
MI	Howell, Great Lakes Comp.	517-548-9100
NH	Amherst, Bennetron	603-880-7008
NJ	Bay Head, Cuccaro Co.	903-892-2511
NC	Raleigh, Bestec	919-790-8988
OH	Dayton, Thompson and Assoc.	513-435-7733
OR	Beaverton, Unicomp	503-643-1645
TN	New Tazewell, Overton Assocs.	615-626-6009
TX	Dallas, Exel Tech	214-239-3935
WA	Spokane, DES Elctrns.	509-922-2971

GLOLITE SALES LTD/GLOWLITE DIV., See Advanced Rubber Concepts

GME SYSTEMS, INC., 12300 Perry Highway, Pittsburgh, PA 15090, Tel: 412-935-0440, FAX: 412-935-9640; Empl.: 7; *Sls. Mgr.:* Bjorn Karlstrom; *Dist. Mgr.:* Raymond Rebholz

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GML CHIP COMPONENTS LIMITED, Hig, Phasell, Block 2 Flat 16 Baghlingampally, Hyderabad A.P., India 500 044, Tel: (91) 842-660106,661593, TELEX: 0425-2105 GML IN, FAX: (91) 842-661484; Empl.: 50

GM NAMEPLATE, INC., 2040 15th Ave. West, Seattle, WA 98119, Tel: 206-284-2200, FAX: 206-284-3705; Empl.: 350; *Sls. Mgr.:* Gerry Gallagher **B•1836-1837; C•1665**

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AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	Irvine, Balzer-Wolf Assoc.	714-261-6877
CA	San Jose, GM Nameplate, Inc.	408-435-1666
CO	Englewood, Delltron	303-741-2122
FL	Orlando, Comp. Sls.	407-823-7480
HI	Honolulu, Menehune Unltd.	808-737-3472
ID	Eagle, GM Nameplate	208-939-7202
IL	Elmhurst, Utronix	708-834-1100
IN	Zionsville, Custom Engineered Parts, Inc.	317-873-5626
MI	Southfield, Ebling Entprs.	313-647-0330
MN	Burnsville, Electromec Sls., Inc.	612-894-8200
MO	St. Louis, Halpin D. Burke & Son	314-968-2727
NH	Mont Vernon, GM Nameplate, Inc.	603-673-9737
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs.	201-575-9300
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Akron, Augnat Assocs.	216-239-2499
OR	Portland, GM-Portland	503-223-9879
PA	Robinson Township, Allied Entrprs.	412-788-2992
TX	Dallas, Comp. Technlg.	214-783-8831
VA	Reston, Colrud Corp.	703-904-0240
WA	Bellevue, American Intl. Entprs.	206-455-4697
EXP	Monterrey, NL, Meixco, Grupo Etimex	83 43-00-41
EXP	Singapore, S & T Entprs.	065-745-9235
Can	Calgary, Alberta, Enerlec Sls. Ltd.	403-256-3627
Can	Richmond, BC, Enerlec Sls. Ltd.	604-273-0882

GMR CO., 804 Main St., Venice, CA 90291-3218, Tel: 310-399-1490, TELEX: 499 2468, FAX: 310-399-1901; Empl.: 62; *Sls. Mgr.:* Harvey Mushman

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FAX: 415-368-0816

GMW ASSOCIATES, P.O. Box 2578, Redwood City, CA 94064, Tel: 415-368-4884; Empl.: 7; *Sls. Mgr.:* Ian Walker **B•1950-1951; D•1260-1263**

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FAX: 714-993-6023

GOLDEN PACIFIC ELECTRONICS, INC, 560 S. Melrose St., Placentia, CA 92670, Tel: 714-993-6970; Empl.: 15; *Sls. Mgr.:* James Au; *Dist. Mgr.:* James Au **D•1030-1032, 1734-1735**

Local Sales Offices & Reps

CA	Garden Grove, ELSCO Elctrns	714-891-4621
CA	Norwalk, Ed Rivers Assocs.	310-868-1471
CA	San Jose, Applied Eltcrns Mktg	408-441-9610
CO	Longmont, Butler Tech. Sls.	303-651-7703
IL	Arlington Heights, M.J. Peterson & Assocs.	708-577-8200
MN	Maple Grove, Electronic Prods. for Ind.	612-493-3346
NJ	Wayne, Breen Assocs	201-696-8683
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
PA	Pittsburgh, K-T Mktg.	412-367-1011
TX	Richardson, Jim D. Gray & Assoc.	214-699-9976
UT	Salt Lake City, Luscombe Engrg.	801-268-3434
Can	Ottawa, Ont., Current Mktg.	613-224-4811

GOLDEN POWER SYSTEMS, INC., 2125-B Madera Rd., Simi Valley, CA 93065, Tel: 805-582-4400, FAX: 805-582-3230; Empl.: 550; *Sls. Mgr.:* Mark Richey

GOLDSTAR PRECISION CO. LTD., Lucky Goldstar, 13013 E. 166th St., Cerritos, CA 90701, Tel: 310-404-0101, FAX: 310-921-6227; Empl.: 12; *Sls. Mgr.:* Reginald Bale; *Dist. Mgr.:* Reginald Bale

GOLDSTAR TECHNOLOGY, INC., 3003 N. First St., San Jose, CA 95134, Tel: 408-432-1331, FAX: 408-432-6053

GOOD-ALL ELECTRIC, INC., 3725 Canal Drive, Fort Collins, CO 80524, Tel: 303-484-3080, 800-826-7891, TWX: 910-930-9015, FAX: 303-484-8649; FSC No.: 22096; Empl.: 135; *Sls. Mgr.:* Sandi K. Salvhus

GORDON BRUSH MFG. CO., INC., 2150 Sacramento St., Los Angeles, CA 90021-1786, Tel: 213-627-6889, FAX: 213-623-4397; FSC No.: 17987; Empl.: 35

J. GORDON ELECTRONIC DESIGN, INC., 7671 Central Ave. NE, Minneapolis, MN 55432, Tel: 612-786-2405, FAX: 612-786-5778; Empl.: 3; *Sls. Mgr.:* Jim Hogenson

GORDON INSTRUMENTS, INC., 3645 California Rd., Orchard Park, NY 14127, Tel: 716-662-5353, 1-800-333-2672, FAX: 716-662-7839; Empl.: 20; *Sls. Mgr.:* John Savage

GORDON, L., PACKAGING, 1050 S. Paca St., Baltimore, MD 21230, Tel: 410-539-6537, FAX: 410-625-7510; Empl.: 150

GORDON PRODUCTS, 67 Del Mar Dr., Brookfield, CT 06804, Tel: 203-775-4501, FAX: 203-775-1162; Empl.: 45; *Sls. Mgr.:* Leon Najman; *Dist. Mgr.:* Leon Najman

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GORDOS, Crouzet Corp., 3237 Commander Dr., Carrollton, TX 75006-2506, Tel: 214-250-1647, 1-800-677-5311; *Sls. Mgr.:* Bill Wiberg **A•1695; B•1458-1463; D•1182-1183**

Local Sales Offices & Reps

AZ	Scottsdale, Jeff Miller	602-948-0751
CA	Costa Mesa, Automation Control & Data Inc.	714-751-6760,FAX:714-751-0726
CA	San Diego, Automation Control & Data Inc.	619-674-5811
CT	Westbrook, John Brewer	203-399-7311
GA	Marietta, Levine Lectronics	404-565-1556
IL	Schaumburg, Eric Pfister	708-885-5696
IN	Indianapolis, HI-Tek Sls. Co.	317-887-2564, FAX:317-888-6476
IA	W. Des Moines, HDI, Ltd.	515-225-3777
KS	Lenexa, Midtec Assocs.,Inc.	913-541-0505, FAX:913-541-1729
MA	Burlington, Anacon Sls. Assocs.	617-272-9080,FX, 617-272-9102
MN	St. Paul, Johnson Co.	612-429-2544
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666, FAX:314-275-8859
NJ	Budd Lake, Guido Assocs.	201-347-4643, FAX:201-691-1468
NM	Albuquerque, Syntech	505-266-7051, FAX:505-266-7953
OH	Centerville (Dayton), Omega Sls., Inc.	513-434-5507,FAX:513-434-5772
OH	Cleveland, Omega Sls., Inc.	216-360-9400, FAX:216-360-0712
OH	Powell, Jack Matthews	614-766-1932
OR	Portland, Control Devices Northwest	503-659-3216
PA	Valley Forge, Providence Mktg. Assocs., Inc.	215-935-3300,FAX:215-935-3387
TX	Dallas, Crouzet Corp.	214-250-1647
WA	Bellevue, Control Devices Northwest	206-451-8552
Intl	AR Rogers, Gordos	501-636-5000
Can	Montreal, Que., Crouzet Corp.	514-735-7926

Local Distributors

CA	Santa Monica, Master Distrs.	310-452-1229
IL	Chicago, Newark	312-784-3670
MA	Peabody, Time Elctrns.	508-532-6200
NJ	Oakland, Relay Specs.	201-337-1000
OH	Cincinnati, Aetna Elec.	513-871-8338
PA	Willow Grove, C.A. Briggs Co.	215-784-9250
SC	Columbia, Resources Elctrns.	803-779-5332
WI	Waukesha, Powermation	414-523-0600

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W.L. GORE & ASSOCS., 555 Paper Mill Rd., Newark, DE 19714, Tel: 302-738-4880, TWX: 510-666-0825, FAX: 302-738-7710; Empl.: 2000; *Sls. Mgr.:* Daniel D. Johnson

W.L GORE & ASSOCIATES, INC., 1505 North Fourth St, P.O. Box 3000, Flagstaff, AZ 86003-3000, Tel: 602-526-3030, 1-800-344-3644, FAX: 602-526-2919; FSC No.: 60622; *Sls. Mgr.:* Jerry H. Johnson; *Dist. Mgr.:* Jerry H. Johnson

GORMAN MACHINE CORP., 7 Burke Dr., Brockton, MA 02401, Tel: 508-588-2900, FAX: 508-588-9560; Empl.: 25; *Sls. Mgr.:* Kenneth P. Gorman

GORMAN-REDLICH MFG. CO., 257 W. Union St., Athens, OH 45701, Tel: 614-593-3150, FAX: 614-592-3898; Empl.: 4; *Sls. Mgr.:* Jim Gorman

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Can	Toronto, Ont., R.H. Nichols	416-851-8871

Local Distributors

CA	Duarte, Pathfinder	818-357-1890
CA	Laguna Hills, Hill House	714-951-1048
CA	Palo Alto, Priz-Co.	415-493-8600
CA	San Bruno, Control Tech.	415-593-2111
CO	R&R Instrmn.	303-340-8728
IL	Algonquin, Marshall Wolf	708-658-8130
IN	Fishers, Couchman-Conant	317-849-9890
LA	New Orleans, Currier & Roser Inc.	504-734-1147
MI	Highland Park, Marsh Instrs.	313-869-9200
MI	Highland Pk., Marsh Instrs.	313-869-9200
MN	New Brighton, J & W Instrs.	612-784-5708
MT	Billings, Kirst Engrg.	406-656-9570
NJ	Landing, PC & S	201-398-5843
NJ	Marmora, Brooks Tech., Inc.	609-390-2380
NY	E. Syracuse, Liberty Elctrns.	315-437-8100
NC	Statesville, Statesville Process Instrs.	704-873-1835
OR	Portland, HIS Elctrns.	503-643-5648
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TN	Knoxville, Southeastern Automation Grp.	615-675-3080
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WA	Bellevue, Eustis Comp.	206-451-0700
WI	Milwaukee, Gordon Hatch Co.	414-671-6550
PR	San Juan, Tomas Cuerda, Inc.	809-758-7830

GO SWITCH, P.O. Box 37290, Louisville, KY 40233, Tel: 502-969-2386, FAX: 502-969-5911; Empl.: 60; *Sls. Mgr.:* David Lambert; *Dist. Mgr.:* David Lambert

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GOULD INC., FOIL DIV, Gould Inc., 35129 Curtis Blvd., Eastlake, OH 44095, Tel: 216-953-5000, FAX: 216-953-5174; Empl.: 15; *Sls. Mgr.:* John P. Callahan

GOULD INC., Test and Measurement Group, 8333 Rockside Rd., Valley View, OH 44125, Tel: 216-328-7000, TELEX: 196113GLD RS UT, FAX: 216-328-7400; FSC No.: 96795; Empl.: 550; *Sls. Mgr.:* C. Nazelli, Sls. V.P.

GOULD SHAWMUT, 374 Merrimac St., Newburyport, MA 01950, Tel: 508-462-6662/3131, FAX: 508-465-6419; FSC No.: 71424; *Sls. Mgr.:* Edward Calhoun

GOWANDA ELECTRONICS CORP., 1 Industrial Pl., Gowanda, NY 14070, Tel: 716-532-2234, TWX: 710-529-1211, FAX: 716-532-2702; FSC No.: 24226;15305; Empl.: 250; *Sls. Mgr.:* H.F. Gearhart; *Dist. Mgr.:* H.F. Gearhart .... **A•1239-1241**

Local Sales Offices & Reps

AL	Huntsville, L&D, Inc.	205-837-8395
AZ	Mesa, Sys. Sls. of AZ Inc.	602-464-9989
NM	Albuquerque, Sys. Sls. of N.M.	505-889-2901
CA	Fremont, Ed Blake Assocs.	510-770-9058
CA	San Diego, Earle & Assocs.	619-278-5441
CA	Torrance, Orion-Eclipse	213-326-0999
CO	Parker, Parker-Webster Co.	303-841-4888
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Palatine, Key Entpr.	708-991-2144
IA	Cedar Rapids, Gavin Sales	319-366-1229
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	N. Reading, Lincoln Assocs.	508-664-6800
MI	Madison Heights, D.E.M. Sls.	313-583-1500
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
MO	Lee's Summit, Omni Tech. Sls.	816-578-4221
NY	Manhasset, Win-Cor Elctrn.	516-627-9474
NY	Pittsford, Andres Comps.	716-385-3818
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-572-0003
PA	Exton, Linear Sls.	215-524-8080
TX	Richardson, Texoma Tech. Sls.	214-238-8127
UT	Murray, Parker-Webster Co.	801-266-9939
WA	Olympia, Bergford & Assocs.	206-866-2001
WI	Milwaukee, Key Entpr.	414-762-2323
Can	St. Laurent, Componetics	514-331-9930

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
CA	Chatsworth, Passive Comps.	818-700-8838
NJ	E. Brunswick, Brothers Electrns.	201-238-2200
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Stanton, Inductive Comps.	714-828-3420
CT	Bridgeport, Park Distributors	203-366-7200
FL	Ft. Lauderdale, Component Distrs.	800-558-2351
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Chanhassen, G&F Distribution	612-934-2907
NY	Hauppauge, Broadline Electric	516-231-4100
PA	Exton, VSH Elctrns.	215-363-2250
VA	Charlottesville, Va. Elctrn. Comps.	804-296-4184
Can	Pointe Claire, Que., Ferrotronics	514-426-0300

GOW-MAC INSTR. CO., P.O. Box 32, Bound Brook, NJ 08805-0032, Tel: 908-560-0600, TELEX: 833-174, FAX: 908-271-2782; Empl.: 52; *Sls. Mgr.:* Jeff Lawson

G P BATTERIES USA, Gold Peak International Ltd., 2772 Loker Ave. West, Carlsbad, CA 92008, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 30; *Sls. Mgr.:* Gregg Kuehn; *Dist. Mgr.:* Bryan Myers

GP:50 NEW YORK, 2770 Long Rd., Grand Island, NY 14072, Tel: 716-773-9300, FAX: 716-773-5019; Empl.: 26; *Sls. Mgr.:* Pat Murphy

GP TRAINING SYSTEMS, GPS Technologies, Inc., 76 Robinson St., Pottstown, PA 19464, Tel: 215-327-8800, FAX: 215-327-1158; Empl.: 1681; *Sls. Mgr.:* Richard Smith; *Dist. Mgr.:* Stacey Jarlsberg

GRADO LABORATORIES, 4614 Seventh Ave., Brooklyn, NY 11220, Tel: 718-435-5340, FAX: 718-633-6941

GRAFOPLAST S.P.A., Wiremarkers, 13, Via Arrivabene, Genova, Italy 16154, Tel: 010. 621687, TELEX: 0283828, FAX: 010. 674448; Empl.: 45; *Sls. Mgr.:* Giorgio Patrone

GRAHAM ELECTRONIC MANUFACTURING INC., 109-State Pl., Escondido, CA 92025, Tel: 619-747-9177, 800-628-4095, FAX: 619-747-9326; Empl.: 14; *Sls. Mgr.:* Samuel L. Band

GRALEX INDUSTRIES, 70 Oak St., Ste. 204, Norwood, NJ 07648, Tel: 800-486-4499, FAX: 201-767-7015; FSC No.: 11332; Empl.: 15; *Dist. Mgr.:* Jan Noothout .... **D•1353**

Local Sales Offices & Reps

CA	San Leandro, Coast	415-483-3774
IL	Franklin Park, Alca	708-451-6644
NJ	Norwood, Gralex Inds., Inc.	800-486-4499

Local Distributors

AZ	Phoenix, Metermaster	602-243-4111
AZ	Tempe, CMI Metermaster	602-431-0880
CA	Los Angeles, Crompton Metermaster	714-921-2101
CA	Los Angeles, Metermaster	213-685-4340
CA	Palo Alto, CMI Metermaster	415-960-8500
CA	Palo Alto, Metermaster	415-968-0313
GA	Atlanta, Metermaster	404-446-0166
GA	Atlanta, Metermaster	404-446-0188
IL	Chicago, Metermaster	312-593-8650
IL	Glendale Hgts., Crompton Metermaster	312-351-4554
MA	N.Billerica, Electra Test, Inc.	508-667-8541
MA	Waltham, Calibron Instrs.	617-894-6440
NJ	Somerset, CMI Metermaster	201-271-1277
NY	Great Neck, Instrument Mart	516-487-7430
OH	Cleveland, Crompton Metermaster	216-651-4100
TX	Dallas, Metermaster	214-271-5671
TX	Houston, Meters & Instrs.	713-644-1631

GRAND TRANSFORMER, INC., 1500 Marion St., Box 799, Grand Haven, MI 49417, Tel: 616-842-5430, FAX: 616-842-1780; Empl.: 125; *Sls. Mgr.:* Ted Jackson; *Dist. Mgr.:* G. V. Retzlaff, Exp. Sls. Mgr.

GRAPHICODE, INC., 19101 36th Ave. W., Ste.204, Lynnwood, WA 98036, Tel: 206-672-1980, FAX: 206-672-2705; Empl.: 5; *Sls. Mgr.:* Douglas M. Pratt

GRAPHICS MICROSYSTEMS, INC., 10375 Brockwood Rd., Dallas, TX 75225, Tel: 214-340-4584, 800-527-1207, TELEX: 506973; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Eddie Deering

GRAPHITE METALLIZING CORP., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702, Tel: 914-968-8400, TELEX: 13-1571, FAX: 914-968-8468; Empl.: 178; *Sls. Mgr.:* E. Walker .... **B•1265**

Local Sales Offices & Reps

OR	Beaverton, Graphite Metallizing	503-646-9964

GRASEBY INFRARED, Graseby PLC, 12151 Research Parkway, Orlando, FL 32826, Tel: 407-282-7700, FAX: 407-273-9046; Empl.: 50

GRASSLIN CONTROLS CORP.:GRASSLIN GMBH & CO., K.G., 24 Park Way, Upper Saddle River, NJ 07458, Tel: 201-825-9696, FAX: 201-825-8694; Empl.: 7; *Sls. Mgr.:* Gene K. Manghi

GRAYHILL INC., 561 Hillgrove Ave., La Grange, IL 60525, Tel: 708-354-1040, FAX: 708-354-2820; FSC No.: 5930; Empl.: 615; *Sls. Mgr.:* Richard K. Neumann; *Dist. Mgr.:* Robert J. Ferrel .... **B•1507, 1729-1733, 1833; C•1341**

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Industrial Distrs. (Solid State Only)

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
CA	Irvine, Quadrep Southern Inc.	714-727-4222
CA	San Jose, Quadrep, Inc.	408-432-3300
CO	Denver, Lindberg Co.	303-758-9033
CT	Branford, Coakley Boyd & Abbett	203-481-2218
FL	Clearwater, Sunland Assocs.	813-536-2955
FL	Lauderhill, Sunland Assocs.	305-748-1303
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Tucker, Rep, Inc.	404-938-4358
IL	Itasca, LTD Elctrns.	708-773-2900
IN	Ft. Wayne, Menze Sls.	219-747-5616
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Gaithersburg, Naudain Assocs. Southern	301-258-5040
MA	Framingham, Coakley Boyd & Abbett	508-820-0800
MI	Royal Oak, Hilltronics Inc.	313-435-0920
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	Florissant, Spectrum Sls.	314-921-1313
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Hackensack, Coakley Boyd Abbett/Metro Div.	201-440-4114
NJ	Marlton, Naudain Assocs.	609-983-5300
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wantagh, Coakley Boyd Abbett	516-783-4102
NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
NC	Morrisville, Reps, Inc.	919-469-9997
OH	Centerville, Bear Mktg. Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
OR	Tigard, Eltech, Inc.	503-684-3458
PA	Allison Park, Bear Mktg.	412-492-1151
TN	Jefferson City, Rep, Inc.	615-475-9012
TX	Austin, Fralia & Co.	512-835-7911
TX	Euless, Fralia & Co.	817-267-3577
TX	Houston, Fralia & Co.	713-772-1572
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Eltech, Inc.	206-643-4330
WI	Mequon, Badgerep	414-241-9200
Can	Burnaby, BC, A.C. Simmonds & Sons Ltd.	604-451-9488
Can	Nova Scotia, A.C. Simmonds & Sons Ltd.	902-865-1889
Can	Pickering, Ont., A. C. Simmonds & Sons Ltd.	416-839-8041
Can	Ville LeMoyne, Quebec, A.C. Simmonds & Sons Ltd.	514-466-5250

Local Distributors

AL	Birmingham, Regan Controls	205-664-2877
AL	Huntsville, Powell Elctrns.	205-837-5300
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, LCOMP Inc.	602-730-1633
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Garden Grove, Richey/Impact Elctrns.	800-421-7258
CA	Gardena, Calif. Switch & Signal	213-770-2330
CA	Inglewood, Newark Elect.	213-671-7377
CA	Los Angeles, Electric Switches	213-660-1310
CA	Mission Viejo, Distributed Motion	714-855-9902
CA	Novato, Westech Automation	415-382-2577
CA	Riverside, Electronic Supply	714-683-7300
CA	San Diego, Electronic Supply	619-693-8222
CA	San Diego, Richey/Impact Elctrns.	619-271-4511
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Francisco, Westech Automation	415-563-9876
CA	San Jose, Powell Elctrns.	408-943-9020
CA	San Jose, Richey/Impact Elctrns.	408-956-8010
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Sunnyvale, Time Elctrns.	408-734-9890
CA	Tustin, Time Elctrns.	714-669-0216
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Denver, CSID, Inc.	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Kent/Shelley Ragon, Inc.	303-792-9100
CO	Englewood, Motion Solutions	303-792-5518
CO	Englewood, Time Elctrns.	303-721-8882
CT	Southbury, Time Elctrns.	203-271-3200
CT	Southington, Electro Mechanical Drives, Inc.	203-621-7335
CT	Wallingford, Sager	203-265-4600
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Orlando, Hammond Elctrns., Inc.	407-849-6060
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Orlando, Time Elctrns.	407-841-6565
FL	Pompano Beach, Peerless Radio	305-973-4141
GA	Duluth, Pioneer Technlgs./Georgia	404-623-1003
GA	Norcross, Hammond Elctrns., Inc.	404-449-1996
GA	Norcross, Time Elctrns.	404-368-0969
ID	Meridian, Pacific Control Sply.	208-286-7404
IL	Batavia, Control Source	708-406-0880
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IL	Palatine; Ohm Elctrn.	708-359-5500
IL	Schaumburg, Time Elctrns.	708-303-3000
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Meunier Elctrn. Supp., Inc.	317-635-3511
IN	Indianapolis, Pioneer Standard	317-573-0880
IN	Indianapolis, Process Automation Devs.	317-879-1100
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Overland Pk., Olive Elctrns.	913-362-1923
MD	Annapolis Jct., Powell Elctrns.	301-953-3435
MD	Baltimore, Resco/Baltimore	410-931-8200
MD	Columbia, Sager Elctrns. Sply.	410-995-4900
MD	Columbia, Time Elctrns.	410-964-3090
MD	Gaithersburg, Pioneer Technlgs.	301-921-0660
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Peabody, Time Elctrns.	508-532-9900
MA	Westborough, Powell Elctrns.	508-366-6100
MI	Grand Rapids, Pioneer Standard	616-698-1800
MI	Livonia, Pioneer/STD Elctrns.	313-525-1800
MI	Livonia, R.S. Elctrns.	313-525-1155
MI	Oak Park, Newark/Detroit Elctrns.	313-967-1570
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Electrol, Inc.	612-521-5051
MN	Minneapolis, Newark Elec.	612-331-6350
MN	St. Paul, Gopher Elctrns.	612-490-4900
MN	St. Paul, Kent/Shelley-Ragon, Inc.	612-642-2828
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MO	Kansas City, LComp, Inc.	816-241-0111
MO	Kansas City, Missouri Valley Elctrl.	816-471-5308
MO	Manchester, Time Elctrns.	314-391-6444
MO	Maryland Hgts., LComp, Inc.	314-291-6200
MO	Maryland Hgts., Olive Elctrns.	314-997-7709
NE	Omaha, Electrol, Inc.	402-691-0662
NH	Merrimack, Brevan Elctrns., Inc.	603-429-1900
NH	Salem, Sager Elect. Sply, Inc.	603-898-1348
NJ	Cliffwood, Federated Purch.	908-290-2900
NJ	Marlton, JRH Elctrns.	609-988-8696
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	West Berlin, General Comps.	609-768-6767
NY	Albany, Kom Lamb, Inc.	518-869-8746
NY	Amherst, Kom Lamb, Inc.	716-691-6400
NY	Binghamton, Pioneer STD Elctrns.	607-722-9300
NY	Buffalo, Summit Distrs.	716-887-2800
NY	East Syracuse, Time Elctrns.	315-432-0355
NY	Fairport, Pioneer-Standard Elctrns., Inc.	716-381-7070
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Kom Lamb, Inc.	716-323-1410
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Syracuse, Kom Lamb, Inc.	315-455-7436
NC	Cary, Powell Elec.	919-467-1212
NC	Charlotte, Regan Controls	704-523-9137
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Regan Controls	919-790-0811
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Cleveland, Pioneer STD Cleveland	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Pioneer STD Elctrns.	513-236-9900
OH	Dayton, Stotts-Friedman Co., Inc.	513-298-5555
OH	Twinsburg, Exonic Sys.	216-425-2100
OH	Valley View, Newark Elect. Cleveland	216-447-8860
OH	Willoughby, Gateway Megatech	216-953-0333
OH	Youngstown, Brenner Indl. Sls.	216-788-8888
OK	Tulsa, Norvell	918-628-1916
OR	Beaverton, Component Resources	503-641-8488
OR	Eugene, Pacific Control Sply	503-342-7294
OR	Portland, Pacific Control Supply, Inc.	503-249-2033
OR	Portland, Radar Elec. Co.	503-232-3404
OR	Portland, Time Elctrns.	503-626-2979
PA	King of Prussia, Applied Controls, Inc.	215-265-3832
PA	Mars, Sager Elect. Supply Co.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Philadelphia, Sager Elect. Supply Co.	215-464-4336
PA	Pittsburgh, Exonic Sys.	412-967-9600
PA	Pittsburgh, Pioneer STD Elctrns. Inc.	412-782-2300
PA	Trevose, Bell Inds. Inc.	215-953-2800
RI	Pawtucket, Major/Edwards	401-725-7400
SC	Columbia, Regan Controls	803-736-3404
SC	Columbia, Resource Elctrns.	803-779-5332
SC	Gaffney, Newark Elect. Gaffney	803-487-3739
TN	Knoxville, Tennessee Armature & Elect. Co.	615-524-3681
TN	Memphis, The Genie Grp.	901-360-0200
TX	Austin, Norvell Elctrns.	512-343-2900
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Harrison Equip.	214-239-2750
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Dallas, Stuart C. Irby Co.	214-934-3300
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elect.Houston	713-270-4800
TX	Houston, Norvell Elctrns.	713-462-1666
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Richardson, Motion Dynamics, Inc.	214-690-3488
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Standard Supp.	801-486-3371
UT	West Valley, Time Elctrns.	801-973-8494
VA	Midlothian, Assocsiated Technlgs.	804-794-6094
WA	Kent, Component Resources, Inc.	206-454-8666
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Cascade Controls	206-881-8843
WA	Seattle, Radar Elect. Co., Inc.	206-282-2511
WI	Appleton, Doig Corp.	414-735-9155
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Classic Comps.	414-786-5300
WI	Thiensville, Doig Corp.	414-242-3256
Can	Burnaby, BC, ITT Multicomps.	604-421-6222
Can	Calgary, Al., Cardinal Ind'l. Elect.	403-259-6817
Can	Concord, Ont., ITT Multicomps.	416-798-4884
Can	Don Mills, Ont., Saynor Varah, Inc.	416-445-0723
Can	Edmonton, Al., Cardinal Ind'l. Elect.	403-483-6266
Can	Montreal, Que., Elctrn. Wholesalers	514-769-8851
Can	Ottawa Ont., Wackid Radio TV Labs	613-728-1821
Can	Richmond BC, Electrosonic, Inc.	604-273-2911
Can	Ville St. Laurent P.Q., ITT Multicommponents	514-335-7697
Can	Willowdale, Ont., Electrosonic, Inc.	416-494-1555

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GREENRAY INDS., INC., 840 W. Church Rd., Mechanicsburg, PA 17055, Tel: 717-766-0223, TWX: 510-650-4939, FAX: 717-790-9509; FSC No.: 16681; Empl.: 40

GREENSPRING COMPUTERS, INC., 1204 O'Brien Drive, Menlo Park, CA 94025, Tel: 415-327-1200, FAX: 415-327-3808; Empl.: 15

GREENWICH INSTRUMENTS USA, 3401 Monroe Rd., Charlotte, NC 28205, Tel: 704-376-1021, FAX: 704-335-8707; *Sls. Mgr.:* Cynthia Rider; *Dist. Mgr.:* Bruce Magruder

GREIBACH INSTRUMENTS DIV., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590; Empl.: 35

THE GRIEVE CORPORATION, 500 Hart Rd., Round Lake, IL 60073-9989, Tel: 708-546-8225, TELEX: 72-2436, FAX: 708-546-9210; Empl.: 120; *Sls. Mgr.:* Frank Calabrese

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GRUENBERG OVEN CO., P.O. Box 3246, 2121 Reach Rd., Williamsport, PA 17701, Tel: 717-326-1755, TELEX: 350079; Empl.: 140; *Sls. Mgr.:* Stuart Lunick

GRUNER, Advanced Components Industries, Inc., 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 310-328-0060, FAX: 310-328-0062; *Sls. Mgr.:* Irma Spreitzer .... **B•1403**

Local Sales Offices & Reps

IL	Shaumburg, Terry McNulty & Assocs.	708-980-9868
MA	Hopkinton, Berkshire Elctrns., Inc.	508-435-9356

GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024, Tel: 313-476-7875, FAX: 313-496-7249; Empl.: 105; *Sls. Mgr.:* Ed Leininger

GSI CORP., 1917 Greenspring Dr., Timonium, MD 21093, Tel: 410-252-1768, FAX: 410-561-1768; FSC No.: 60990; Empl.: 50; *Sls. Mgr.:* T.B. Weadock .... **C•1749-1751**

Local Sales Offices & Reps

AL	Huntsville, DTM, Inc.	205-539-8059
AZ	Tempe, EDS	602-438-1547
CA	Bonita, The Bryson Co.	619-428-2788
CA	Canoga Pk., GLM	818-346-0224
CA	Pleasanton, Advanced Tech. Sls.	510-847-2060
FL	Miami, SMI	305-387-5955
FL	Orlando, SMI	407-856-4140
FL	Tampa, SMI	813-933-5833
GA	Duluth, DTM, Inc.	404-381-5592
IL	Cary, J. D. Noble & Assocs., Inc.	708-639-2440
MA	Clinton, CWS, Inc.	508-368-8753
MN	Eden Prairie, Aldridge Assocs. Inc.	612-944-8433
NJ	Ho-Ho-Kus, D. J. Fisher Co., Inc.	201-652-0090
NY	Pittsford, CCS, Inc.	716-383-0546
NC	Raleigh, DTM, Inc.	919-859-0025
NY	Syracuse, CCS Inc.	315-488-1250
TX	Allen, EDS	214-924-3753

GTE CONTROL DEVICES, INC., Route 35, P.O. Box 175, Standish, ME 04084, Tel: 207-642-4535, FAX: 207-642-0198; Empl.: Over 1,000; *Sls. Mgr.:* David Brown, Mktg. Mgr.; *Dist. Mgr.:* L.Smith

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HAMAMATSU PHOTONIC SYSTEMS CORP., Industrial Video, 47A Manning Rd., Billerica, MA 01821, Tel: 508-671-5000, FAX: 508-671-9415; Empl.: 25; *Sls. Mgr.:* Paul Roehrenbeck

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MD	Silver Springs, Print Prods. Intl.	310-587-7824
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MO	St. Louis, I.S.L. Corp.	314-423-3141
MO	St. Louis, Instru-Med (ICU)	314-845-2299
NJ	Elizabeth, NEI	908-355-5502
NM	Albuquerque, J. Smith & Assoc.	505-345-6504
NY	Franklin Square, RJT Educational	516-354-2983
TX	Dallas, Knight Elctrns.	214-340-0265
TX	Dallas, Tucker Elctrns.	214-348-8800

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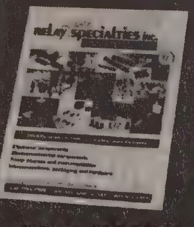

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FL	Tampa, Electramark	813-889-7775
GA	Atlanta, Wallace Elctrn. Sls. (Sen/SW Only)	404-634-3159
GA	Norcross, Electramark (Relays only)	404-446-7915
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
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AZ	Tempe, Cypress Elctrns.	602-966-2256
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CA	Los Angeles, Master Distrs.	310-452-1229
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CA	Santa Clara, Kent Elctrns.	408-727-9810
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CO	Englewood, Harrison Equip. Co.	303-694-6320
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Wallingford, Sager Elec.	203-262-1700
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FL	Lakeland, AA Elec.	813-665-6941
FL	Orlando, Hammond Elctrns.	407-849-6060
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GA	Norcross, Hammond Elctrns.	404-449-1996
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MN	Minneapolis, Newark Elctrns.	612-331-6350
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NH	Salem, Sager Elec.	603-898-1348
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Marlton, Capstone	609-596-7500
NJ	Oakland, Relay Specs.	201-337-1000
NJ	W. Berlin, General Comps.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
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NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
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TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Fort Worth, Allied Elctrns.	817-595-3500
TX	Fort Worth, Tandy Elctrns.	817-870-5614
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Kent Elctrns.	713-780-7770
TX	Stafford, Harrison Equipment	713-879-2727
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Richland, Radar Elec. Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Cedarburg, Automation Engrg.	414-377-7500
WI	Green Bay, Automation Engrg.	414-499-6000
WI	Mequon, Taylor Electric	414-241-4321
Can	Burnaby, BC, ITT Multicomponents	604-291-8866
Can	Calgary, AB., ITT Multicomponents	403-273-2780
Can	Concord, Ont., ITT Multicomponents	416-798-7884
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Mississauga, Ont., Capstone	416-670-2010
Can	Nepean, Ont., ITT Multicomponents	613-596-6980
Can	Ville S. Laurent, PQ, ITT Multicomponents	514-335-7697
Can	Winnipeg, MB., ITT Multicomponents	403-273-2780

HAMLIN LCD STANDISH INDS., See Standish Industries, Hamlin LCD Div.

HAMMOND MANUFACTURING

FAX: 716-894-1156

HAMMOND MANUFACTURING CO., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710; Empl.: 1,450; *Sls. Mgr.:* Ray Shatzel .... **C•1049**

Local Sales Offices & Reps

AZ	Phoenix, Tritek	602-371-0860
CA	N. Hollywood, Bassett Sls. Corp.	818-766-2117
CA	San Carlos, Bridge Mktg.	415-965-8045
CO	Boulder, The Stratford Grp.	303-530-3194
FL	Tampa, SRT Mktg.	813-884-4805
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Indianapolis, Schank Elctrns. Mktg.	317-842-6204
MD	Hunt Valley, S.K. McDonald	410-584-8631
MA	N. Scituate, W. A. Hendrickson Co.	617-545-0652
MI	Southfield, Component Assocs.	313-355-4110
MN	Golden Valley, Ambassador Inds. Mktg.	612-542-8437
MO	St. Louis, Kathrinus, Kelly & Baumhauer	314-647-2400
NY	Manhasset, Win-Cor Elctrn. Sls.	516-627-9474
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, Millar Elctrns.	919-828-8840
OH	Cincinnati, Frank E. Kahsar Sls.	513-922-3133
OR	Lake Oswego, Joseph Blancard Sls.	503-620-6888
TX	Dallas, J. Y. Schoonmaker Co., Inc.	214-349-1650

Local Distributors

AL	Birmingham, ACK, Inc.	205-322-0588
AZ	Phoenix, Electronic Parts Co.	602-277-7281
AZ	Phoenix, Tri-Tek	602-371-0860
AZ	Tucson, Southwest Sls.	602-628-1613
AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
CA	Chatsworth, Poco Sls.	818-700-8727
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Redwood City, H.D.B.	415-368-1388
CA	San Diego, Western Radio Elec.	619-268-4400
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Santa Ana, ITT Multicomponents	714-727-4001
CO	Denver, Fistell Elctrns.	303-629-1312
CT	Bridge Port, Park Distrbg.	203-366-7200
CT	Danbury, Pilgrim Elec.	203-792-7274
CT	Hartford, Hatry Elec.	203-527-1881
CT	New London, Jan Elctrn. Supp.	203-442-4386
CT	Norwalk, Cobra	203-847-6442
CT	Wallingford, Midstate Elec.	203-265-9900
DE	Wilmington, Whlsl. Elctrns.	302-652-3222
FL	Jacksonville, EMSCO	904-356-4851
FL	Orlando, EMSCO	407-849-6060
FL	Tampa, EMSCO	813-253-2684
FL	West Palm Beach, Atlantic Elect.	407-686-8553
GA	Atlanta, Ack, Inc.	404-351-6340
GA	Norcross, Emsco	404-925-8366
GA	Norcross, Whitehead Elctrns.	404-923-6667
GA	Norcross, Wholesale Inds. Elec.	404-447-8431
IL	Benenville, Goold Elctrns.	708-860-7171
IL	Chicago, Newark Elec.	312-784-5100
IL	Joliet, Mainline Elec.	815-436-3900
IL	Niles, Joseph Elec.	708-312-297-4200
IL	Wheeling, Hawk Elec.	708-459-4030
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, Advent Elec.	317-872-4910
IN	Indianapolis, Mar Elec.	317-633-6699
IA	Cedar Rapids, Dee Elec.	319-365-7551
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	New Orleans, W. B. Allen Supp.	504-525-8222
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Gaithersburg, M. S. Elec.	301-921-0200
MA	Haverhill, Spartan Elctrns.	508-373-1200
MA	Needham, Y.D.I.	617-449-1005
MA	Springfield, Signal Elctrn. Supp.	413-739-3893
MA	Wellesley Hills, Target Elctrns. Supp.	617-235-2545
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Eden Prairie, Cassidy Elctrns.	612-895-9026
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Tortec Corp.	612-866-3662
MO	Kansas City, Electronic Supp.	816-931-0250
MO	Kansas City, Walters Ind. Elec.	816-561-7015
MO	St. Louis, Van Sickle Radio	314-621-5000
NH	Dover, American Radio Corp.	603-335-3118
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Randolph, Mouser Elctrns.	201-328-3322
NJ	Raritan, Masters Elctrn. Supp.	201-725-3533
NJ	Totowa, Route Elctrns.	201-256-8555
NM	Albuquerque, Beta Tron Elctrns.	505-821-1122
NY	Buffalo, Genesee Ind. Elec.	716-873-9661
NY	Buffalo, Summit Dist.	716-887-2800
NY	Long Island City, H.L. Dalis Inc.	718-361-8700
NY	Poughkeepsie, Chief Elctrns.	914-471-1300
NY	Rochester, Masline Elec.	716-546-5373
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elec.	315-337-5400
NY	Syracuse, Salina Elec.	315-422-2336
NY	Troy, Trojan Elec.	518-272-4481
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Greensboro, Hammond Elec.	919-275-6391
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Roberts Elec.	216-238-1711
OH	Columbus, Thompson Elec. Supp.	614-228-6191
OH	Dayton, Stotts Friedman	513-298-5555
OH	Warren, Rem Elctrns. Supp.	216-373-1300
OK	Oklahoma City, Radio, Inc.	405-528-2391
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Toledo, International Co.	503-336-2221
PA	Drexel Hill, Kass Elec.	215-449-2300
PA	Erie, REM Elctrns.	814-453-5626
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elec.	215-293-9000
RI	Pawtucket, Major Elec. Supp.	401-725-7400
SC	Charleston, Wholsale Inds. Elctrns.	803-722-2634
SC	Greenville, EMSCO	803-233-4121
SC	Taylors, Cantrell Wholesale	803-268-1194
TX	Corpus Christi, Douglas Elec.	512-883-5103
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wholesale Elec.	214-969-9400
TX	Ft. Worth, Allied Elec.	817-336-5401
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, The Altair Co.	713-462-3029
TX	Houston, Tri Star Eltrns.	713-667-7200
TX	Midland, ESI Supp.	915-694-9657
TX	San Antonio, Altex Elctrns.	512-828-0503
TX	San Antonio, Sherman Elec.	512-224-1001
UT	Salt Lake City, Standard Elec. Supp.	801-486-3371
VA	Annadale, Arcade Elctrns.	703-941-1074
VA	Annandale, Arcade Elctrns.	703-256-4610
VA	Arlington, Arlington Elctrns.	703-524-2412
VA	Virginia Beach, Norfolk Wire & Elctrns.	804-499-1100
WA	Bellevue, Integrated Elec.	206-455-2727
WI	Oshkosh, Elctrn. Inds.	414-235-8930
WI	Racine, Badger Elctrn. Supp.	414-637-1256
WI	Waukesha, Hawk Elctrns.	414-547-4457

HANCOCK ELECTRONICS CORP., 350 Lincoln St., Hingham, MA 02043, Tel: 617-740-4190, FAX: 617-740-4192; FSC No.: 66851; Empl.: 8; *Sls. Mgr.:* Robert H. Sturdy

HANDLES UNLIMITED, Vernaline Products Division, 333 Strawberry Field Rd., Warwick, RI 02887-6979, Tel: 800-227-0254, 401-739-7600, FAX: 401-732-6119; FSC No.: 08730; Empl.: 25; *Sls. Mgr.:* William Rife; *Dist. Mgr.:* William Rife

HAND HELD PRODUCTS, INC., 8008 Corporate Center Dr., Charlotte, NC 28226, Tel: 704-541-1380, TWX: 810-621-0380 PROTECH, FAX: 704-541-1333; *Sls. Mgr.:* Jim Trautwein; *Dist. Mgr.:* Jim Trautwein

H & L INSTRUMENTS, 1440 Rollins Road, Burlingame, CA 94010, Tel: 415-342-7850, FAX: 415-347-1065; Empl.: 7; *Sls. Mgr.:* Jenifer H. Landman

HANDY & HARMAN ELCTRN. MATLS. CORP., 72 Elm St., N. Attleboro, MA 02760, Tel: 508-695-1401, FAX: 508-695-7565; Empl.: 300; *Sls. Mgr.:* T. Longo

HANDY & HARMAN PRECIOUS METALS REFINING, 300 Rye Street, S. Windsor, CT 06074, Tel: 1-800-421-0411, 203-289-4327, FAX: 203-289-6494

HANIFY-KING PC, 1 Federal St., Ste. 13 Fl., Boston, MA 02110-2003, Tel: 617-492-0700, TELEX: 6714194, FAX: 617-492-7908; *Sls. Mgr.:* Paul Blumeufeld

HANKSCRAFT MOTORS, Sub of Gerber Prod. Co., P.O. Box 190, Reedsburg, WI 53959, Tel: 608-524-4341, FAX: 608-524-4342; Empl.: 75

HANOVIA, Canrad, 100 Chestnut St., Newark, NJ 07105, Tel: 201-589-4300, TELEX: 13-8531, FAX: 201-589-4430; Empl.: 250; *Sls. Mgr.:* Dennis M. Priscandaro; *Dist. Mgr.:* Dennis M. Priscandaro

HANSCOM, H. F., CO., INC., 225 Chapman St., Providence, RI 02905, Tel: 401-941-1455, FAX: 401-781-8835; Empl.: under 50; *Sls. Mgr.:* Allan Hanscom

HANSEN CORP., Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-385-3013; Empl.: 400; *Sls. Mgr.:* Dennis E. Monforton

HANTRONIX INC.

FAX: 408-749-0477

HANTRONIX, INC., Liquid Crystal Display, 250 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-736-3191, TELEX: 880165; Empl.: 25; *Sls. Mgr.:* Jake B. Yu; *Dist. Mgr.:* Ken Mc Reynolds .... **B•1070-1071**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Laguna Hills, 4 Star Elctrn. Sls.	714-583-9781
CA	Riverside, 4 Star Elctrn. Sls.	909-780-5146
CA	San Jose, Luscombe Engrg.	408-370-2020
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Waterbury, Ray Perron & Co., Inc.	203-756-9684
FL	Davie, Dan-Tech. Sls.	305-581-2882
IL	Arlington Hghts., Coombs Assoc.	708-439-9810
IN	Indianapolis, C.M.P. Engrg./Sls.	317-849-9277
KS	Prairie Village, Crosslink	913-649-7100
MD	Ellicot City, Technology Sls.	410-461-7802

HAMMOND

CABINETS
ENCLOSURES

In Stock

POCO SALES
8925 Fullbright Avenue
Chatsworth, CA 91311
(818) 700-8727

PoCo Sales

MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Detroit, C.M.P. Engrg./Sls.	313-477-7700
NJ	Lebanon, Sylvester Sls. Assoc.	908-735-2488
NJ	Medford, CEF Assoc.	609-953-8945
NY	Manluis, Lamtec Sls.	315-682-4780
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Cleveland, C.M.P. Engrg./Sls.	216-398-0400
OH	Dayton, C.M.P. Engrg./Sls.	513-836-0951
OR	Hillsboro, Temco Northwest	503-645-2030
PA	Pittsburgh, C.M.P. Engrg./Sls.	412-826-3800
TX	Dallas, Innovative Tech. Sls.	214-699-3485
WA	Birch Bay, Temco North West	206-371-0423
WA	Bothell, Temco North West	206-481-6150
WI	Milwaukee, Coombs Assoc.	414-351-6123

Local Distributors

CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Industry, Ital Elctrns Sls.	818-968-8515
CA	Mission Viejo, Opto Plus	714-380-8654
CA	San Diego, Deco Elctrns., Inc.	619-693-1595
CA	San Diego, Mock 3	619-693-8230
CA	San Jose, Spectra Elctrn. Inc.	408-955-7800
CO	Aurora, Q P S	303-343-9260
CO	Littleton, Displays Plus	303-730-7333
IL	Chicago, Leed Elctrns., Inc.	312-625-2800
IL	North Brook, Classic Comps.	708-272-9650
IL	Schaumburg, Q.P.S.	708-884-6620
MA	Wilmington, North Star Elec.	508-657-5155
MN	Brooklyn Park, Tech. Comps.	612-561-5556
MN	Plymouth, Leeds Elctrns., Inc.	612-557-1277
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
NM	Albuquerque, Betatron	505-821-1122
NY	Rochester, North Star Elect.	716-244-9846
OR	Salem, Light Wave Elctrns.	503-585-4770
PA	Prairie Village, Crosslink	913-649-7100
TX	Austin, Omni Pro	512-794-9200
TX	Austin, Wofford	512-339-1131
TX	Carrollton, Omni Pro	214-713-9000
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Dallas, Wofford	214-340-8555
TX	Houston, Omni Pro	713-270-1700
TX	Tomball, Wofford Elctrns.	713-351-2255
WI	New Berlin, Classic Comps.	414-786-5300
Can	Ontario, Intelatech, Inc.	416-629-0082

HARBIN ELCTRNS. CO., 3826 Old Getwell Rd., Memphis, TN 38118, Tel: 901-794-1667, FAX: 901-794-2515; Empl.: 15

HARBOUR IND. (CANADA) LTD., 1365 Industriel Blvd., Farnham, Quebec, Canada J2N 2X3, Tel: 514-293-5304, FAX: 514-293-2421; Empl.: 31; *Sls. Mgr.:* Marc Longpre

HARDIGG CASES, Hardigg Industries, 393 N. Main St. P.O. Box 201, South Deerfield, MA 01373, Tel: 413-665-2163, FAX: 413-665-8061; FSC No.: 11214; Empl.: 200; *Sls. Mgr.:* Stanley J. Morgan

HARDMAN: HARCROS CHEMICALS INC., 600 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-3000, FAX: 201-751-8407; Empl.: 75; *Sls. Mgr.:* Donald J. Wirth

HAROWE SERVO CONTROLS, INC.:A FASCO CO., 110 Westtown Rd. P.O. Box 547, West Chester, PA 19380, Tel: 215-692-2700, FAX: 215-696-2264; FSC No.: 06989; Empl.: 300; *Sls. Mgr.:* William J. Cuff

HARREL, INC., 16 Fitch St., E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* Richard Decew

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93012, Tel: 805-987-9511, TELEX: 182327, FAX: 805-987-2547; Empl.: 350; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Jeff Shaffer

HARRIS MICROWAVE SEMICONDUCTOR, Harris Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2222, TWX: 910-338-2247, FAX: 408-432-3268; *Sls. Mgr.:* Jim Klug

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32902, Tel: 1-800-4 HARRIS, FAX: 407-724-3937; FSC No.: 34371; Empl.: 9000; *Sls. Mgr.:* Carlton Smith; *Dist. Mgr.:* Valerie Lewis

HARTING ELEKTRONIK, INC., 2155 Stonington Ave., Ste. 212, Hoffman Estates, IL 60195, Tel: 708-519-7700, ext. 200, FAX: 708-519-9771; Empl.: 24; *Sls. Mgr.:* Donald G. Blummer, Natl. Sls. Mgr. .... **C•1343-1345**

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Phoenix, Dalis Elctrns.	602-272-2626
CA	Irvine, Kensington	714-588-0575
CA	San Jose, Compass Comps.	408-432-7575
CA	Santa Clara, Foresight Elctrns.	408-980-9700
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CT	Wallingford, Control Design Supp.	203-269-9955
IL	Arlington Hgts., LoDan Elctrns.	708-398-5311
IL	Schaumburg, Control Design Supp.	708-307-8900
IN	Indianapolis, Control Design Supp.	317-788-4559
MA	Woburn, Control Design Supp.	617-932-9404
MI	Madison Hgts., Tracer Control Co.	313-545-7140
MO	Maryland Hgts., French Gerleman Elec. Co.	314-569-3122
NM	Albuquerque, Bestech Elctrn. Comp. Sls.	505-298-0034
NC	Charlotte, Control Design Supp.	704-588-4410
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Malvern, Control Design Supp.	215-296-0150
PA	North Versailles, CMD Elctrns., Inc.	412-678-6020
TX	Dallas, Control Design Supp.	214-358-1441
TX	Dallas, Omni Pro Elctrns., Inc.	800-926-8926
TX	Houston, TriStar Elctrns. Corp.	713-667-7200
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WI	New Berlin, Control Design Supp.	414-784-1015
Can	Kingston, Ont., Elctrn. Packaging Sys. Ltd.	613-384-1142
Can	Victoria, B.C., Pacific Coast Elctrns., Ltd.	604-385-5111

HARTLEY PRODUCTS, 5732 Oleander Dr., P.O. Box 4794, Wilmington, NC 28406, Tel: 919-392-0500, FAX: 919-392-1077; *Sls. Mgr.:* R. Schmetterer

HARWIL CORPORATION, 1548 17th St., Santa Monica, CA 90404, Tel: 310-829-2310, FAX: 310-829-2259; Empl.: 14

HASCO COMPONENTS INTERNATIONAL CO., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Chris Mennella .... **B•1514-1520, 1735**

Local Sales Offices & Reps

AL	Huntsville, Hasco Comps. Intl. Corp.	800-852-5050
AK	Anchorage, Hasco Comps. Intl. Corp.	800-852-5050
AZ	Phoenix, Hasco Comps. Intl. Corp.	800-852-5050
CA	Irvine, Hasco Comps. Intl. Corp.	800-852-5050
CA	Los Angeles, Hasco Comps. Intl. Corp.	800-852-5050
CA	San Francisco, Hasco Comps. Intl. Corp.	800-852-5050
CT	Hartford, Hasco Comps. Intl. Corp.	800-852-5050
GA	Atlanta, Hasco Comps. Intl Corp.	800-852-5050
IL	Chicago, Hasco Comps. Intl. Corp.	800-852-5050
KS	Kansas City, Hasco Comps. Intl. Corp.	800-852-5050
LA	New Orleans, Hasco Comps. Intl. Corp.	800-852-5050
MA	Framingham, Hasco Comps. Intl. Corp.	800-852-5050
MO	Kansas City, Hasco Comps. Intl. Corp.	800-852-5050
NM	Albuquerque, Hasco Comps. Intl. Corp.	800-852-5050
NY	Port Washington, Hasco Comp. Intl. Corp.	800-852-5050
NY	Rochester, Hasco Comps. Intl. Corp.	800-852-5050
NC	Raleigh, Hasco Comps. Intl. Corp.	800-852-5050
OH	Cleveland, Hasco Comps. Intl. Corp.	800-852-5050
TX	Dallas, Hasco Comps. Intl. Corp.	800-852-5050
VA	Charlottesville, Hasco Comps. Intl. Corp.	800-852-5050
WA	Seattle, Hasco Comps. Intl. Corp.	800-852-5050
WI	Milwaukee, Hasco Comps. Intl. Corp.	800-852-5050

Local Distributors

AR	N. Little Rock, Control Design	501-851-3137
CT	Wallingford, Control Design	203-269-9955
FL	Sanford, Control Design	407-328-8011
GA	Stone Mountain, Control Design	800-432-0072
IL	Carrol Stream, Lectro Comps.	800-323-2282
MA	Woburn, Control Design	617-932-9404
MO	St. Louis, Control Design	314-432-1116
NJ	Rockaway, Tonar	201-586-9000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NC	Charlotte, Control Design	704-588-4410
PA	Philadelphia, Sharp Elctrns.	215-969-3300
WI	New Berlin, Control Design Supp.	414-784-1016
Can	Mississauga, C.E.A.	416-602-9717

HATHAWAY CORPORATION:MOTION CONTROL DIV., 10827 E. Marshall, Tulsa, OK 74116, Tel: 918-438-7800, FAX: 918-438-7629; Empl.: 80; *Sls. Mgr.:* David Richards

HAUMAN, INC., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, FAX: 408-434-9832; *Sls. Mgr.:* Willis Yeh .... **D•1265, 1737**

Local Sales Offices & Reps

AL	Huntsville, B & C Instruments, Inc.	205-883-6530
CA	Sunnyvale, E.I.L. Instrs.	408-744-0271
CO	Denver, E.I.L. Instrs.	303-534-4160
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
IL	Wood Dale, Allied Elctrns.	708-860-0007
IN	Indianapolis, Allied Elctrns.	317-875-0448
KY	Louisville, Allied Elctrns.	502-452-2293
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Boston, E.I.L. Instrs.	617-272-9450
MI	Grand Rapids, Allied Elctrns.	616-949-8200
NJ	Moorestown, Allied Elctrns.	609-234-7769
NY	Rochester, E.I.L. Instrs.	716-586-8251
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Dayton, E.I.L. Instrs.	513-435-2134
OK	Tulsa, Allied Elctrns.	918-664-0844
OR	Portland, Westcon Inc.	503-283-0132
PA	Pittsburgh, E.I.L. Instrs.	412-823-2255
SC	Greenville, Allied Elctrns.	803-288-8835
TX	Houston, E.I.L. Instrs.	713-271-3100
UT	Salt Lake City, Allied Elctrns.	801-261-5244
VA	McClean, E.I.L. Instrs.	703-569-2611
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Milwaukee, Allied Elctrns.	414-796-1280

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AK	Anchorage, Alaska Elctrnc. Supp.	907-563-3774
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Canoga Pk., RAG Elctrns.	818-998-6500
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Newtown, Conn Cal Labs	203-270-1263
FL	Melbourne, E.I.L. Instrs.	407-725-8300
GA	Duluth, Allied Elctrns.	404-497-9544
ID	Bridge View, E.I.L. Instrs.	708-430-2292
IL	Oak Forest, Allied Elctrns.	708-918-0250
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
IA	West Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, E.I.L. Instrs.	502-454-3420
LA	Metaire, Allied Elctrns.	504-885-1195
MD	Hunt Valley, Allied Elctrns.	410-584-7400
MA	Billerica, Allied Elctrns.	508-667-7921
MI	Livonia, Allied Elctrns.	313-462-0190
MN	Bloomington, Allied Elctrns.	612-881-0838
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Allied Elctrns.	402-697-0038
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Clarksburg, Accutest Instrs.	800-524-0747
TX	Garland, Tucker Elctrns.	800-527-4642
WA	Bellevue, Vetco	206-869-7025

HAUEG DIVISION, A Subsidiary of Ametek Inc., 900 Greenbank Rd., Wilmington, DE 19808, Tel: 302-995-0400, 800-441-7777, FAX: 302-995-0491; *Sls. Mgr.:* Bill Wenner

HAVERLY SYSTEMS, INC., 12 Hinchman Ave., Box 919, Denville, NJ 07834, Tel: 201-627-1424, FAX: 201-625-2296; Empl.: 33; *Sls. Mgr.:* Ken Spencer

HAYDON SWITCH & INSTRUMENT, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, TELEX: 643852-HSIINTLWBY, FAX: 203-756-8724; FSC No.: 02005; Empl.: 100; *Sls. Mgr.:* Wendy Rossi

HAYES INSTRUMENT SERVICE INC., 530 Boston Rd., Billercia, MA 01821, Tel: 508-663-4800, FAX: 508-663-3812; Empl.: 25; *Sls. Mgr.:* Thomas P. Fitzgerald

HBM, INC., 19 Bartlett Street, Marlboro, MA 01752, Tel: 508-624-4500, FAX: 508-485-7480; Empl.: 105; *Sls. Mgr.:* Robert Gray

HBS EQUIPMENT CORPORATION, 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, FAX: 213-888-9982; Empl.: 60; *Sls. Mgr.:* Sam Houston

HC Power, inc.

FAX: 714-261-6584

HC POWER INC., 17032 Armstrong Ave., Irvine, CA 92714-5716, Tel: 714-261-2200; FSC No.: 0D6P8; *Sls. Mgr.:* Jack Graham .... **D•1738-1741**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Phoenix, Tektris	602-437-1915
CA	Huntington Beach, Tektris	714-964-8560
CA	La Mesa, Tektris	800-875-0855
CA	San Diego, ATA Assocs.	619-792-6079
CA	Santa Clara, Electro Venture	408-727-1553
CA	Valencia, Tektris	805-295-8747
CO	Englewood, Taylor Mktg.	303-850-0207

CO	Littleton, Taylor Mktg.	303-850-0207
FL	Oldsmar, Suncoast	813-787-9221
GA	Lawrenceville, Murcota	404-513-8093
IL	Elmhurst, Utronix	708-834-1100
IN	Indianapolis, JC Hofstetter	317-897-7914
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, The Beams Co.	314-434-8448
NH	Londonderry, Power Solutions Mktg.	603-432-5476
NY	Rochester, Power Conversion & Assoc.	716-426-3598
NC	Winston-Salem, Murcota	919-722-9445
OH	Dayton, JC Hofstetter	513-296-1010
OH	Medina, JC Hofstetter	216-725-4477
OR	Portland, Power Factor Assocs.	503-233-6969
PA	Pittsburg, JC Hofstetter	412-356-2305
RI	Barrington, Power Solutions Mktg.	401-245-5045
TX	Dallas, Dynamark	214-437-3333
UT	Ogden, Taylor Mktg.	801-546-9570
VA	Sterling Park, Beacon North	703-478-2480
NY	Spring Valley, Powertronics	914-735-3775
Can	Lachine, Digidyne	514-631-1891
Can	Napean, Digidyne	613-727-5632
Can	Toronto, Digidyne	416-674-0444

HC PROTEK, 154 Veterans, Northvale, NJ 07647, Tel: 201-767-7242, FAX: 201-767-7343; *Sls. Mgr.:* Alex Orloff

HDR POWER SYSTEMS, INC., 4242 Reynolds Dr., Hilliard, OH 43026, Tel: 614-771-5500, FAX: 614-771-7219; Empl.: 90; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, TELEX: 64585, FAX: 703-620-3169; Empl.: 95

H D SYSTEMS, INC., 89 Cabot Court, Hauppauge, NY 11788, Tel: 516-231-6630, FAX: 516-231-6803; Empl.: 5; *Sls. Mgr.:* Tetsuo Ikuta

HEADWAY RESEARCH, INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, FAX: 214-272-7817; Empl.: 45

HECON CORP., 15 Meridian Road, Eatontown, NJ 07724, Tel: 908-542-9200, TELEX: 13-2457; Empl.: 75; *Sls. Mgr.:* Kenneth W. Aurin

HEDRICH USA, INC., 4201-D Stuart Andrew Blvd., Charlotte, NC 28217, Tel: 704-522-0006, FAX: 704-522-0036

HEEGER, INC., 6400 Fleet St., City of Commerce, CA 90040, Tel: 213-728-5108, 728-4729, 728-6913, FAX: 213-728-4740; Empl.: 10; *Sls. Mgr.:* Robert A. Heeger

HEI CORPORATION, P.O. Box 88806, Carol Stream, IL 60188, Tel: 708-665-5500, FAX: 708-665-5769; Empl.: 20

HEIDENHAIN CORP., 115 Commerce Dr., Schaumberg, IL 60173, Tel: 708-490-1191, FAX: 708-490-3931; Empl.: 72; *Sls. Mgr.:* Rick Korte; *Dist. Mgr.:* Rick Glos

HEI, INC., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, Tel: 612-443-2500, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 200; *Sls. Mgr.:* Dale Nordquist .... **A•1700-1702**

Local Sales Offices & Reps

MN	Victoria, HEI Inc.	612-443-2500

HEI, INC., Optoelectronics Div., 1495 Steiger Lake La.,P.O.Box 5000, Victoria, MN 55386, Tel: 612-443-2500, TWX: 510-601-7785, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 150; *Sls. Mgr.:* Dale Nordquist

HEINEMANN PRODUCTS, Eaton Corporation, P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-896-0009, FAX: 609-896-1631; FSC No.: 74193; Empl.: 350; *Sls. Mgr.:* John McNamara .... **B•1360-1363**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. No.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Englewood, CompuTech Mktg.	303-773-3981
FL	Oviedo, Conley & Assocs.	407-365-3283
FL	Wellington, Conley & Assocs., Inc.	407-790-3926
GA	Duluth, Dixie Mktg.	404-381-5592
IL	Northbrook, D. Dolin Sls.	708-498-6770
IN	Ft. Wayne, O.H. Bromberg & Assocs.	219-456-6010
IA	Hiawatha, Ard Sls. Co.	319-393-6392
KY	Alexandria, O.H. Bromberg & Assoc.	606-635-3063
KY	Louisville, O.H. Bromberg & Assocs.	502-456-1498
MD	Upperco, Imagitron Sls. Co., Inc.	301-374-5600
MA	Ashland, Sullivan Tech. Sls.	508-881-2215
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, Furber Sls. Co., Inc.	612-881-3620
MO	Kansas City, Hill & Co.	816-361-1669
MO	St. Louis, Hill & Co.	314-842-6868
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NY	Rochester, R. M. Scanlon & Assocs.	716-359-0773
NY	Syracuse, R.M. Scanlon & Assoc., Inc.	315-463-7682
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cleveland, Brown Elect. Prod.	216-331-2072
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Dayton, O. H. Bromberg & Assocs.	513-434-8788
OR	Beaverton, Westmark Elctrns., Inc.	503-641-8780
PA	Allison Park, KW Electrn. Sls.	412-366-9396
NJ	Lawrenceville, DVS Co.	609-896-1112
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415
WA	Bellevue, Westmark Elctrns., Inc.	206-454-1944
WI	Milwaukee, Key Entpr.	414-762-2323

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Chatsworth, POCO Sls.	818-700-8727
CA	Inglewood, Newark Elctrns.	301-671-7370
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Oakland, Brill Elctrns.	510-834-5888
CA	San Carlos, Campbell & George	415-594-1994
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Van Nuys, Fuses, Unltd.	818-786-8111
CO	Aurora, Jet Elctrns.	303-364-1000
CO	Denver, CSID Inc.	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CT	Hartford, L. E. Whelan Co.	203-296-5000
CT	Wallingford, Green Shaw Co.	203-265-3333
FL	Oviedo, Dixie Sls.	407-365-1515
GA	Atlanta, Georgia Control Cen.	404-767-6677
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Morton Grove, Nedco Elctrns.	708-967-0500
IL	Northbrook, Classic Comps. Supp.	708-272-9650
IN	Carmel, Breakers Unltd.	317-896-5399
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Columbia, DK Elctrns., Inc.	301-995-1950
MD	Crofton, Custom Marine Svcs.	301-721-7354
MA	Andover, Bell Inds.	508-474-8880
MA	Needham, Power Electro Supp.	617-444-6866
MA	Newton, Green Shaw Co.	617-969-8900
MA	Woburn, Apparatus Svc.	617-933-5999
MI	Oak Pk., Newark Elctrns.	313-967-1570
MI	Southfield, Michigan Lectrols Corp.	313-353-1350
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Maryland Heights, Lcomp, Inc.	314-291-6200
NJ	Lawrenceville, Riverside Comps. Supp.	609-896-1611
NY	Johnson City, Help Elctrns., Inc.	607-729-3528
NY	New Hyde Park, I/O Corp. of NY	516-355-0135
NY	Ronkonkoma, Arrow Elctrns.	516-467-1000
NY	Whitestone, Power Electro Supp. Co.	718-767-1447
NC	Charlotte, Motionex Inc.	704-377-1555
NC	Raleigh, Greene-Shaw Co.	919-954-7138
OH	Cleveland, I/O Corp. of Cleveland	216-642-7300
OH	Dayton, Duellman Elec.	513-461-8022
OH	Dayton, Stotts Friedman Co.	513-298-5555
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Valley View, Newark Elctrns.	216-447-8860
OR	Portland, Taylor Elec.	503-233-5321
PA	Allison Park, Circuit Breakers, Inc.	412-487-9090
PA	Erie, REM Elctrns.	814-453-5626
PA	Fort Washington, I/O Corp. of Phila.	215-641-1870
PA	West Chester, West Chester Elec. & Electrn.	215-696-7500
TN	Chattanooga, Techni-Tronics, Inc.	615-332-2119
TX	Dallas, Geeco Sls. Co.	214-341-2626
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elctrns.	713-782-4800
VA	Ashland, Hanover Controls & Supp. Corp.	804-550-2449
VA	Charlottesville, Va. Elctrn. Comps.	804-296-4184
WA	Seattle, H. C. Campbell Co.	206-433-1900
WI	Milwaukee, Hunt Co.	414-383-1781

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 718-565-0004, FAX: 718-565-2582; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456-1069, Tel: 805-928-3851, FAX: 805-928-2369; FSC No.: 13201; Empl.: 85

HELM INSTRUMENT CO., INC., 1387 Dussel Drive, Maumee, OH 43537, Tel: 419-893-4356, FAX: 419-893-1371; Empl.: 55; *Sls. Mgr.:* M. Wilhelm; *Dist. Mgr.:* N. Phillips

HENRICKS TECHNOLOGIES, INC., 365 College St., Forsyth, GA 31029, Tel: 912-993-1060, 800-241-0806, FAX: 912-993-1068; Empl.: 30; *Sls. Mgr.:* Paul D. Setters

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HERGA INC. HERGA ELECTRIC LIMITED, 602 Brandywine Parkway, West Chester, PA 19380, Tel: 215-430-1970, FAX: 215-430-7785; Empl.: 5

HERITAGE METAL FINISHING INC., 800 S. Market St. P.O. Box 446, Elizabethtown, PA 17022, Tel: 717-367-1561, FAX: 717-367-2474; Empl.: 43; *Sls. Mgr.:* Terry L. Rinesmith

HERMETIC SEAL CORP., 4232 Temple City Blvd., Rosemead, CA 91770, Tel: 213-283-0411, FAX: 818-443-6610; FSC No.: 04820; Empl.: 200

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, TELEX: 796125 Hermetic CKSA, FAX: 405-224-9423; FSC No.: 65623; Empl.: 200; *Sls. Mgr.:* R. Helms, Kim Baker .... **B•1737, 1954-1955**

Local Sales Offices & Reps

AZ	Phoenix, Toweard Engrg. Assocs.	602-955-3193
CA	Arcadia, V. Gott & Assocs.	818-445-9729
CA	Palo Alto, Adtek Assocs.	415-327-0300
CA	San Diego, V. Gott & Assocs.	619-489-0893
GA	Atlanta, Electro Technlg. Prods.	404-262-1522
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
NY	Oceanside, Current Inds.	516-678-3895
OR	Beaverton, Unicomp, Inc.	503-684-8221
PA	Furlong, Avenir	215-348-8290
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-890-8810
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Snohomish, Unicomp, Inc.	206-568-0511
WA	Spokane, Unicomp, Inc.	509-922-4883

Local Distributors

TX	Ft.Worth, Allied Elctrns. Inc.	817-595-3500

HERSEY MEASUREMENT CO., Flow Measurement, Inc., P.O. Box 4585, Spartanburg, SC 29305, Tel: 803-574-8960, 1-800-845-2102, FAX: 803-578-7308; Empl.: 80; *Sls. Mgr.:* Bob Hill

HERTNER DIV.:EXIDE CORP., 12690 Elmwood Ave., Cleveland, OH 44111, Tel: 216-252-4242, FAX: 216-941-4330; FSC No.: 28398; Empl.: 100; *Sls. Mgr.:* R.C. Wright

HEURISTICS INCORPORATED, 9845 Horn Rd., Ste. 100, Sacramento, CA 95827, Tel: 916-369-6606, FAX: 916-369-6175; Empl.: 70; *Sls. Mgr.:* Mike McMann, Genl. Mgr.

HEWLETT-PACKARD COMPANY, Direct Marketing Organization, P.O. Box 58059, MS 51L-SJ, Santa Clara, CA 95051-8059, Tel: 800-452-4844; Empl.: 93,100

HEXACON ELECTRIC CO., 161 W. Clay Ave., Roselle Park, NJ 07204, Tel: 908-245-6200, FAX: 908-245-6176; Empl.: 150; *Sls. Mgr.:* Robert L. Miller

HEYCO MOLDED PRODUCTS, INC., Box 160, Kenilworth, NJ 07033, Tel: 908-245-0033, 800-526-4182, FAX: 908-245-3238; FSC No.: 28520; Empl.: 135

HEYCO STAMPED PRODUCTS, See Cabletest International Inc.

HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626, FAX: 617-646-2662; Empl.: 13

HIAC/ROYCO, Pacific Scientific Co., 11801 Tech Rd., Silver Spring, MD 20904, Tel: 301-680-7000, TELEX: 197635 PACSCIUT; Empl.: 125; *Sls. Mgr.:* Lou Sarto

HIBBING ELCTRNS. CORP., OECO Corp., 3125 East 14th Ave., P.O. Box 129, Hibbing, MN 55746-0129, Tel: 218-263-8971, FAX: 218-263-8970; Empl.: 405; *Sls. Mgr.:* Michael Walsh

HICKOK ELECTRICAL INSTRUMENT COMPANY, 10514 Dupont Ave., Cleveland, OH 44108, Tel: 216-541-8060, FAX: 216-761-9879; FSC No.: 28569; Empl.: 230; *Sls. Mgr.:* Bob Fiorille

HICO HORIZONS INTL. CO., See Maxon Precision Motors

HI-G COMPANY SUB. OF NYTRONICS, See Stuthers-Dunn, Inc. and Hi-G Co., Inc., Sub. of Nytronics.

HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, FAX: 215-593-2985; FSC No.: 21052; Empl.: 50; *Sls. Mgr.:* Joseph F. Quinn

HIGHLAND TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-753-5814, FAX: 415-753-3301; Empl.: 12; *Sls. Mgr.:* David Taeler

HIGH REL GROUP, 2127 Ringwood Ave, San Jose, CA 95131, Tel: 408-321-6400, FAX: 408-321-6415; FSC No.: 4Y548; Empl.: 25; *Sls. Mgr.:* Beth Pagino

HIGH VOLTAGE SYSTEMS, INC., Universal Designs Corp., P.O. Box 649, Chappaqua, NY 10514, Tel: 914-238-8462, FAX: 914-238-8462; Empl.: 15; *Sls. Mgr.:* Vincent A. Gianguzzi

HIGH VOLTAGE TECHNOLOGY INC., 71 Alexander St., Yonkers, NY 10701, Tel: 914-423-6636, FAX: 914-968-0347; Empl.: 12

HILEVEL TECHNOLOGY, 2991 Dow Ave., Tustin, CA 92680, Tel: 714-573-1888, FAX: 714-573-1899; Empl.: 30; *Sls. Mgr.:* Dolores DeRosa

HILTON INDUSTRIES, INC., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232, Tel: 813-371-2600, FAX: 813-371-7750; Empl.: 137; *Sls. Mgr.:* Larry Copenhaver; *Dist. Mgr.:* Larry Copenhaver

HIPOTRONICS INC., Rte. 22, P.O. Box 414, Brewster, NY 10509, Tel: 914-279-8091, TELEX: 425476, TWX: 710-574-2420, FAX: 914-279-2467; FSC No.: 25284; Empl.: 230; *Sls. Mgr.:* Kenneth Johnson

HIRAM JONES ELECTRONICS, 11607 Vanowen St., No. Hollywood, CA 91605, Tel: 213-875-0213, FAX: 818-982-7339; FSC No.: 04867; Empl.: 8

THE HIROL COMPANY, 1170 W. McNab Rd., Ft. Lauderdale, FL 33309, Tel: 305-974-4900, FAX: 305-975-4734; Empl.: 45; *Sls. Mgr.:* Richard Diefenderfer .... **B•1072; C•1664, 1685**

Local Sales Offices & Reps

CA	Laguna Nigel, E.J. Stanton & Sons	714-496-4027
MA	Norton, Paul Vincent	508-285-9037
Intl	Singapore, Dynamar Computer	011-65-2813388
Intl	United Kingdom, Read Cosine Ltd.	0202-632274/5

HIROSE ELECTRIC U.S.A., INC. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 2688 Westhills Ct., Simi Valley, CA 93065, Tel: 805-522-7958, FAX: 805-522-3217; Empl.: 55

RICHARD HIRSCHMANN OF AMERICA INC., Industrial Row, P.O. Box 229, Riverdale, NJ 07457, Tel: 201-835-5002, FAX: 201-835-8354; *Sls. Mgr.:* A. Hoell, Opers. Mgr. Connectors .... **C•1347**

Local Distributors

CA	Irvine, Kensington Elctrns.	714-583-0575
CA	San Diego, Instrument Engrs.	619-673-3644
CA	San Jose, Spectra Elctrns.	408-955-7800
CO	Aurora, Jet Elctrns. Supp.	303-364-1000
CT	Bridgeport, Park Distrs.	203-366-7200
IL	Addison, Belford Elctrns.	708-691-1100
IL	Glendale Hgts., Mac Gregor & Co.	708-469-4080
IN	Carmel, Altex Elctrns., Inc.	317-848-1323
MA	Westboro, In Stock Prods.	508-870-5750
MN	Minneapolis, Elec-Trol	612-521-5051
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Moorestown, Marlac Elctrns.	609-234-4200
NJ	Union, Meridian Supply Co.	908-687-6220
NC	Fuguay-Varina, Rye Inds., Inc.	919-557-0511
TX	Richardson (exc. El Paso City), Centurion Mktg.	214-783-6762
TX	Tomball, Wofford Elctrns.	713-351-2255
Can	Montreal, Que., Hooker Elctrns.	514-487-5151

HISONIC, INC., 310 North Marion, P.O. Box 1130, Olathe, KS 66051, Tel: 913-782-0012, FAX: 913-782-0562; FSC No.: 11402; Empl.: 185; *Sls. Mgr.:* Jack O. Cooper III .... **A•2360**

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
FL	Ft. Lauderdale, MacKay, Smith & Assocs.	407-423-4353
FL	Orlando, MacKay, Smith & Assocs.	407-423-4353
FL	Palm Coast, MacKay, Smith & Assocs.	904-445-8328
FL	St. Petersburg, MacKay, Smith & Assocs.	407-423-4353
GA	Atlanta, MacKay, Smith & Assocs.	404-496-9913
KS	Shawnee Mission, Florence & Meyer	913-722-5210
MA	Boston, Rosen & Assocs.	617-449-4700
MO	St. Louis, Florence & Meyer	913-722-5210
NC	Charlotte, MacKay, Smith & Assocs.	919-847-2277
NC	Raleigh, MacKay, Smith & Assocs.	919-847-2277
TX	Austin, Aid Elctrns.	512-836-6724
TX	Irving, AID Elctrns.	214-790-4761

Local Distributors

FL		407-423-4353

HITACHI

FAX: 404-409-3028

HITACHI AMERICA, LTD., Electron Tube Division, 3850 Holcomb Bridge Rd., Ste. 300, Norcross, GA 30092, Tel: 404-409-3000; Empl.: 50; *Sls. Mgr.:* Tim Patton; *Dist. Mgr.:* Steve Bubb .... **B•1073-1076**

Local Sales Offices & Reps

AL	Huntsville, Group 2000	205-536-2000
AL	Huntsville, Technlg. Mktg. Assoc.	205-883-7893
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Agoura Hills, Quadrep Southern Inc.	818-597-0222
CA	Irvine, Quadrep	714-527-4222
CA	San Diego, Quadrep Southern Inc.	619-560-8330
CA	San Jose, Quadrep	408-432-3300
CO	Parker, Parker Webster	303-841-4888
CT	Wallingford, Technlg. Sls., Inc.	203-269-8853
FL	Deerfield Beach, Technlg. Mktg. Assoc.	305-427-1090
FL	Largo, Technlg. Mktg. Assoc.	813-531-4405
FL	Orlando, Technlg. Mktg. Assoc.	407-857-3760
FL	Winter Park, Technlg. Mktg. Assoc.	407-671-2245
GA	Norcross, Group 2000 Sls.	404-729-1889
ID	Ketchum, Crown Elctrns.	208-622-8125
IL	Chicago, Sumer Inc.	708-991-8500
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260
IN	Kokomo, M. Gottleib Assoc. Inc.	317-455-0444
IA	Cedar Rapids, Wes Tech Assocs.	319-393-9790
KS	Overland Park, Electri Rep	913-649-2168
MD	Columbia, Robert Elctrn. Sls.	410-995-1900
MA	Waltham, Technlg. Sls. Inc.	617-890-5700
MI	Flint, M. Gottleib Assoc. Inc.	313-732-3922
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Minneapolis, Tek Rep Inc.	612-832-0277
MO	St. Louis, Electri Rep	314-993-4421
NJ	Teaneck, Strategic Sls., Inc.	201-833-0099
NM	Albuquerque, System Sls. of AZ	505-889-2901
NY	Fairport, Technlg. Sls., Inc.	716-223-7500
NC	Cary, Group 2000 Sls.	919-481-1531
OH	Beachwood, Thompson & Assoc.	216-831-6277
OH	Dayton, Thompson & Assocs.	513-435-7733
OH	Orient, Thompson & Assoc.	614-877-4304
OK	Tulsa, West Assoc.	918-492-4300
OR	Portland, Crown Elctrns.	503-620-8320
PA	Warrington, Strategic Sls. Inc.	215-491-0340
PA	Willow Grove, Technlg. Sls., Inc.	215-784-0170
TX	Austin, West Assocs.	512-343-1199
TX	Houston, West Assocs.	713-621-5983
TX	Richardson, West Assoc.	214-680-2800
UT	Murray, Parker Webster	801-266-9939
WA	Bellevue, Crown Elctrns.	206-453-5100
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Kanata, Ont., Hitachi Canadian Ltd.	613-591-1990
Can	Mississuaga, Ont., Longman Sls.	416-670-8100

Local Distributors

AL	Huntsville, Marshall	205-881-9235
AL	Huntsville, Reptron	205-722-9500
AZ	Phoenix, Marshall	602-496-0290
AZ	Phoenix, Sterling	602-437-5565
CA	Agoura Hills, Western Micro	818-707-0377
CA	Calabasas, Marshall Inds.	818-878-7028
CA	Chatsworth, Sterling	818-407-8850
CA	El Monte, Marshall Inds.	808-307-6000
CA	Irvine, Marshall	714-458-5394
CA	Irvine, Marshall Ind.	714-458-5398
CA	Milpitas, Marshall	408-942-4600
CA	Milpitas, Marshall Inds.	408-942-4700
CA	Orange, Western Micro	714-637-0200
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	San Diego, Marshall	619-578-9600
CA	San Diego, Sterling	619-271-6555
CA	San Diego, Western Micro	619-453-8430
CA	San Jose, Merit Elctrns.	408-434-0800
CA	Saratoga, Western Micro	408-725-4753
CA	Tustin, Sterling	714-259-0900
CO	Englewood, Sterling	303-792-3939
CO	Thornton, Marshall	303-451-8383
CT	Milford, Milgray	203-878-5538
CT	Wallingford, Cronin	203-265-3134

CT	Wallingford, Marshall	203-265-3822
CT	Wallingford, Sterling	203-265-9539
FL	Altamonte Springs, Marshall	407-767-8585
FL	Altamonte Springs, Vantage	305-429-1001
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Reptron	305-735-1112
FL	Orlando, Milgray	407-647-5747
FL	Tampa, Reptron	813-854-2351
FL	Tampa, Reptron	813-855-4656
GA	Atlanta, Marshall	404-923-5750
GA	Atlanta, Milgray	404-446-9777
GA	Norcross, Reptron	404-446-1300
IL	Palatine, Milgray	708-202-1900
IL	Schaumburg, Marshall	708-490-0755
IL	Schaumburg, Reptron	312-882-1700
IN	Indianapolis, Marshall	317-297-0483
KS	Kansas City, Marshall	913-492-3121
KS	Lenexa, Sterling	913-492-5406
KS	Overland Park, Milgray	913-236-8800
MD	Baltimore, Resco	301-931-8200
MD	Beltsville, Resco	301-937-9100
MD	Columbia, Milgray	301-995-6169
MD	Columbia, Sterling	301-290-3800
MD	Columbia, Vantage	301-720-5100
MD	Silver Springs, Marshall	301-622-1118
MA	Andover, Vantage	508-687-3900
MA	Burlington, Western Micro	508-273-2800
MA	Needham, Cronin	617-449-5000
MA	New England, Milgray	508-657-5900
MA	Wilmington, Marshall	508-657-9064
MI	Livonia, Marshall	313-525-5850
MI	Livonia, Reptron	313-525-2700
MN	Minneapolis, Marshall	612-559-2211
MN	Minneapolis, Sterling	612-831-2666
MN	Minnetonka, Reptron	612-938-0000
MO	Bridgeton, Marshall	314-291-4650
NJ	Clifton, Vantage	201-777-4100
NJ	Edison, Sterling	908-417-1000
NJ	Fairfield, Marshall Inds.	201-882-0169
NJ	Marlton, Milgray	609-983-5010
NJ	Marlton, Western Micro	609-596-7775
NJ	Mt. Laurel, Marshall	609-234-9100
NJ	Parsippany, Milgray	201-335-1766
NM	Albuquerque, Sterling	505-884-1900
NY	Farmingdale, Milgray	516-420-9800
NY	Hauppauge, LI, Marshall	516-273-1515
NY	Johnson City, Marshall	607-798-1611
NY	Pittsford, Milgray	716-381-9700
NY	Rochester, Marshall	716-235-7620
NY	Smithtown, Vantage	516-543-2000
NC	Raleigh, Marshall	919-878-9882
NC	Raleigh, Milgray	919-790-8094
NC	Raleigh, Reptron	614-436-6675
OH	Dayton, Marshall	513-898-4480
OH	Solon, Marshall	216-248-1788
OH	Solon, Reptron	216-349-1415
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Sterling	918-663-2410
OR	Beaverton, Marshall	503-644-5050
OR	Beaverton, Western Micro	503-629-2087
PA	Pittsburgh, Marshall Inds.	412-788-0441
TX	Austin, Marshall	512-837-1991
TX	Austin, Sterling	512-836-1341
TX	Carrollton, Marshall	214-233-5200
TX	Carrollton, Sterling	214-243-1600
TX	Dallas, Milgray	214-248-1603
TX	Houston, Marshall	713-895-9200
TX	Houston, Sterling	713-627-9800
TX	Stafford, Milgray	713-240-5360
UT	Salt Lake City, Marshall	801-485-1551
UT	Salt Lake City, Milgray	801-272-4999
UT	Salt Lake City, Sterling	801-972-5444
VA	Richmond, Sterling	804-226-2190
WA	Bothel, Marshall Inds.	206-486-5747
WA	Redmond, Western Micro	206-881-6737
WI	Milwaukee, Marsh	414-475-6000
WI	Waukesha, Marshall	414-797-8400
Can	Alberta, ITT	403-273-2780
Can	Alberta, ITT	403-436-9555
Can	Brampton, Ont., Marshall Inds.	416-458-8046
Can	British Columbia, ITT	604-291-8866
Can	Manitoba, ITT	204-697-2300
Can	Ontario, ITT	416-736-1144
Can	Ontario, ITT	613-596-6980
Can	Pt. Claire, Que., Marshall Inds.	514-694-8142
Can	Quebec, ITT	514-335-7697

HITACHI AMERICA, LTD., 2000 Sierra Point Parkway, Brisbane, CA 94005, Tel: 415-589-8300, 1-800-HITACHI (Sales Offices), TELEX: 17-1581, TWX: 910-338-2103, FAX: 415-583-4207

HITACHI AMERICA, LTD., 220 White Plains Rd., Tarrytown, NY 10591, Tel: 914-631-0600, TELEX: 234553, FAX: 914-631-0672; *Sls. Mgr.:* William Porter; *Dist. Mgr.:* John McDonnell

HITACHI DENSHI AMERICA LTD., Test & Meas. Div., 371 Van Ness Way, Ste. 120, Torrance, CA 90501, Tel: 310-328-6116, FAX: 310-328-6252; Empl.: 110; *Sls. Mgr.:* Richard Westle, Natl. Sls. Mgr.

HITECH EQUIPMENT CORP., 9400 Activity Rd., San Diego, CA 92126, Tel: 619-566-1892, FAX: 619-530-1458; Empl.: 12

HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 708-746-2447, FAX: 708-746-4945; Empl.: 35; *Sls. Mgr.:* J. Gordon Johnson

HITEMP TECHNOLOGIES, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0740, FAX: 408-922-0534; Empl.: 15; *Sls. Mgr.:* Roger Meade

HITRAN

FAX: 908-782-9733

HITRAN CORPORATION, 362 Highway 31, Flemington, NJ 08822-1238, Tel: 908-782-5525; FSC No.: 27672; Empl.: 120; *Sls. Mgr.:* James Hindle .... **A•2361; D•1744, 2266-2267**

Local Sales Offices & Reps

AL	Birmingham, Robertson Sls.	205-823-4187
AZ	Scottsdale, Electro Mktg.	602-991-0110
CT	Ridgefield, Manning & Assocs., Inc.	203-438-5027
CT	W. Reading, Vesco, Inc.	203-790-0702
IL	Addison, Hedge Assocs., Inc.	312-543-0888
LA	Metairie, RAPCO Assocs., Inc.	504-887-9500
NC	Charlotte, Servicon Sls. Corp.	704-588-1035
PA	Fort Washington, Hostvedt-Pavoni, Inc.	215-643-5757
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
WV	Sissonville, Interstate Ind. Sls. Corp.	304-988-3687
Can	Mississauga, Reemio	416-821-9375

Local Distributors

RI	Providence, WALCO Elec. Co.	401-467-6500,

HMC/HUB MATERIAL COMPANY, 33 Springdale Ave., Canton, MA 02021, Tel: 617-821-1870, FAX: 617-821-4133; FSC No.: SIC CODE 5085; Empl.: 20; *Sls. Mgr.:* Howard Chase

HMW ENTERPRISES, INC., 207 N. Franklin St., Waynesboro, PA 17268, Tel: 717-765-4690, FAX: 717-765-4660; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* M. K. Ensminger

HOBART TAFA TECHNOLOGIES, Hobart Bros. Co., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 60; *Sls. Mgr.:* Robert Unger; *Dist. Mgr.:* Robert Unger

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, FAX: 413-733-6573; *Sls. Mgr.:* Edwin L. Kossoy

HOFFMAN, P.R., CO., MATERIALS PROC, 321 Cherry St., Carlisle, PA 17013, Tel: 717-243-2011, FAX: 717-243-1672; Empl.: 125; *Sls. Mgr.:* Galen Martin

HOFFMAN ENGINEERING, 900 Ehlen Dr., Anoka, MN 55303, Tel: 612-421-2240, FAX: 612-421-1556; *Dist. Mgr.:* Paul Premo

HOFFMAN ENGINEERING CORP., 20 Acosta St., Stamford, CT 06902, Tel: 203-325-8933, FAX: 203-327-4812; FSC No.: 06097; Empl.: 49; *Sls. Mgr.:* Jack DeSoye

HOKE INCORPORATED, 1 Tenakill Pk., Cresskill, NJ 07626, Tel: 201-568-9100, TELEX: 135428, FAX: 1-201-568-5913; *Sls. Mgr.:* Ray Pohlke; *Dist. Mgr.:* Ray Pohlke

HOKURIKU USA LTD., 117 Jetplex Circle, Ste. C-1, Madison, AL 35758, Tel: 205-772-9620, FAX: 205-772-3475; Empl.: 9; *Sls. Mgr.:* Kathleen Leverock

HOLADAY INDUSTRIES, INC., 14825 Martin Drive, Eden Prairie, MN 55344, Tel: 612-934-4920, FAX: 612-934-3604; Empl.: 29; *Sls. Mgr.:* David Baron

HOLD-HEET PRODUCTS CORP., 5011 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-728-4454, 312-728-4455, FAX: 312-728-2016; Empl.: 15; *Sls. Mgr.:* Dan Mundt; *Dist. Mgr.:* Dan Mundt

HOLLEX, INC., See Cabletest Products Co.

HOLLINGSEAD INTERNATIONAL, 13701 Excelsior Drive, Santa Fe Springs, CA 90670, Tel: 310-921-3438, FAX: 310-921-6313; FSC No.: 30528; Empl.: 85; *Sls. Mgr.:* Keith McKinney

HOLLIS AUTOMATION, Esterline Corporation, 15 Charron Ave., Nashua, NH 03063, Tel: 603-889-1121, FAX: 603-880-0939; FSC No.: RCA 294005; Empl.: 130; *Sls. Mgr.:* Brian Duffey; *Dist. Mgr.:* Jerry Vermette

HOLT INC., 9351 Jeronimo Rd., Irvine, CA 92718, Tel: 714-859-8800, TELEX: 182704, FAX: 714-859-9643; FSC No.: 44270; Empl.: 53; *Sls. Mgr.:* Keith Thayer

HOLT INSTRUMENT, C.P.D. Engineering, Inc., 126 Mott St., PO Box 230, Oconto, WI 54153, Tel: 414-834-2222, FAX: 414-834-5710; FSC No.: 09435; Empl.: 10; *Sls. Mgr.:* C. P. De Witt

Local Sales Offices & Reps

CA	Torrance, Cutlass Elctrns., Inc.	714-549-9358
IL	I & C Sls.	1-800-536-5555
IN	I & C Sls.	1-800-536-3333
MI	Southgate, I & C Sls.	1-800-536-5555
OH	Cincinnati, I & C Sls.	1-800-536-5555
Can	Ontario, Duncan Instrs. Canada Ltd.	416-742-4448

HOMALITE™

FAX: 302-652-4578

HOMALITE, Whitco, Inc., 11 Brookside Dr., Wilmington, DE 19804, Tel: 302-652-3686; FSC No.: 4330,4240,4710,6605; Empl.: 35; *Sls. Mgr.:* Jack Whittaker .... **B•1077**

HOME AND BUILDING CONTROL, Honeywell Inc. MN 27-3176, Honeywell Plaza, Minneapolis, MN 55408, Tel: 1-800-328-5111; Empl.: 5000

HONDA CONNECTORS, See Mhotronics, Inc.

HONEYWELL INFORMATION SYSTEMS, 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICROSWITCH DIV., 830 E. Arapaho Dr., Richardson, TX 75081, Tel: 214-470-4271, TELEX: 73-0890, FAX: 214-470-4417; Empl.: 300; *Sls. Mgr.:* Tom Mabrey; *Dist. Mgr.:* Frank Davis

HOOSIER MAGNETICS, INC., 6545 W. Central Ave. Rm.203, Toledo, OH 43617, Tel: 419-841-7173, FAX: 419-841-7359; FSC No.: 3160; Empl.: 90

HOPPECKE BATTERY SYSTEMS, INC., 10 Park Place, Bulter, NJ 07405, Tel: 201-492-0045, FAX: 201-492-2714; *Sls. Mgr.:* Ted Czauski, Dir. Mktg. & Sls.

HOPPER ELECTRONICS, 1943 West North Lane, Ste.9, Phoenix, AZ 85021-1932, Tel: 602-870-3093, FAX: 602-944-6704; Empl.: 10

HOTPACK CORP., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694, FAX: 215-637-0519; FSC No.: 66; Empl.: 100; *Sls. Mgr.:* Hugh McKenna

Hotpack is a manufacturer and is sold direct. To contact the salesman in your area call 800-523-3608 or 215-824-1700.

HOUSE OF BATTERIES

FAX: 714-375-0235

HOUSE OF BATTERIES, 16512 Burke La., Huntington Beach, CA 92647, Tel: 1-800-432-3385, 714-375-0222; Empl.: 20; *Sls. Mgr.:* Pat Hoscoe .... **D•1446**

Local Sales Offices & Reps

AZ	Phoenix, JBS	602-893-2382
CA	Cupertino, Prism Tech. Sls.	408-435-7377
CA	Irvine, Atlas Tech. Sls.	714-474-9850
CA	Martinez, Tech Sls.	415-686-2680
CA	Norwalk, Ed Rivers Assoc.	310-868-1471
CA	San Diego, Jack Murphy Co.	619-697-2150
CA	Simi Valley, W.H. Daugherty Co.	213-622-2849
IL	Schiller Park, Wm. R. Bolles Assoc.	708-678-7888
MN	Afton, Real Elctrns.	612-436-1950
NY	Newburgh, Anderson Sls.	914-565-2493
OR	Portland, Roger Minthorne Co.	503-246-4556
TX	Richardson, Krone & Assocs.	214-437-1892
WI	Mequon, Wm. R. Bolles Assoc.	414-241-3320

HOUSTON ATLAS, Envirotech Controls, Inc., 22001 Northpark Dr., Kingwood, TX 77339-3804, Tel: 713-348-1000, TELEX: 6821159 BCAC UW, FAX: 713-462-1831; Empl.: 250; *Sls. Mgr.:* Marshall Brown

HOUSTON INSTRUMENT, AMETEK, Inc., 8500 Cameron Rd., Austin, TX 78753, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDUSTRIES, INC./BREVEL MOTORS, Box 287, One North Dixie Hwy., Milford, IL 60953, Tel: 815-889-4105, FAX: 815-889-4313; Empl.: 350; *Sls. Mgr.:* Hans Wolf; *Dist. Mgr.:* Dave Hotler

HP DIRECT, Hewlett-Packard, 1320 Kifer Rd., Sunnyvale, CA 94086, Tel: 800-538-8787; Empl.: 80,000

HUALON MICROELECTRONICS CORP., Chung Shan North Road, Taipei, Taiwan, Tel: 886-2-536-2151, FAX: 886-2-531-3241

HUALON MICROELETRONICS CORPORATION, Hualon Group, #1 R & D 4th Rd., S.B.I.P., Hsin-Chu, Taiwan, Tel: 415-288-0390, FAX: 415-288-0399; Empl.: 984; *Sls. Mgr.:* Mr. Tyrone Huang; *Dist. Mgr.:* Mr. Tyrone Huang

Local Sales Offices & Reps

CA	San Francisco, The Summa Grp. Ltd.	415-288-0390

HUBBELL INDUSTRIAL CONTROLS INC., 50 Edwards St., Madison, OH 44057, Tel: 216-428-1161, ESYLNK: 980-439, FAX: 216-428-7635

HUDSON TOOL & DIE CO., 1327 U.S. Hwy 1, Ormond Beach, FL 32174, Tel: 904-672-2000, FAX: 904-676-6212; FSC No.: 02875; Empl.: 300

HUGHES AIRCRAFT CO., Interconnect Systems Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5772, FAX: 714-660-6981; FSC No.: 53669; *Sls. Mgr.:* Terry Jarnigan; *Dist. Mgr.:* Terry McCann

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999, Tel: 310-517-6000, TELEX: 67-7064, TWX: 910-347-7321, FAX: 310-517-6714; Empl.: 1000; *Sls. Mgr.:* D.B. Giguere

HUGHES AIRCRAFT CO., Industrial Products Division, 2051 Palomar Airport Rd., Carlsbad, CA 92009, Tel: 619-931-3000, FAX: 619-931-3334

HUGHES ELECTRONICS PRODUCTS CORP., 34467 Industrial Rd., Livonia, MI 48150, Tel: 313-427-8310, FAX: 313-427-2282; Empl.: 20; *Sls. Mgr.:* Richard L. Smith

HUGHES MICROELECTRONIC CIRCUITS DIVISION, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903, Tel: 714-759-2952, TWX: &, FAX: 714-759-2280

HUGHES SEMICONDUCTOR PRODUCTS CTR., M/S B1250, 500 Superior Ave., Newport Beach, CA 92663, Tel: 714-759-2665, FAX: 714-759-2913; FSC No.: 62458; Empl.: 328; *Sls. Mgr.:* Del Brand; *Dist. Mgr.:* Kathie Lake

HUGHEY & PHILLIPS, INC., 2162 Union Pl., P.O. Box 2167, Simi Valley, CA 93062, Tel: 805-581-5591, FAX: 805-581-5032; FSC No.: 94295; Empl.: 40; *Sls. Mgr.:* Peter H. Johnson; *Dist. Mgr.:* Peter H. Johnson

HUGIN INDUSTRIES INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, FAX: 415-961-6431; Empl.: 6; *Sls. Mgr.:* Peter Hugin

HUMISEAL DIV., CHASE Corporation, 26-60 BQE West, Woodside, NY 11377, Tel: 718-932-0800, FAX: 718-932-4345; FSC No.: 99109;46058; Empl.: 150; *Sls. Mgr.:* William G. Lott

Humphrey Inc.

FAX: 619-565-6873

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631; Empl.: 325 .... **B•1956-1958**

Local Sales Offices & Reps

CA	Granada Hills, L.L. Stoakes, Inc.	818-368-6752, FAX:818-831-0015
CA	Palo Alto, Harris Engrg. Assocs.	415-328-3370, FAX:415-328-4191
CA	Playa Del Rey, L.L. Stoakes, Inc.	310-822-8553, FAX:213-200-3662
CA	San Diego, L.L. Stoakes, Inc.	619-452-1600, FAX:619-452-0966
CA	San Jose, ECC Products, Inc.	408-289-8545, FAX:408-289-9123
FL	Orlando, Gra-Mar, Inc.	407-658-1971, FAX:407-658-4101
IN	Fishers, Carter, McCormic & Peirce, Inc.	317-842-9277,FAX:317-577-2741
IA	Cedar Rapids, Dy-Tronix Inc.	319-377-8275, FAX:319-377-9163
KS	Leawood, Dy-Tronix Inc.	913-339-6333, FAX:913-339-9449
KS	Wichita, Dy-Tronix Inc.	316-838-0884, FAX:316-838-2645
LA	Broussard, The Instr. Shoppe	318-837-9976
MD	Annapolis Junction, Stemler Assocs., Inc.	301-490-1078,FAX:301-490-1073
MA	Wayland, High Tech Sls., Inc.	508-653-3838, FAX:508-651-3784
MI	Farmington Hills, Carter Technlg., Inc.	313-477-7700,FAX:313-477-4149
MO	Bridgeton, Dy-Tronix Inc.	314-291-4777, FAX:314-291-3861
NY	E. Setauket, Eastern Metro Assocs., Inc.	516-928-2726,FAX:516-928-3807
OH	Englewood, Carter, McCormic & Peirce, Inc.	513-836-0951,FAX:513-836-2358
OH	Parma, Carter, McCormic & Peirce, Inc.	216-398-0400,FAX:216-398-0766
PA	Pittsburgh, Carter Technlg., Inc.	412-826-3800, FAX:412-826-5009
TX	Dallas, W.N. Rider Co.	214-357-2246, FAX:214-357-2246
TX	El PAso, Nokomis of El Paso, Inc.	915-778-2801

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, Tel: 219-356-0778, FAX: 219-356-7891; *Sls. Mgr.:* Michael Khorshid .... **A•1936-1938**

Local Sales Offices & Reps

IN	Huntington, HEI	219-356-0756
MA	Burlington, Tri-Com Assocs., Inc.	617-272-8163
MN	Roseville, Pro Tec Power Sls., Inc.	612-483-0409
MO	St. Louis, Rep-Tronics	314-576-9816
PA	Greensberg, Pro-Mark	412-832-3800

Local Distributors

CA	Fountain Valley, Comp. Center	714-979-0433
CA	Los Angeles, Cal State Elctrns.	213-933-8187
CA	Monrovia, Daring	818-357-0021
FL	Ft. Lauderdale, NRC Elctrns., Inc.	305-772-4500
MO	St. Louis, Franklin Elctrns.	314-933-5333

HUNTSVILLE MICROSYSTEMS, INC., 3322 South Memorial Pkwy., Huntsville, AL 35801, Tel: 205-881-6005, TWX: 510-600-8258, FAX: 205-882-6701; Empl.: 50; *Sls. Mgr.:* Jim Bell

HURRICANE ELECTRONICS LAB, P.O. Box 1280, Hurricane, UT 84737, Tel: 801-635-2003, FAX: 801-635-2495; FSC No.: 64109; Empl.: 35; *Sls. Mgr.:* C. R. Reeve

Local Distributors

TX	Fort Worth, Tandy Elctrns. Natl. Parts Div.	817-870-5600

hurst

FAX: 812-386-7504

HURST MANUFACTURING DIV., Box 326, Princeton, IN 47670, Tel: 812-385-2564; Empl.: 200; *Sls. Mgr.:* Don Morrow .... **B•1266-1270**

Local Sales Offices & Reps

AZ	Phoenix, Sierra Ind. Eng.	602-272-0084
CA	Fremont, Coherent Automation	510-657-2100
CA	Los Angeles, Sierra Ind'l. Engrg. Co.	213-624-3123
IL	Chicago, Golten Assocs.	708-512-0093
IN	Indianapolis, Emerson Motor Div.	317-842-1342
MD	Glen Arm, Hodgins Assoc.	301-592-7047
MA	Lexington, Hathaway Elctrns.	617-861-7010
MI	Grand Rapids, Emerson Motor Div.	616-942-9500
MN	Wayzata, Cardinal Sls. Co.	612-475-0042
NJ	Sussex, Carbone Assocs.	201-875-1882
NM	Phoenix, Sierra Ind. Eng.	602-272-0084
NY	Youngstown, D & O Engrg.	716-754-2091
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
OH	Centerville, Omega Sls. Inc.	513-434-5507
OK	Edmond, Emerson Motor Div.	405-340-8228
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
TX	Arlington, Emerson Motor Div.	213-380-2670
WA	Seattle, Northmar	206-524-5170
WI	Milwaukee, Badgerep Inc.	414-241-9200
EXP	NY, Freeport, Churchin Assc. Ltd.	516-864-8589

Local Distributors

AZ	Phoenix, Minarik Elec.	602-233-3000
CA	Glendale, Minarik Elec.	818-507-6500
CA	Santa Clara, Minarik Elec.	408-727-0575
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Commerce City, Minarik Elec.	303-289-5800
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Orlando, EMSCO	407-849-6362
GA	Norcross, EMSCO	404-925-8366
IL	Schaumburg, Minarik Elec.	708-885-9337
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Somerville, Electro Sls.	617-666-0500
MN	Mendota Hgts.	612-452-6467
NJ	Fanwood, MacPherson Controls	201-757-5110
NY	Long Island City, B & B Motor & Control	718-784-1313
NC	Greensboro, EMSCO	919-275-8776
OH	Solon, Repco Elctrns.	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-8123
OR	Portland, Minarik Elec.	503-253-3402
PA	Philadelphia, H & R Corp.	215-426-1700
SC	Greenville, EMSCO	803-233-4121
TX	Dallas, Mechanical Southwest	214-634-0921
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Irving, Minarik Elec.	214-402-8188
WA	Redmond, Minarik Elec.	206-885-0832
Can	Burlington, Ont., White Radio Ltd.	416-632-6894

HUTRONIX, INC., 101 W 11th Street, Douglas, AZ 85607, Tel: 602-364-2432, FAX: 602-364-6174; FSC No.: 70206; Empl.: 50; *Sls. Mgr.:* John Huls

HV COMPONENT ASSOCIATES INC., P O Box 2484, Farmingdale, NJ 07727, Tel: 908-938-4499, FAX: 908-938-4451; Empl.: 20; *Sls. Mgr.:* Dennis R. Dean

HYBRICON CORPORATION, 12 Willow Road, Ayer, MA 01432, Tel: 508-772-5422, TWX: 710-347-0654, FAX: 508-772-2963; Empl.: 74; *Sls. Mgr.:* Jim Gallagher

HYBRID DESIGNS, INC., 666 W. Baker, Costa Mesa, CA 92626, Tel: 714-557-9933, FAX: 714-557-0322; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Bob Soberman

HYBRID ELECTRONICS CORP., 6 DeAngelo Dr., Bedford, MA 01730, Tel: 617-275-5350, FAX: 617-275-3470,617-275-0218; Empl.: 12; *Sls. Mgr.:* John Pantazis

HYBRIDS INTERNATIONAL, Frequency Products Div., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 20; *Sls. Mgr.:* Abdul Ghafoor

HYBRIDS INTERNATIONAL, LTD.

THICK FILM DIV.

FAX: 913-764-6409

HYBRIDS INTERNATIONAL LTD., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-6400; Empl.: 45; *Sls. Mgr.:* Bob Goodwin .... **A•1406-1407, 1699**

HYBRIDYNE, INC., 2155 N. Forbes Blvd., Tucson, AZ 85745, Tel: 602-629-0001, FAX: 602-791-3899; Empl.: 65; *Sls. Mgr.:* Tom Fern

HY-CAL ENGINEERING, Unit of General Signal, 9650 Telstar Ave., El Monte, CA 91731, Tel: 818-444-4000, FAX: 818-444-1314; FSC No.: 12199; Empl.: 98; *Sls. Mgr.:* Douglas W. Rasmussen

HYCOMP, INC., 165 Cedar Hill St, Marlborough, MA 01752, Tel: 508-485-6300, FAX: 508-481-1547; FSC No.: 34707; Empl.: 43; *Sls. Mgr.:* David Petros

HYDRO-GEN PRODUCTS INC., P.O. Box 1517, Fort Collins, CO 80522-1517, Tel: 800-779-0126, FAX: 303-498-0528; Empl.: 25; *Sls. Mgr.:* Derek Bobo; *Dist. Mgr.:* Derek Bobo

HYLETRONICS:LITTON INDUSTRIES, 10 Maguire Rd., Lexington, MA 02173-3199, Tel: 617-276-3298, FAX: 617-276-2127; FSC No.: ODZK6; Empl.: 48; *Sls. Mgr.:* Rodney Hsing

HY MEG CORP., 854 Westgate, Addison, IL 60101, Tel: 708-543-9250, FAX: 708-543-9260; Empl.: 24; *Sls. Mgr.:* Vincent Cupidro

HYPATIA INC., 15270 SW Holly Hill Rd., Hillsboro, OR 97123-9074, Tel: 503-628-2936, FAX: 503-628-2936; *Sls. Mgr.:* Bruce Campbell

HYPERION INDUSTRIES CORP., 134 Coolidge Ave., Watertown, MA 02172, Tel: 617-926-0140, FAX: 617-926-3707; FSC No.: 09448; Empl.: 130; *Sls. Mgr.:* Aldo Bussi

HYPERLOGIC CORPORATION, 1855 E. Valley Pkwy., Ste.210, Escondido, CA 92027, Tel: 619-746-2765, FAX: 619-746-4089

HYPERTRONICS CORP., 16 Brent Dr., Hudson, MA 01749, Tel: 508-568-0451, 800-225-9228, FAX: 508-568-0680; FSC No.: 50541; Empl.: 145; *Sls. Mgr.:* E. Dalrymple .... **C•1348-1352**

Local Sales Offices & Reps

AL	Huntsville, Elec. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, TC Elctrns. Sls., Inc.	602-994-5153
CA	Newbury Park, Interconn	805-499-4024
CA	Pleasanton, Leddy Assocs.	510-417-1033
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Bethany, Reps. Corp.	203-393-0024
DC	Washington, Tyler Griffin Co.	215-647-1550
FL	Melbourne, Synergistic Technlgs.	407-242-9661
GA	Atlanta, Elec. Mktg. Assoc.	404-448-1215
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Indianapolis, CC Elctrns.	317-921-5000
MD	Baltimore, Tyler Griffin Co.	301-995-1215
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Wellesley, Reps. Corp.	617-237-6476
MA	Wellesley, The Reps	617-237-6476
MN	Bloomington, Mumco, Inc.	612-854-4161
NJ	Wayne, G.T. Assocs.	201-694-6040
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Raleigh, Elec. Mktg. Assoc.	919-847-8800
SC	Greenville, Elec. Mktg. Assoc.	803-233-4637
TX	Irving, Trice Mktg.	214-255-1877
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Bellevue, A.I.E. Inc.	206-455-4697

HY-Q INTERNATIONAL (USA) INC., 1438 Cox Rd., Erlanger, KY 41018, Tel: 606-283-5000, FAX: 606-283-0883; FSC No.: 1CU70; Empl.: 35; *Sls. Mgr.:* Pam Deshler .... **A•1408**

HYTEK MICROSYSTEMS, INC., 400 Hot Springs Rd., Carson City, NV 89706, Tel: 702-883-0820, FAX: 702-883-0827; FSC No.: 0ANM4; Empl.: 40; *Sls. Mgr.:* Jon Presnell

HYTRONICS CORPORATION, 15401 Roosevelt Blv., Clearwater, FL 34620, Tel: 813-536-7861; Empl.: 50; *Sls. Mgr.:* Jack Colgan

HYUNDAI ELECTRONICS AMERICA, Semiconductor Division, 166 Baypointe Parkway, San Jose, CA 95134, Tel: 408-473-9200, TELEX: 278841 HEA UR, FAX: 408-943-9567

HYUNDAI ELECTRONICS INDUSTRIES CO. LTD., San 136-1, Ami-ri, Bubal-eub, 1 Chon-Kun, Kyoungki-do, Korea, Tel: (0336)30-4114,(02)741-0661, FAX: (0336)30-2077/8,(02)744-3526

IBI SYSTEMS INC., 6842 NW 20 Ave., Ft. Lauderdale, FL 33309, Tel: 305-978-9225, FAX: 305-978-9226; Empl.: 7

IBM®

IBM UNITED STATES/US OEM MARKETING, 1133 Westchester Ave., White Plains, NY 10604, Tel: 1-800-969-8643 .... **D•1117-1141**

ICI INC., 1901 Petra La., Placentia, CA 92670, Tel: 714-579-7575, FAX: 714-579-3127; Empl.: 8

IC MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

ICO-RALLY CORPORATION, 2575 E. Bayshore Rd., Palo Alto, CA 94303, Tel: 415-856-9900, FAX: 415-856-8378; FSC No.: 51705; Empl.: 45; *Dist. Mgr.:* B. Enad/A. Bourassa

ICS ELECTRONICS CORP., 744 S. Hillview Dr., Milpitas, CA 95035-5545, Tel: 408-263-5500, 1-800-952-4499, FAX: 408-263-5896; FSC No.: 58558; Empl.: 15; *Sls. Mgr.:* Bill Wallace; *Dist. Mgr.:* Jerry Mercola

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, Scientific Dvcs.-Mtn.	602-839-6626
CA	Los Alamitos, Tritek Solutions	714-236-1190
CA	San Diego, Tritek Solutions	619-455-1911
CA	San Jose, Tritek Solutions	408-554-0455
CO	Denver, Scientific Dvcs.-Mtn	303-665-8089
CT	Mt. Carmel, Scientific Dvcs.-New Eng.	203-248-9361
FL	Ft. Lauderdale, Saber Assocs.	305-792-7280
FL	Melbourne, Saber Assocs.	407-724-0920
FL	Orlando, Saber Assocs.	407-724-0920
FL	Tampa, Saber Assocs.	407-724-0920
GA	Atlanta, Saber Assocs.	800-327-0853
IL	Chicagc, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
IA	Cedar Rapids, KJS Mktg.	816-578-4751
MD	Burtonsville, Eastern Instrmn. Corp.	301-384-8500
MA	Waltham, Scientific Dvcs.-New Eng.	617-890-2252
MI	Detroit, TMS Inc.	313-462-2100
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, KJS Mktg.	314-770-1412
NJ	Teaneck, Scientific Dvcs.-East	201-440-3430
NM	Albuquerque, Scientific Dvcs.-Mtn	505-883-3668
NY	Liverpool, Northern Tech. Sls.	315-451-1091
NC	Raleigh, Saber Assocs.	800-327-0853
OH	Cleveland, TMS Inc.	216-327-3527
OH	Dayton, TMS Inc.	513-429-1142
PA	Horsham, Scientific Dvcs.-East	215-956-0700
PA	Pittsburg, TMS Inc.	412-221-2338
WA	Bellevue, The Western Rep	206-746-1127
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

Can	Montreal, Que., Multitest Elctrns.	514-337-0723
Can	Ottowa, Ont., Multitest Elctrns.	613-727-0848
Can	Toronto, Ont., Multitest Elctrns.	416-609-8396
Can	Vancouver, B.C., Jerome & Francis	604-986-1286

IC SENSORS, INC., 1701 McCarthy Blvd., Milpitas, CA 95035, Tel: 800-767-1888, FAX: 408-432-7322; Empl.: 160; *Sls. Mgr.:* Richard A. Auxer

idea

FAX: 310-690-1352

IDEA, INC., 1300 Pioneer St., Ste. B, Brea, CA 92621, Tel: 310-697-4332; *Dist. Mgr.:* Desiree A. Owsian .... **B•1164-1165**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
CO	Longmont, Butler Tech. Sls.	303-651-7703
GA	Marietta, E-Squared Mktg.	404-565-2088
IA	Cedar Rapids, Tech. Elect., Inc.	319-366-5443
KS	Andover, QDC South	316-733-9756
KS	Overland Park, QDC Inds.	913-341-2214
MN	Eagan, QDC North	612-454-0893
MO	Ballwin, QDC East	314-458-1896
NH	Nashua, Bennetron	603-880-7008
OH	Columbus, The Bill Romine Co.	614-436-0565
TX	Carrollton, All Tech. Sls. & Mktg.	214-418-0850

Local Distributors

AL	Huntsville, CRI	205-722-0038
CA	Buena Park, Ford Elctrns., Inc.	714-521-8080
CA	San Jose, Rose Elctrn. Distrbg.	408-943-0200
CO	Denver, QPS Elctrns., Inc.	303-373-2766
FL	Delray Beach, Fastbolt Florida Corp.	407-272-3100
IL	Chicago, Leeds Electro Comps.	312-625-3800
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
MN	Plymouth, Leeds Electro Comp.	612-557-1277
NH	Atkinson, Astrum Elec., Inc.	603-898-3399
NY	Farmingdale, Bulbtronics	516-249-2272
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
TX	Austin, Applied Prods.	512-832-9804
WI	Brookfield, Leeds Electro Comp.	414-789-6995
Can	Calgary, Alb., Memco Corp.	403-258-3399
Can	Markham, Ont., Carsten Elctrns.	416-477-9898
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	Surrey, B.C., Memco Corp.	604-590-1553

IDEAL INDUSTRIES, INC., Becker Place, Sycamore, IL 60178, Tel: 815-895-5181, TWX: 910-639-0613; Empl.: 700; *Sls. Mgr.:* Bob Bukowsky

IDEAL PRECISION METER, 214 Franklin St., Brooklyn, NY 11222, Tel: 212-383-6904, TWX: 710-584-2160; FSC No.: 11707;10304-41; Empl.: 150; *Sls. Mgr.:* T. Bell

IDEAL SEMICONDUCTOR, 46721 Fremont Blvd., Fremont, CA 94538, Tel: 510-226-7000, FAX: 510-226-1564

IDEAL TAPE CO., American Biltrite Inc., 1400 Middlesex St., Lowell, MA 01851, Tel: 508-458-6833, FAX: 508-458-0302

idec

FAX: 408-744-9055

IDEC CORPORATION, 1213 Elko Drive, Sunnyvale, CA 94089-2211, Tel: 408-747-0550, TELEX: 34-0601, TWX: 910-339-9383; FSC No.: 60886; Empl.: 90; *Sls. Mgr.:* Wallace Baldwin, Genl. Sls. Mgr. .... **B•1522-1523, 1738-1740**

Local Sales Offices & Reps

AL	Birmingham, Bryco Co.	205-672-9760
AZ	Phoenix, Western Automation	602-265-2788
CA	Laguna Hills, Western Automation	714-859-6988
CA	Sunnyvale, Idec Corp.	408-747-0550
CO	Lakewood, T.M.M.I.	303-232-1516
IL	South Barrington, Bu-Nell Engrg.	312-551-9000
IN	Indianapolis, Ronald Ray & Assoc.	317-841-9144
KS	Overland Park, TMW	913-383-1818
MA	Norwood, Hyland Assocs.	617-762-0345
MI	Detroit, IDEC Corp.	313-795-0291
MI	Farmington, Nova Elctrl. Assocs., Inc.	313-553-0100
MN	Minnetonka, S. J. Collins & Assocs.	612-933-7661
MO	St. Louis, TMW Co.	314-664-4005
NM	Albuquerque, T.M.M.I.	505-298-6893
NY	Patchogue, Optimum Sls. Co.	516-758-0644
NY	Syracuse, Lachut Elctrl. Sls. Inc.	315-458-6480
NC	Kernersville, Heritage Sls. Assocs.	919-996-4374
OH	Cleveland, Matthew Haley Co.	216-892-1820
OH	Perrysburg, Matthew Haley Co.	419-874-0488
OK	Tulsa, Don Plummer Sls. Co.	918-835-0979
PA	Cuddy, Brown-Yates Elec.Equip. Co.	412-221-4200
PA	Philadelphia, Fite-Walker, Inc.	215-233-2100
SC	Taylors, Heritage Sls. Assocs.	803-292-1723
TN	Knoxville, Tubbs Agy.	615-577-0689
TN	Memphis, Winstead Tech. Svcs.	901-372-4550
TX	Dallas, SW Mktg. Assocs.	214-341-8631
TX	Houston, SW Mktg. Assocs.	713-537-8166
UT	Salt Lake City, T.M.M.I.	801-487-7676
VA	Northboro, IDEC Corp.	508-393-2474
VA	Richmond, Dunnington & Assocs.	804-282-8383
WI	Appleton, Bu-Nell Engrg.	414-733-4242
WI	Waukesha, Bu-Nell Engrg.	414-784-0994

IDENTATRONICS, INC., 425 Lively Blvd., Elk Grove Village, IL 60007-2082, Tel: 708-437-2654, 1-800-323-5403, TELEX: 754319 CARD UD, FAX: 708-437-2660; Empl.: 50; *Sls. Mgr.:* Mike Sloe

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
idec CORPORATION
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

IDM (INTERNATIONAL DESIGN MODELING), 43 Smith Rd., Bedford, NH 03110, Tel: 603-472-7068, FAX: 603-472-7043

IEC ELECTRONICS CORP., 105 Norton St., Newark, NY 14513, Tel: 315-331-7742, FAX: 315-331-3547; Empl.: 900; *Sls. Mgr.:* Stephen Hotchkiss; *Dist. Mgr.:* Stephen Hotchkiss

IEE (INDUSTRIAL ELECTRONIC ENGINEER, INC.), 7740 Lemona Ave., Van Nuys, CA 91409, Tel: 818-787-0311, FAX: 818-787-3953; Empl.: 300; *Sls. Mgr.:* R. Nisar .... **B•1078-1079, 1835**

Local Sales Offices & Reps

AL	Huntsville, TMA Technlg. Mktg. Assocs.	205-883-7893,FAX:205-882-6162
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971, FAX:602-263-8914
CA	Campbell, LCO Tech. Sls.	408-378-9900, FAX:408-370-0447
CA	Carlsbad, Zerimar Sls; Inc.	619-436-3379
CA	Woodland Hills, Varigon, Inc.	818-594-5080
CO	Golden, Cristee-Meade Co.	303-279-5070, FAX:303-232-0323
CT	North Haven, Kitchen & Kutchin, Inc.	203-239-0212,FAX:203-234-9108
FL	Deerfield, TMA Tech. Mktg. Assocs.	305-427-1090, FAX:305-427-1626
FL	Largo, TMA Technlg. Mktg. Assocs.	813-531-4405, FAX:813-545-8617
FL	Winter Park, TMA Tech. Mktg. Assocs.	407-671-2245,FAX:407-857-6412
GA	Norcross, TMA Tech. Mktg. Assocs.	404-446-3565, FAX:404-446-0569
IL	Highland Park, Bransky Sis.	708-433-2375, FAX:708-433-2377
IN	Indianapolis, Wilson Tech. Sls.	317-872-2513, FAX:317-872-0664
KS	Lenexa, Midtec	913-541-0505,FAX:913-541-1729
MA	Burlington, Kitchen & Kutchin, Inc.	617-229-2660, FAX:617-273-5895
MI	Southfield, L. H. Dickelman Co.	313-353-8210, FAX:313-353-1433
MN	Burnsville, 2M Sales, Inc.	612-890-7774, FAX:612-894-9342
MO	St. Louis, Midtec	314-275-8666,FAX:314-275-8859
NY	Buffalo, Advanced Comps., Inc.	716-832-6791
NY	E. Syracuse, Advanced Comps. Corp., Inc.	315-437-6700,FAX:315-699-4611
NY	Endicott, Advanced Comps. Comp. Inc.	607-785-3191
NY	Manhasset, Win-Cor elctrn. Sls.	516-627-9474
OH	Richfield, Geotronix, Inc.	216-659-6100, FAX:216-659-3435
OH	Trotwood, Geotronix, Inc.	513-854-5939, FAX:513-837-0537
OR	Beaverton, Olson Tech. Sls. Corp.	503-643-9488, FAX:503-626-1985
PA	Allison Pk., Geotronix, Inc.	412-487-1770, FAX:412-487-1331
PA	Norristown, RJI	215-631-1414,FAX:215-631-1640
TX	Dallas, M-Rep, Inc.	214-484-5711
VA	Springfield, Pantech	703-451-5700, FAX:703-451-5949
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792, FAX:206-883-9478
WI	Cedarburg, Bransky Sls.	414-377-6837, FAX:414-377-6837

Local Distributors

AZ	Phoenix, Tri-Tek, Inc.	602-371-0860, FAX:602-371-0874
CA	Garden Grove, Richey/Impact Elctrns.	714-895-0060,FAX:714-891-3563
CA	Gardena, California Switch & Signal Co.	213-538-9830,FAX:213-327-2741
CO	Denver, Integrated Elctrns. (IEC)	303-292-6121, FAX:303-297-2053
FL	Miami, Electronic Equip. Co., Inc.	305-526-6000, FAX:305-871-3736
IL	Bensenville, Voyager Elctrns. Corp.	708-860-1300, FAX:708-860-1573
IL	Chicago, Newark Elctrns.	312-784-5100, FAX:312-784-5100
MA	Needham, Cronin Elctrns. Inc.	617-449-5000, FAX:617-444-8395
MI	Southfield, Michigan Lectrols Corp.	313-353-1350, FAX:313-353-1433
MN	Minneapolis, Stark Elctrns.	612-332-1325, FAX:612-332-1783
NM	Albuquerque, Betatron Elctrns.	505-821-1122, FAX:505-828-0450
NY	Mamaroneck, Logicomp Elctrncs.	914-698-9332, FAX:914-698-9456
NY	Rochester, Masline Elctrns.	716-546-5373, FAX:716-546-2004
NC	Raleigh, So. Eastern Elctrns.	919-828-2311, FAX:919-828-2311
OH	Dayton, The Stotts-Friedman Co.	513-298-5555, FAX:513-298-3046
OH	Richfield, Alpha Distr. Corp.	216-659-7100, FAX:216-659-3459
SC	Taylors, Cantrell Whlsls.	803-268-1194, FAX:803-244-9080
TX	Richardson, The Altair Co.	214-231-4665, FAX:214-699-3207
TX	Stafford, Southwest Elctrns.	713-240-4000, FAX:713-240-5672

IEH CORP., 140 West 58th St.-8E, Bay Ridge, NY 11220, Tel: 718-492-4440, FAX: 718-492-9897; FSC No.: 97913; Empl.: 100; *Sls. Mgr.:* Terry Hart; *Dist. Mgr.:* Jenny Heredia

IEM-FUSION INC., 30275 Bainbridge Rd., Cleveland, OH 44139, Tel: 216-349-1960, FAX: 216-349-2206; Empl.: 4; *Sls. Mgr.:* Larry Shindell

IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 213-849-2481, TWX: 910-498-2206, ESYLNK: 62951515, FAX: 818-848-8872; FSC No.: 98978; Empl.: 97; *Sls. Mgr.:* George S. Ollen .... **C•1592**

Local Sales Offices & Reps

AL	Huntsville, Mtn. Electro Mktg.	205-881-3937
AZ	Scottsdale, Faser Tech. Sls.	602-948-4404
CA	Chatsworth, Wes-K/Raltech	818-700-0933
CA	La Jolla, Coastal Elctrn. Sls.	619-459-4148
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Boulder, R.F. Mayo Assocs.	303-422-2155
CT	Danbury, Hathaway Elctrns.	203-790-6993
FL	Maitland, Hawkins-Frederickson	407-831-2474
GA	Norcross, Mtn. Electro Mktg.	404-448-5594
IL	Park Ridge, Synmark Sls. Inc.	708-390-9696
IN	Indianapolis, Elctrn. Rep., Inc.	317-894-1414
KS	Wichita, Thunderbird Tech. Sls.	316-636-5777
KY	East, Catalyst Sls. Co.	800-873-0170
KY	Lexington, Elctrn. Reps., Inc.	606-277-0436
MD	Silver Springs, Mid-Atlantic Sls. Co.	301-593-7749
MA	Lexington, Hathaway Elctrns., Inc.	617-861-7010
MI	Canton, Techrep, Inc.	313-981-1950
MN	Minneapolis, Elec. Comp. Sls., Inc.	612-933-2594
MO	Maryland Heights, Thunderbird Tech. Sls.	314-298-8940
NJ	E. Brunswick, Shepard & Assocs.	908-254-5757
NJ	Marlton, BGR Assocs.	609-983-1020
NM	Albuquerque, C.T. Carlberg & Assoc.	505-899-2155
NY	E. Syracuse, Advanced Comps. Corp.	315-437-6700
NC	Raleigh, Mtn. Electro Mktg.	919-839-8662
OH	Hamilton, Catalyst Sls. Corp.	800-873-0170
OR	Portland, Temper Tech. Mktg.	503-292-8201
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434
TX	Houston, R.J. Powers & Assocs., Inc.	713-784-5860
VA	Charlottesville, Mid-Atlantic Sls. Co.	804-973-8099
Can	Mississauga, R-Theta Mfg.	416-890-0221

Local Distributors

AZ	Scottsdale, Spirit Elctrns.	602-998-1533
CA	Burbank, IERC	818-842-7277
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Sunnyvale, PSC	408-737-1333
CO	Littleton, Indelco	303-795-3431
FL	Clearwater, Lynch Gentry Assocs.	813-433-2697
FL	Coral Springs, HAI Elctrns.	305-752-7551
FL	Sunrise, QAR/All American	305-572-7999
GA	Atlanta, Motion Elctrns., Inc.	404-455-8262
IL	Addison, Belford Elctrns.	708-691-1100
IN	Carmel, Altex Elctrn., Inc.	317-848-1323
MD	Gaithersburg, M.S. Elctrns.	301-921-0200
MD	Rockville, QAR/All American	301-251-1205
MA	Billerica, A.W. Mayer Elctrns.	617-229-2255
MI	Wyoming, North Coast Comps., Inc.	616-452-0800
MN	Eden Prairie, QAR/All American	612-944-2151
NM	Albuquerque, Walker Elctrns. Supp.	505-883-2992
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Bohemia, March Elctrns.	516-563-6000
NY	Mt. Vernon, QAR/All American	914-699-2240
NC	Raleigh, Resco-Raleigh	919-781-5700
OH	Cleveland, Advacom, Inc.	216-688-5311
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
OR	Portland, United Radio Supp.	503-233-5341
PA	Bristol, Aim Elctrns.	215-946-3900
RI	Pawtucket, Major Edwards Elctrns.	401-725-7400
TX	Ft. Worth, Carlton-Bates	817-293-5558
TX	Houston, Lenert Co.	713-225-1465
TX	Mansfield, Mouser Elctrns.	817-483-0165

iET

FAX: 516-334-5988

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959, 800-899-8438; FSC No.: 62015; *Sls. Mgr.:* Sam Sheena .... **D•1214, 1266-1273**

IFR SYS. INC., 10200 W. York St., Wichita, KS 67215, Tel: 316-522-4981, TWX: 910-741-6952, FAX: 316-522-1360; Empl.: 550; *Sls. Mgr.:* T. Dideum

IICON CORPORATION, 16040 Caputo Drive, Morgan Hill, CA 95037, Tel: 408-779-7466, FAX: 408-779-7350; Empl.: 14; *Sls. Mgr.:* Ron De Jong

DDC

ILC DATA DEVICE CORPORATION®

FAX: 516-567-7358

ILC DATA DEVICE CORP., 105 Wilbur Pl., Bohemia, NY 11716-2482, Tel: 516-567-5600; FSC No.: 19645; Empl.: 700; *Sls. Mgr.:* Marshall Lacoff .... **D•1190-1191**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tuscon, Fred Board Assocs.	602-994-9388
CA	Fallbrook, Gary Chilcote & Assocs.	619-728-7678
CA	Garden Grove, ILC Data Dvcs. Corp.	714-895-9777
CA	Woodland Hills, ILC Data Dvcs. Corp.	818-992-1772
CO	Englewood, Quorum 3 Sls. Grp.	303-799-8100
CT	Canton Center, Dynamic Sls. of New Eng.	203-693-6567
FL	Boca Raton, Perrott Assocs.	407-362-0191
FL	Cassleberry, Perrott Assocs.	407-830-0094
FL	Melbourne, Perrott Assocs.	407-676-0305
FL	Palm Harbor, Perrott Assocs.	813-789-9393
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Itasca, Janus, Inc.	708-250-9650
IN	Carmel, Giesting & Assocs.	317-844-5222
KS	Lenexa, Dytec/South	913-888-0215
KS	Wichita, Dytec South, Inc.	316-263-7090
MD	Baltimore, Bagoul/Grimm Assocs.	410-719-0770
MA	Burlington, Dynamic Sls. of New Eng.	617-272-5676
MI	Comstock Pk., Giesting & Assocs.	616-784-9437
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	Eden Prairie, Comprehensive Tech.	612-941-7181
MO	Maryland Hgts., Dytec/South	314-739-0665
NJ	Marlton, BGR Assocs.	609-983-1879
NJ	Totowa, ILC Data Dvcs. Corp.	201-785-1734
NM	Albuquerque, Nelco Electronix	505-292-1399
NY	E. Rochester, Tri Tech Elctrns., Inc.	716-385-6500
NY	Fayetteville, Tri-Tech Elctrns, Inc.	315-446-2881
NY	Fishkill, Tri Tech Elctrns., Inc.	914-897-5611
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
NC	Raleigh, Montgomery Mktg; Inc.	919-851-0010
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Dayton, Lionel Fedotin	513-275-9345
OH	Euclid, Giesting & Assocs.	216-261-9705
OR	Portland, Venture Elctrns.	503-624-0617
PA	Pittsburgh, Giesting & Assocs.	412-828-3553
TX	Austin, Bonser-Philhower Sls.	512-346-9186
TX	Houston, Bonser-Philhower Sls.	713-782-4144
TX	Richardson, Bonser-Philhower Sls.	214-234-8438
VT	Graniteville, Dynamic Sls. of New Eng.	802-476-4223
VA	Sterling, ILC Data Dvcs. Corp.	703-450-7900
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Waukesha, Janus, Inc.	414-542-7575
Can	Ontario, Cantec Rep., Inc.	416-791-5922
Can	Ontario, Cantec Rep., Inc.	613-725-3704
Can	Quebec, Cantec Rep., Inc.	514-623-5496

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, FAX: 408-744-0829; Empl.: 375; *Sls. Mgr.:* Lynn Reiter; *Dist. Mgr.:* John Reilly

IC ILLINOIS CAPACITOR, INC.

FAX: 708-673-2850

ILLINOIS CAPACITOR, INC., 3757 W. Touhy Ave., Lincolnwood, IL 60645, Tel: 708-675-1760; Empl.: 35; *Sls. Mgr.:* George Wundsan .... **A•1082-1083**

Local Sales Offices & Reps

AZ	Scottsdale, Lindberg Co.	602-998-2944
AR	Little Rock, Doby Assocs., Inc.	501-221-0326
CA	Anaheim, WestRep	714-527-2822
CA	San Diego, Westrep	619-674-1880
CO	Denver, Lindberg Co.	303-758-9033
GA	Roswell, JWL Assocs.	404-518-8500

IL	Lincolnwood, Illinois Capacitor, Inc.	708-675-1760
IN	Carmel, Valentine & Assocs.	317-846-0008
IA	Marion, AEM, Inc.	319-377-1129
KS	Lenexa, AEM Inc.	913-888-0022
KY	Henderson, Valentine & Assocs.	502-826-9444
MD	Gaithersburg, Bresson Assocs.	301-330-8274
MD	Germantown, Bresson Assocs.	301-540-0110
MA	Brookline, Technology Prods. Grp.	617-731-0858
MI	Canton, TechRep, Inc.	313-981-1950
MN	Bloomington, Horizon Technlgs.	612-884-6515
MS	Jackson, Doby Assocs.	601-981-1138
MO	Bridgeton, AEM, Inc.	314-298-9900
NJ	Woodbridge, Jade Mktg.	201-750-2998
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Electra Sls.	
NY	Rochester, Electra Sls. Corp.	716-427-7860
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OR	Portland, Caruso & Camelleri Assocs.	503-246-5439
PA	Narberth, Bresson Assocs.	215-664-6460
TN	Collierville, Doby Assocs. Inc.	901-854-5482
TX	Dallas, Innovative Tech. Sls., Inc.	214-699-3485
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Caruso & Camelleri Assocs.	206-455-8811
WI	Milwaukee, Erdman Sls. Co.	414-281-1330

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AL	Huntsville, Resticap Inc.	205-883-4270
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Phoenix, Neumann Elctrns.	602-788-3737
AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
AR	Springdale, Carlton Bates Co.	501-756-5012
CA	Irvine, Integrated Elctrns. Corp.	714-753-0127
CA	Milpitas, California Capacitor	408-262-6000
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Norwalk, Myco Elctrnc. Supp.	213-404-2053
CA	Sacramento, Integrated Elctrns., Corp.	916-363-6030
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900
CA	Tustin, Projections Unltd.	714-544-2700
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
CO	Englewood, Kimball Elctrns.	303-893-1413
CO	Littleton, Indelco	303-795-3431
CT	Wallingford, GRS Midan Elctrns.	203-265-2077
CT	Wallingford, Midstate Elctrns. Co.	203-265-9900
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Melbourne, GRS Elctrns.	407-768-6966
FL	Melbourne, Pridmore Corp.	407-727-2491
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Whitehead Elctrns.	404-923-6667
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Pocatello, Kimball Elctrns.	208-232-2241
IL	Hoffman Estates, Integrated Elctrns. Corp.	708-843-2040
IL	Northbrook, Classic Comps. Supp. Co.	708-272-9650
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Carmel, Altex	317-848-1323
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
IA	Des Moines, Mid-State Distrbg.	515-244-7231
IA	Mason City, Mid-State Distrbg.	515-423-8012
KS	Shawnee, Finnigan Elctrns.	913-268-6917
KS	Wichita, RSC Elctrns.	316-267-5213
LA	Shreveport, Carlton Bates	318-636-9975
MD	Baltimore, Resco/Baltimore	301-931-8200
MD	Beltsville, Resco/Washington	301-937-9100
MD	Columbia, GRS Elctrns. Co. Inc.	410-995-6744
MA	Billerica, Mayer Elctrns. Co.	508-667-2545
MA	Woburn, Lorcor	617-935-5024
MI	Farmington Hills, Advent Elctrns., Inc.	313-477-1650
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Kansas City, Walters Indl. Elctrns., Inc.	816-531-7015
MO	Springfield, Carlton Bates	417-862-1699
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NE	Omaha, Mid-State Distrbg.	402-592-5965
NJ	Camden, G.R.S. Elctrns. Co., Inc.	609-964-8560
NJ	Teterboro, EAC	201-288-4477
NJ	Union, Lectron Inds.	908-687-2626
NY	Buffalo, Summit Distrs. Inc.	716-887-2829
NY	E. Rochester, Rome Elctrns.	716-248-0160
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Rochester, Help Elctrns.	716-264-9300
NY	Rochester, Summit Distrs., Inc.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NY	Williamsville, Rome Elctrns.	716-626-1602
NC	Charlotte, EMC	704-394-6195
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Columbus, AESCO Elctrns.	614-882-6762
OH	Columbus, EMC	614-299-4161
OH	Highland Hgts., EMC	216-442-3441
OK	Oklahoma City, Carlton Bates Co.	405-681-4446
OK	Oklahoma City, RSC Elctrns.	405-631-7729
OK	Tulsa, Altair Elctrns.	918-252-5781
OK	Tulsa, Carlton Bates Co.	918-250-1626
OR	Beaverton, Integrated Elctrns. Corp.	503-641-1690
PA	Exton, VSH Elctrns.	215-363-2250
PA	No. Versailles, CMD	412-678-6020
PA	Philadelphia, Shap Elctrns. Co., Inc.	215-969-3300
PA	York, ECI	717-854-8880
RI	Pawtucket, Major/Edwards Elctrn., Supp. Inc.	401-725-7400
TN	Jackson, Carlton-Bates Co.	901-664-2714
TN	Memphis, Carlton Bates	901-365-3539
TN	Nashville, Carlton Bates	615-885-3232
TX	Austin, Carlton-Bates Co.	512-837-9098
TX	Ft. Worth, Carlton-Bates Co.	817-293-5558
TX	Houston, Altair Elctrns.	713-462-3029
TX	Houston, Carlton-Bates Co.	800-622-4420
TX	Richardson, Altair Elctrns.	214-231-5166
TX	Richardson, RSC Elctrns.	214-644-3444
TX	San Antonio, Carlton-Bates Co.	512-805-8300
TX	Texarkana, Carlton-Bates Co.	903-792-6923
UT	Salt Lake City, Integrated Elctrns. Corp.	801-977-9750
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WA	Bellevue, Integrated Elctrns., Corp.	206-455-2727
WI	Milwaukee, Badger Capacitor Sls.	414-281-1330
WI	New Berlin, Classic Comps. Supp. Co.	414-786-5300
WI	New Berlin, NEP Elctrns.	414-785-9100

Illinois Lock

FAX: 708-537-1881

ILLINOIS LOCK CO., The Eastern Co., 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 708-537-1800; Empl.: 120; *Sls. Mgr.:* Brian D. Reed .... **B•1742-1743**

IMAGE GRAPHICS, INC., 917 Bridgeport Ave., Shelton, CT 06484, Tel: 203-926-0100, FAX: 203-926-9705; FSC No.: 5M867; Empl.: 65; *Sls. Mgr.:* Putnam Morgan

IMAGENATION CORPORATION, 1200 N.E. Keyes Rd., Vancouver, WA 98684, Tel: 206-944-9131, FAX: 206-944-9131; FSC No.: 5998; Empl.: 7

IMAGE SYSTEMS CORP., 11595 K-Tel Dr., Hopkins, MN 55343, Tel: 612-935-1171, FAX: 612-935-1386; Empl.: 25; *Sls. Mgr.:* Marta Scheff Volbrecht

IMAGRAPH CORP., Microfield Graphics, 11 Elizabeth Drive, Chelmsford, MA 01824, Tel: 508-256-4624, FAX: 508-250-9155; Empl.: 30; *Sls. Mgr.:* Joseph Plonski

IMAGING TECHNOLOGY INC., 55 Middlesex Tpke., Bedford, MA 01730-1421, Tel: 617-275-2700, FAX: 617-275-9590; Empl.: 120; *Sls. Mgr.:* John Hughes; *Dist. Mgr.:* John Hughes

IMAGRAPH CORP., Microfield Graphics, 11 Elizabeth Drive, Chelmsford, MA 01824, Tel: 508-256-4624, FAX: 508-250-9155; Empl.: 30; *Sls. Mgr.:* Joseph Plonski

IMATRONIC, INC., 1275 Paramount Pkwy., Batavia, IL 60510, Tel: 708-406-1920, FAX: 708-879-6749; Empl.: 15; *Sls. Mgr.:* Annette J. Elias .... **B•1323**

I.M.C., (International Microtronics Corp.), 4016 E. Tennessee St., Tuscon, AZ 85714, Tel: 602-748-7900, FAX: 602-790-2808; FSC No.: 5371; Empl.: 22; *Sls. Mgr.:* O. Fest; *Dist. Mgr.:* O. Fest

IMC MAGNETICS CORP., 1900 E. Fifth St., Tempe, AZ 85281, Tel: 602-968-4441, TWX: 910-951-0001, FAX: 602-968-5026; *Sls. Mgr.:* Joseph Gute

IMC MAGNETICS CORP., NMB Corp., 475 Wireless Blvd, Hauppauge, NY 11788, Tel: 516-231-8100, FAX: 516-231-0477; Empl.: 150; *Sls. Mgr.:* Bob Baker, Dir. of Sls.

IMC POWER SOURCES, 1435 Koll Circle, Ste. 102, San Jose, CA 95112, Tel: 408-441-9614, FAX: 408-441-7912; Empl.: 12; *Sls. Mgr.:* B. Burres

IM/D, E.P.E. Corp., 540 Commercial St., Manchester, NH 03101, Tel: 603-669-5224, FAX: 603-669-3826; Empl.: 20; *Sls. Mgr.:* Frank N. Haigh

IMPERIAL ASTRONICS

An ***ANDIG*** Company

FAX: 818-886-4658

IMPERIAL ASTRONICS, Andig Inc., 19151 Parthenia St. J, Northridge, CA 91324, Tel: 818-886-7672; FSC No.: 50843; Empl.: 38; *Sls. Mgr.:* Laurie Lee, GM .... **A•1940-1943**

Local Sales Offices & Reps

CA	American Canyon, Jacobson & Assocs.	707-552-4412
MD	Churchton, Dawn Assoc.	301-261-5001
MA	Shrewsbury, Janco New England Inc.	508-754-9840
MN	Apple Valley, Comm-Link Inc.	612-322-1595
MO	Grandview, R.R. Burton & Assocs.	816-763-5385
NJ	Lakewood, Atek	908-905-4443
NM	Albuquerque, J. Smith & Assoc. Inc.	505-345-6501
OH	Cleveland, John O. Olsen Co. Inc.	216-838-0510
TX	Dallas, Weisler & Assoc. Inc.	214-437-2386

IMPULSE ENGINEERING, 7647 Pine Tree Pl., Goleta, CA 93117-1023, Tel: 805-685-2030, FAX: 805-968-1000; Empl.: 1

I.M.S. EQUIPMENT, INC., See Worldnet Marketing, Inc.

IMTRONICS INDUSTRIES INC., 11930 31st Ct. N., St. Petersburg, FL 33716, Tel: 813-572-9010, FAX: 813-572-9012; Empl.: 10; *Sls. Mgr.:* Steven B. Cohen

INA BEARING CO., INC., 308 Springhill Farm Rd., Fort Mill, SC 29715, Tel: 803-548-8500, FAX: 803-548-8599; Empl.: 1300 o; *Sls. Mgr.:* Richard Angell, VP Sls./Mktg.; *Dist. Mgr.:* Earl Dukes, VP

INCONIX CORP, See Hancock Electronics Corp.

INCOTHERM LIMITED, Inco Alloys Ltd., Holmer Road, Hereford, United Kingdom HR4 9SL, Tel: (44) 432 355880, FAX: (44)432 352711; Empl.: 10; *Sls. Mgr.:* C. Paul Furniss

ELINA FAN

INDEK

FAX: 408-433-9330

INDEK CORPORATION, 2360 Qume Dr., No. A, San Jose, CA 95131, Tel: 408-432-1199; Empl.: 7; *Sls. Mgr.:* Charles Granata; *Dist. Mgr.:* Charles Granata, Dir. Sls. .... **C•1593-1596**

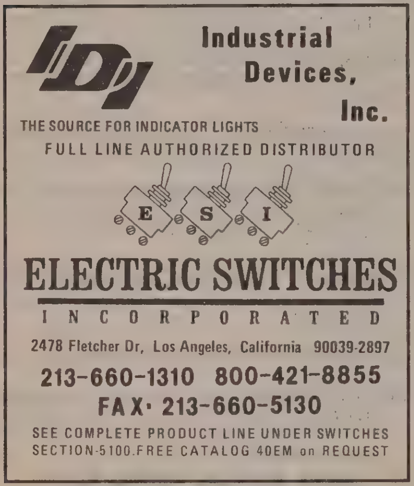
Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Dana Point, PCA MKtg. & Sls. Engrg.	714-493-9822,FAX:714-240-1894
CA	Santa Clara, I Squared Inc.	408-988-3400
CT	Guilford, Liberty Electro Mktg.	203-453-8508
FL	Hiahleah, Hughes Assocs.	305-362-8167
FL	Melbourne, Hughes Assocs.	407-253-3031
GA	Norcross, Mountain Electro Mktg.	404-448-5594, FAX:404-448-8230
IL	Deerfield, Brock & Cushman	708-405-9777, FAX:708-405-9778
IN	Valparaiso, Catalyst Sls.	219-477-4004
MA	Topsfield, Liberty Electro Mktg.	508-887-6655, FAX:508-887-2329
MN	Eden Prairie, PWC, Inc.	612-934-1409
MO	Florissant, Delltron	314-839-0033, FAX:314-839-4290
NJ	Cherry Hill, Vantage Sls. Co.	609-424-6777, FAX:609-424-8909
NY	Glen Cove, Dyno-Rep	516-676-1598, FAX:516-676-4355
NC	Cary, Hughes Assocs.	919-467-7029
OH	Columbus, Bill Romine Co.	614-436-0565
OH	Dayton, Bill Romine Co.	614-436-0565
TX	Austin, Kruvand Assocs.	512-219-9443
TX	Dallas, Kruvand Assocs.	214-437-3355
VA	Front Royal, Eltron Sls. Inc.	703-635-7201, FAX:703-635-1933
Can	Laval, Interep Technlgs. Ltd.	514-667-1444

Local Distributors

AZ	Phoenix, Force Electronics	609-437-1060, FAX:609-437-2369
AZ	Tempe, Time Elctrns.	602-967-2000

AR	Little Rock, Carton-Bates	501-562-9100
CA	El Segundo, Force Electronics	213-772-1324, FAX:213-536-0139
CA	San Diego, Force	619-569-9661
CA	San Diego, Time Elctrns.	619-578-2500
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, D.C. Elctrns.	408-453-2400
CA	San Jose, Daine Prods.	408-265-7220
CA	Sunnyvale, Time Elctrns.	408-734-9890
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Time Elctrns.	818-593-8400
CO	Englewood, Time Elctrns.	303-721-8882
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Southbury, Time Elctrns.	203-262-1319
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Orlando, Time Elctrns.	407-841-6565
GA	Norcross, Time Elctrns.	404-368-0969
IL	Palatine, Ohm Elctrns.	708-303-3000
IL	Schaumburg, Time Elctrns.	708-303-3000
MD	Columbia, Time Elctrns.	410-964-3091
MA	Peabody, Time Elctrns.	508-532-6200
MA	Westborough, In-Stock Prods.	508-870-5750, FAX:508-870-0573
MA	Wilmington, Heiland Electronics	508-657-4870, FAX:508-658-0278
MA	Winchester, Webb Distbn., Inc.	617-729-5800, FAX:617-729-6839
MN	Edina, Time Elctrns.	612-943-2433
MN	Fridley, Voyager Elctrns.	612-571-7766,F, 612-571-9519
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Louis, Beckwith Elec.	314-343-6463, FAX:314-343-7026
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	West Berlin, GCI Corp.	609-768-6767, FAX:609-768-3649
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Ronkonkoma, Conco Elctrns.	516-467-8200, FAX:516-467-3165
NC	Raleigh, Century Elctrns.	919-596-2220
NC	Raleigh, Time Elctrns.	919-847-9650
OH	Cincinnati, Hughes-Peters	513-351-3000
OH	Columbus, Hughes-Peter Inc.	614-294-5351, FAX:614-294-7115
OH	Columbus, Time Elctrns.	614-794-3301
OK	Oklahoma City, Carlton-Bates	405-681-4446
OK	Tulsa, Carlton-Bates	918-250-1626, FAX:918-250-1178
OR	Beaverton, Time Elctrns.	503-626-2979
PA	Norristown, Century Elctrns. Comp.	215-631-5400, FAX:215-631-5406
TX	Austin, Carlton-Bates	512-937-9098
TX	Farmers Branch, Force Electronics	214-247-9955, FAX:214-247-0619
TX	Forthworth, Carlton-Bates	817-293-5558
TX	Houston, Force Electronics	713-561-8644
TX	Richardson, Time Elctrns.	214-644-4644
UT	Salt Lake City, Standard Supply	801-486-3371, FAX:801-466-2362
UT	West Valley, Time Elctrns.	801-973-8494
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184,FAX:804-971-8411
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Priebe Elctrns.	206-881-2363, FAX:206-881-0508
Can	Pointe Claire, Que., Ferrotronic Comps.	514-426-0300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INDIANA MICROELECTRONICS CENTER, Indiana Bus. Modernization & Technology Corp., 118 East Ludwig Rd., Fort Wayne, IN 46825, Tel: 219-482-8200, FAX: 219-482-8800; Empl.: 8

INDIUM CORPORATION OF AMERICA, 1676 Lincoln Ave., Utica, NY 13502, Tel: 315-853-4900, 1-800-4INDIUM, TELEX: 937363, FAX: 315-853-1000; Empl.: 150; *Sls. Mgr.:* Micheal W. Beam - Dir. Worldwide Sls.; *Dist. Mgr.:* Michael W. Beam

INDRAMAT, The Rexroth Corp., 255 Mittel Dr., Wood Dale, IL 60191, Tel: 708-860-1010, FAX: 708-530-4631; Empl.: 120; *Sls. Mgr.:* Richard J. Huss; *Dist. Mgr.:* Richard J. Huss

INDUCTOR SUPPLY, 1849 W. Sequoia Ave., Orange, CA 92668-1017, Tel: 714-978-2277, 800-854-1881, 800-472-8421, FAX: 714-978-2411; Empl.: 25; *Sls. Mgr.:* Neal McDonald

INDUSTRIAL COMPUTER DESIGNS, INC., 31264 Labaya Dr., Westlake Village, CA 91362, Tel: 818-889-3179, FAX: 818-889-1490; Empl.: 10; *Sls. Mgr.:* L. Webb

INDUSTRIAL COMPUTER SOURCE, 10180 Scripps Ranch Blvd., San Diego, CA 92131, Tel: 619-271-9340, FAX: 619-271-9666; FSC No.: 7042; Empl.: 85; *Sls. Mgr.:* Nate Bailey

INDUSTRIAL CONTROL CO., 3100 Suntree Blvd., Rockledge, FL 32955, Tel: 407-259-7105; FSC No.: 90081; Empl.: 15; *Sls. Mgr.:* I. Nobilio

INDUSTRIAL CPU SYSTEMS, INTL., 111 W. Dyer Rd., Ste. D, Santa Ana, CA 92707, Tel: 714-957-2815, FAX: 714-957-3128; Empl.: 8; *Sls. Mgr.:* Dick McCormick

INDUSTRIAL DEVICES CORPORATION, 64 Digital Drive, Novato, CA 94949-5728, Tel: 415-883-3535, 800-747-0064, FAX: 415-883-2094; Empl.: 60; *Sls. Mgr.:* Louis Walton; *Dist. Mgr.:* Alan Statz

FAX: 201-489-6911

INDUSTRIAL DEVICES, INC., 260 Railroad Ave., Hackensack, NJ 07601, Tel: 201-489-8989; FSC No.: 91802; Empl.: 275; *Sls. Mgr.:* Paul Flynn .... **B•1166-1167**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg. Co., Inc.	205-880-0592
CA	San Diego, Universal Comps. Co.	310-783-0220
CA	Santa Clara, WestRep	408-988-8833
CA	Torrance, Universal Comps.	213-783-0220
CO	Littleton, Harthun Assocs., Inc.	303-792-5545
FL	Tampa, APM Assocs.	813-886-2457
GA	Norcross, Electro-Mech Sls. Engrg. Co., Inc.	404-447-6478
IN	Indianapolis, Needler Sls. Co., Inc.	317-255-8056
IA	Cedar Rapids, KKB, Inc.	313-373-1730
MD	Columbia, PSA, Inc.	215-245-0513
MA	Westborough, Anchor Engrg.	617-870-0573
MI	E. Detroit, Fred Harris & Assocs.	313-776-5430
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Blue Springs, KKB, Inc.	816-229-0001
MO	St. Louis, KKB, Inc.	314-647-2000
NY	Glen Cove, Dyno-Rep	516-676-1598
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, Electro-Mech Sls. Engrg. Co., Inc.	919-790-9300
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Hillsboro, Temco Northwest	503-649-8375
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Trevose, PSA, Inc.	215-245-0513
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-580-5754
TX	Richardson, R. F. Kimball Co.	214-231-3447
VA	Oakton, PSA, Inc.	301-953-4884
WA	Bothell, Temco Northwest	206-821-5434
WA	Hillsboro, Temco Northwest	503-645-2030

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
CA	Fremont, Allied Elctrns.	415-487-5250
CA	Gardena, Calif. Switch & Signal	213-770-2330
CA	Los Angeles, Elec. Switches	213-664-1141
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	Sacramento, Zack Elctrns.	916-446-3131
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrn. Distrbg. Co.	408-943-0255
CA	Santa Ana, Sunray Lighting, Inc.	714-556-3630
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Tustin, Allied Elctrns.	714-669-4190
CO	Arvada, Denver Beta	303-431-7161
CO	Denver, Allied Elctrns.	303-790-1662
CO	Denver, Con. Parts	303-623-5313
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Pompano Bch., Allied Elctrns.	305-978-3008
FL	W. Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Norcross, Whitehead Elctrns.	404-923-6667
ID	Boise, Radar/Elec.	208-336-2322
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rockford, Mid-West Associated	815-962-8036
IL	Wheeling, Hawk Elctrns.	800-843-4295
IL	Wood Dale, Electro-Kinetics	312-595-6700
IN	East Chicago, ACRO Elctrns.	312-375-1269
IN	Evansville, Hutch & Son	812-425-7201
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Allied Elctrns.	317-875-0448
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, MAR Elctrns., Inc.	317-633-6699
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
LA	Lafayette, Ralph's	318-234-4507
MD	Baltimore, PEI/Genesis	301-931-8280
MD	Columbia, Sager Elctrns.	301-995-6580
MD	Gaithersburg, Capitol Radio Whlsrs.	301-881-2270
MD	Jessup, Treeko Elctrns.	301-792-0112
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Worcester, Coghlin Elect.	617-756-8311
MI	Flint, Shand Elctrns.	313-743-8940
MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Shand Elctrns.	313-422-7000
MI	Saginaw, Shand Elctrns.	517-753-9900
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Control Des. Supp.	612-721-1628
MN	Minneapolis, Stark Elctrns.	612-332-1325
MS	Tupelo, Bluff City Elctrns.	601-842-6923
MO	Kansas City, RS/Olive Elctrns.	913-362-1923
MO	Maryland Hgts., RS/Olive Elctrns.	314-997-7709
MO	St. Louis, Van Sickle Radio-Elec.	314-621-5000
NE	Lincoln, Scott Elctrn. Supp.	402-466-822
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Hanover, State Elctrns. Parts	201-887-2550

NJ	Oakland, Relay Spec.	201-337-1000
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Sager Elctrl. Supply Co.	516-348-1300
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Cameron & Barkley	919-828-2311
NC	Raleigh, Sager	919-850-9550
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Warren, REM Elctrns.	216-373-1300
OK	Tulsa, PEI Genesis	918-622-8520
OR	Portland, United Radio Supp.	503-233-7151
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom, Inc.	814-476-7774
PA	Philadelphia, PE/Genesis	215-673-0400
PA	Philadelphia, PEI/Genesis	215-673-0400
SC	Columbia, Dixie Radio Supp.	803-779-5332
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5601
TX	Fort Worth, Swieco Elctrns.	800-255-9319
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	San Antonio, Sherman Elctrns. Supp.	512-224-1004
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Glen Allen, Hermitage Distrs.	804-798-3830
WA	Seattle, Allied Elctrns.	206-547-2827
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns.	414-475-6000

INDUSTRIAL DIELECTRICS, INC., P.O. Box 357, Noblesville, IN 46060, Tel: 317-773-1766, FAX: 317-773-3877; Empl.: 250; *Sls. Mgr.:* Tom Merrell; *Dist. Mgr.:* Tom Merrell

INDUSTRIAL ELECTRONIC RESOURCES, 172 Business Center Drive, Corona, CA 91720, Tel: 909-734-1111, 800-433-5160, FAX: 909-734-2710; Empl.: 14

INDUSTRIAL ELECTRONICS CORP., 24175 Gibson Drive, Warren, MI 48089, Tel: 313-759-4450, FAX: 313-759-1589; Empl.: 30; *Sls. Mgr.:* Allen A. Russell

INDUSTRIAL INDEXING SYSTEMS, INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181, FAX: 716-924-2169; Empl.: 40; *Sls. Mgr.:* David Dunnill; *Dist. Mgr.:* David Dunnill

INDUSTRIAL MIDWEC CAPACITOR, See Charles Inds. Ltd.

INDUSTRIAL MONITORING INSTRUMENTATION, PCB Piezotronics Inc., 3425 Walden Ave., Depew, NY 14043, Tel: 716-684-0003, FAX: 716-684-3823

INDUSTRIAL SERVICE TECHNOLOGY, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1033, 800-835-2611; Empl.: 13; *Sls. Mgr.:* Mark Welscott

Powertron

FAX: 516-883-7155

INDUSTRIAL TEST EQUIPMENT CO., Inc., 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Jay Monroe .... **D•1012, 2268-2271**

INDUSTRIAL TIMER CO., 30 Industrial Park Rd., P.O. Box 307, Centerbrook, CT 06705, Tel: 203-767-7130, FAX: 203-767-9137; Empl.: 55; *Sls. Mgr.:* Ann Fraser Carroll

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, FAX: 215-345-0111; FSC No.: 6115; Empl.: 14; *Sls. Mgr.:* Joanne Dorr; *Dist. Mgr.:* D. E. Sanderson

INFICON LEYBOLD-HERAEUS, INC., See Leybold Inficon, Inc.

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, FAX: 302-658-2475; *Sls. Mgr.:* M. Schwartz

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DISPLAY SYSTEMS TECHNOLOGIES

FAX: 203-879-3404

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716, Tel: 203-879-4944; FSC No.: 09087; Empl.: 44; *Sls. Mgr.:* Robert Vance .... **B•1012-1013, 1080**

Local Sales Offices & Reps

MA	Medfield, Nortech Engrg. Sls.	508-359-6063

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFOMETRIX, 2200 Sixth Ave. No. 833, Seattle, WA 98121, Tel: 206-441-4696, FAX: 206-441-0841; Empl.: 10; *Sls. Mgr.:* Paul Bailey

INFOPRINT, INC., Micro Electronic Business, Inc., 4315 N. Elston Ave., Chicago, IL 60641, Tel: 312-539-6045, FAX: 312-539-6645

INFORMATION RETRIEVAL SYSTEMS, INC., 1705 Second Ave. Ste. 3N, New York, NY 10128, Tel: 212-348-6268; Empl.: 3; *Sls. Mgr.:* Lynne McNamara

INFORMATION TRANSFER INC., Box 357, Bloomfield, NY 14469, Tel: 716-657-7074, FAX: 716-657-7432; FSC No.: 55137; Empl.: 50; *Sls. Mgr.:* John Dillman .... **D•1192-1193**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno-Metrics	205-830-2832
AZ	Chandler, VIC Myers Assocs.	602-345-6449
CO	Denver, VIC Myers Assocs.	303-730-7313
CA	Sunnyvale, Westech	408-735-8647
FL	Winter Park, Wade H. Boggs, Inc.	407-647-2226
MD	Baltimore, Stemler Assocs.	301-944-8262
NJ	Cherry Hill, Stemler Assocs.	609-966-4070
NM	Albuquerque, VIC Myers Assocs.	505-884-6878
UT	Salt Lake City, Vic Myers Assocs.	801-581-1760

INFRANOR, 45E Great Hill Road, Naugatuck, CT 06770, Tel: 203-729-8258, 800-BE-SERVO, FAX: 203-729-6969; Empl.: 11 .... **B•1271**

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INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388, FAX: 516-563-3389; *Sls. Mgr.:* Adam P. Friedman .... **C•1136**

Local Distributors

AL	Birmingham, ACK Radio Supp.	205-322-0588
AZ	Tucson, Electronic City	602-622-1173
CA	San Luis Obispo, Midstate Elctrns. Supp.	805-543-2770
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
IL	Lombard, NyTron Elctrns.	312-691-8900
IN	Evansville, Tri-State Supp. Co.	812-423-4257
IA	Cedar Rapids, Iowa Radio Supp. Co.	800-332-5296
KY	Louisville, P.I. Burkes	502-589-3960
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Needham, Y.D.I.	617-449-1005
MI	Canton, The Elctrn. Connection	313-595-6655
NY	Lindenhurst, RNJ Elctrns.	516-226-2700
NY	Long Island City, Typeco	718-706-6666
NY	Richmond Hill, Anchor	212-846-2420
NC	Charlotte, Slayton Elctrns.	704-375-6600
OK	Oklahoma City, Radio Supp., Inc.	405-332-6127
OR	Beaverton, Norvac	503-644-1025
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TX	Fort Worth, Sweico	817-335-6521
VA	Roanoke, H. C. Baker	703-344-9209

INLAND MOTOR, Kollmorgen Corp., 501 First St., Radford, VA 24141, Tel: 703-639-9045, FAX: 703-731-4193; FSC No.: 11384; Empl.: 580

INMARK CORP., 4 Byington Pl., Norwalk, CT 06850, Tel: 203-866-8474, FAX: 203-866-0918; *Sls. Mgr.:* Roger Hibbert

INMET CORPORATION, 300 Dino Drive, Ann Arbor, MI 48103, Tel: 313-426-5553, FAX: 313-426-5557; FSC No.: 64671; Empl.: 40; *Sls. Mgr.:* Tim Solomon

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., Dynatech Corporation, 10110 USA Today Way, Miramar, FL 33025, Tel: 305-432-0300, FAX: 305-432-0705; Empl.: 40; *Sls. Mgr.:* Marshall Roper

INRECO, See Ransco Industries

INRESCO, INC., 2411 Atlantic Avenue, Manasquan, NJ 08736, Tel: 908-223-6330, FAX: 908-223-2571; Empl.: 8

INSERVCO, INC., 128 Commerce Drive, Box 110, LaGrange, OH 44050, Tel: 1-216-355-5102, FAX: 1-216-355-5342; Empl.: 100; *Sls. Mgr.:* C. Scott Sudnick

INSTEK CORPORATION, 1205 John Reed Ct., City of Industry, CA 91745, Tel: 818-336-6537, FAX: 818-369-1748; Empl.: 350; *Sls. Mgr.:* Michael Silverstein, National .... **D•1745**

Local Sales Offices & Reps

AL	Hoover, Henry Phillips Co., Inc.	205-733-0043
AZ	Tempe, Sertek, Inc.	800-334-7127
CO	Englewood, Sertek, Inc.	800-334-7127
GA	Roswell, Henry Phillips, Co., Inc.	404-992-3070
IL	Addison, Elctrn. Specs.	708-250-9080
IN	Mulberry, Maish Sls.	317-296-2322
MI	Warren, Burcaw Co.	313-573-4605
MN	Minneapolis, MSJ Mktg., Inc.	612-755-1865
NM	Sertek, Inc.	800-334-7127
NY	Little Neck, M S Sls.	718-224-9746
NC	Statesville, Henry Phillips Co., Inc.	704-876-0730
SC	Henry Phillips Co., Inc.	800-877-3070
TN	Henry Phillips Co., Inc.	800-877-3070
UT	Sertek, Inc.	800-334-7127

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Fred Pummill

INSTRUM, 176 W. Pomona Ave., Monrovia, CA 91016, Tel: 818-303-4210, FAX: 818-303-4210; Empl.: 5; *Sls. Mgr.:* Ralph Morrison

ICS

FAX: 708-543-6244

INSTRUMENTATION & CONTROL SYS., ICS.Inc., 520 Interstate Rd, Addison, IL 60101, Tel: 708-543-6200, TELEX: 271503 ICS UR; Empl.: 20; *Sls. Mgr.:* Harold Miller .... **B•1524-1525; D•2272-2273**

Local Sales Offices & Reps

MA	Topsfield, Whitehead Assocs., Inc.	508-887-8050

UPS Representatives

TX	Dallas, Adair & Assocs.	214-321-9970
TX	Houston, Adair & Assocs.	713-827-7155

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Mobile, Allied Elctrns.	205-476-1875
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Fremont, Allied Elctrns.	510-770-0590
CA	Irvine, Allied Elctrns.	714-727-3010
CA	Rocklin, Allied Elctrns.	916-632-3104
CA	San Diego, Allied Elctrns.	619-279-2550
CA	San Francisco, Allied Elctrns.	415-952-9599
CA	Torrance, Allied Elctrns.	310-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Jacksonville, Allied Elctrns.	904-346-0761
FL	Largo, Allied Elctrns.	813-541-4660
FL	Pompano Bch., Allied Elctrns.	305-978-3008
GA	Duluth, Allied Elctrns.	404-497-9544
GA	Roswell, Henderson Ind. Equip.	404-552-0185
IL	Des Plaines, Allied Elctrns	708-803-1040
IL	Libertyville, Allied Elctrns.	708-918-0250
IL	New Lenox, Allied Elctrns.	815-485-1511
IL	Oak Forest, Allied Elctrns.	708-535-0038
IL	Rockford, Powermation	815-397-0510
IL	Wood Dale, Allied Elctrns.	708-860-0007
IN	Indianapolis, Allied Elctrns.	317-875-0448
IA	W. Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, Allied Elctrns.	502-452-2293
LA	Metairie, Allied Elctrns.	504-885-1195
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
MA	Norwood, Allied Elctrns.	617-255-0361
MI	Grand Rapids, Allied Elctrns.	616-949-8200
MI	Plymouth, Allied Elctrns.	313-416-9300

MN	Bloomington, Allied Elctrns.	612-881-0838
MN	St. Paul, Powermation	612-645-0781
MO	Earth City, Allied Elctrns.	314-291-7031
NE	Omaha, Allied Elctrns.	402-697-0238
NH	Nashua, Allied Elctrns.	603-883-3006
NJ	Audubon, Universal Elctrn. Supp.	1-800-327-3529
NJ	Edison, Allied Elctrns.	908-572-9600
NJ	Moorestown, Allied Elctrns.	609-234-7769
NJ	Parsippany, Allied Elctrns.	201-428-3350
NY	Fairport, Allied Elctrns.	716-425-3850
NY	Lagrangeville, Allied Elctrns.	914-452-1470
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Cincinnati, Allied Elctrns.	513-771-6990
OH	Solon, Allied Elctrns.	216-248-4200
OH	Worthington, Allied Elctrns.	614-785-1270
OK	Tulsa, Allied Elctrns.	918-664-0844
OR	Portland, Allied Elctrns.	503-252-0335
PA	Camp Hill, Allied Elctrns.	717-975-3570
PA	Pittsburgh, Allied Elctrns.	412-367-4124
SC	Greenville, Allied Elctrns.	803-288-8835
TN	Memphis, Allied Elctrns.	901-367-2895
TX	Austin, Allied Elctrns.	214-553-4370
TX	Austin, Allied Elctrns.	512-219-7171
TX	El Paso, Allied Elctrns.	915-779-6294
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Houston, Allied Elctrns.	713-455-3993
TX	Humble, Allied Elctrns.	713-466-8005
UT	Salt Lake City, Allied Elctrns.	801-261-5244
VA	Alexandria, Allied Elctrns.	703-750-8206
VA	Springfield, Allied Elctrns.	703-644-9515
VA	Virginia Beach, Allied Elctrns.	804-363-8662
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Allied Elctrns.	1-800-433-5700
WI	Green BAy, Powermation	414-496-0944
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	Waukesha, Powermation	414-523-0600

INSTRUMENTATION NORTHWEST, 14972 N.E. 31st Circle, Redmond, WA 98052, Tel: 206-885-3729, FAX: 206-867-0404; Empl.: 26; *Sls. Mgr.:* Robert Shea

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, FAX: 612-544-4887; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT DESIGN ENGINEERING ASSOCS., INC., See IDEA, Inc.

INSTRUMENTED SENSOR TECHNOLOGY, INC., 4704 Moore St., Okemos, MI 48864, Tel: 517-349-8487, FAX: 517-349-8469; Empl.: 10

INSTRUMENT ENCLOSURES, 4088 South K St., Tulare, CA 93274, Tel: 209-688-1100, FAX: 209-688-1193; FSC No.: 62012; Empl.: 40; *Sls. Mgr.:* Mike Love

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESEARCH CO., 6420A Dobbin Rd., Columbia, MD 21045, Tel: 410-740-3411, FAX: 410-740-2928; Empl.: 10

INSTRUMENTS, INC., 7263 Engineer Rd., Ste. G, San Diego, CA 92111, Tel: 619-571-1111, FAX: 619-571-0188; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

FAX: 516-467-8558

INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779, Tel: 516-467-8400; Empl.: 25 .... **D•1013**

Local Sales Offices & Reps

AL	Eva, Barr Elctrn. Instrs.	205-796-7533
AZ	Mesa, DJM Elctrns.	602-821-1440
CA	Fremont, DJM Elctrns.	415-490-7406
CA	Sunnyvale, DJM Elctrns.	408-749-8936
CA	Valencia, DJM Elctrns.	805-254-2677
CO	Englewood, R.A. Mayes Co.	303-761-9447
FL	Barr Elctrns.	800-242-7138
KS	Lenexa, KJS Mktg.	913-962-1795
MD	Centerville, EMC Technologists	301-758-3510
MO	Maryland Heights, KJS Mktg.	314-770-1412
NH	Brookline, EMC Sls., Inc.	603-672-4455
NJ	N. Plainfield, Brady Co.	908-755-7900
NM	Albuquerque, Mesa Tech. Corp.	505-883-8833
PA	Sewickley, Teplitz/Byrne Assocs.	412-741-3628

TX	Richardson, Scientific Dvcs.	214-231-8106
VA	Sterling, EMC Technologists	703-450-7988
WA	Bothell, Del Black Assocs.	206-487-4396
Can	Nepean, Ont., Multilek, Inc.	613-226-2365

INSTRUMENT SOCIETY OF AMERICA, P.O. Box 12277, Research Triangle Park, NC 27709, Tel: 919-549-8411, TELEX: 802-540, FAX: 919-549-8288; Empl.: 102

Instrument Specialties Co., Inc.

FAX: 717-424-6213

INSTRUMENT SPECIALTIES CO. HEADQUARTERS, P.O. Box A, Delaware Water Gap, PA 18327-0136, Tel: 717-424-8510, TWX: 510-671-4526; Empl.: 330; *Sls. Mgr.:* John Blazejewski ... **C•1687-1694**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs.	602-944-9542
CA	San Jose, O'Donnell Assocs.	408-456-2950
CA	Torrance, O'Donnell Assocs.	310-781-2255
CO	Littleton, D. M. Harthun Assocs.	303-795-5545
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
FL	Deerfield Bch., Kinetic Sls., Inc.	305-480-6040
FL	Palm Harbor, Kinetic Sls., Inc.	813-934-3768
KS	Prairie Village, Thunderbird Tech. Sls. & Svcs.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls. & Svcs.	316-636-5018
MI	Howell, Great Lakes Comps.	517-548-9100
MN	St. Paul, Arkco Sls.	612-777-7454
MO	Maryland Heights, Thunderbird Tech. Sls. & Svcs.	314-298-8940
NM	Albuquerque, O'Donnell Assocs.	505-889-4522
TN	Franklin, D. L. Clark & Assocs.	615-790-7457
TX	Dallas, Materials Technlg.	214-484-4677
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392
Can	Pickering, Ont., A. C. Simmonds & Sons	416-839-8041

INSTRUMENT SPECIALTIES CO., Western Div., 505 Porter Way, Placentia, CA 92670, Tel: 714-579-7100, FAX: 714-579-7105; Empl.: 25; *Sls. Mgr.:* William Oliver; *Dist. Mgr.:* Phil Strong .... **C•1687-1694**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs., S.W.	602-944-9542
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs., Inc.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Englewood, D.M. Harthun Assocs., Inc.	303-792-5050
CO	Littleton, D.M. Harthun Assoc.	303-795-5545
FL	Altamonte Springs, Kinetic Sls.	407-339-3855
FL	Boca Raton, Kinetic Sls., Inc.	407-852-8595
FL	Palm Harbor, Kinetic Sls.	813-934-3768
ID	Boise, Temco Northwest	208-345-2051
KS	Leawood, Thunderbird Tech Sls. & Svs., Inc.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls.	313-636-5018
MN	St. Paul, Arkco Sls.	612-777-7454
MO	Maryland Heights, Thunderbird Tech. Sls.	314-298-8940
NM	Albuquerque, O'Donnell Assocs., S.W.	505-889-4522
OR	Hillsboro, Temco Northwest	503-645-2030
TN	Franklin, D.L. Clark & Assoc., Inc.	615-790-7457
TX	Dallas, J.M. Spell	214-620-0040
TX	Dallas, Materials Technlg. Co.	214-484-4677
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392
Can	Pickering, Ont., A.C. Simmonds & Sons, Ltd.	416-839-8041

INSULATON COMPONENTS ASSOCIATES, INC., P.O. Box 4849, Downey, CA 90241, Tel: 310-861-7268, FAX: 310-861-7265

INSULCAST, Permagile Inds. Inc., 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, 800-645-7546, TELEX: 221720 PERM UR, FAX: 516-349-1156; FSC No.: 13549; Empl.: 37; *Sls. Mgr.:* William P. Flaim, Natl. Sls. Mgr.

FAX: 206-284-3705

INTAQ KEY PANELS, GM Nameplate, Inc., 2040 15th Ave. W., Seattle, WA 98119, Tel: 206-284-2200; FSC No.: 9905; Empl.: 350; *Sls. Mgr.:* Gerry Gallagher .... **B•1836-1837; C•1665**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev./Sls.	602-438-1547
AL	Huntsville, JWL Assocs.	205-883-1712
CA	San Diego, Omni	619-268-9606
CA	San Jose, G M California	408-435-1666
CA	Irvine, Balzer-Wolf Assoc.	714-261-6877
CO	Englewood, Delltron	303-741-2122
FL	Orlando, Comp. Sls.	407-823-7480
HI	Honolulu, Menehune Unlimited	808-737-3472
ID	Eagle, GM/West	208-939-7202
IL	Elmhurst, Utronix	708-834-1100
IN	Zionsville, WK/Custom Engrd. Pts.	317-873-5626
MI	Southfield, E&A Inds., Inc.	313-647-0330
MN	Burnsville, Electromec Sls., Inc.	612-894-8200
MO	St. Louis, Halpin D. Burke & Son	314-968-2727
NH	Mt. Vernon, GM/Northeast	603-673-9737
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	West Caldwell, Grimm, Siegel & Assoc.	201-575-9300
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Akron, Augnat Assocs.	216-239-2499
OR	Portland, GM-Portland	503-223-9879
PA	Robinson Township, Allied Entprs.	412-788-2992
TX	Dallas, Comp. Techng.	214-783-8831
VA	Reston, Colrud Corp.	703-904-0240
WA	Bellevue, American Intl. Entprs.	206-455-4697
EXP	Singapore, S&T Entrps.	065-745-9235
Can	Calgary, Alb., Enerlec Sls. Ltd.	403-256-3627
Can	Richmond B.C., Enerlec Sls. Ltd.	604-273-0882

INTEC CONTROLS CORP., 55 West St., Walpole, MA 02081, Tel: 508-660-1221, FAX: 508-660-2374; Empl.: 40; *Sls. Mgr.:* Gerard Feldeisen; *Dist. Mgr.:* Gerard Feldeisen

INTEGRATED CIRCUITS INC. (ICI), See Interpoint Corporation

INTEGRATED CIRCUIT SYSTEMS INC., PO Box 968, 2435 Blvd. of the Generals, Valley Forge, PA 19482-0968, Tel: 215-666-1900, FAX: 215-666-1099; Empl.: 150; *Sls. Mgr.:* J. Black

INTEGRATED DEVICE TECHNOLOGY, INC., 2975 Stender Way, Santa Clara, CA 95054-3090, Tel: 408-727-6116, TWX: 910-338-2070, FAX: 408-492-8674; FSC No.: 61772; Empl.: 2090; *Sls. Mgr.:* Dan Lewis, VP; *Dist. Mgr.:* Bill Franciscovich

INTEGRATED ENGINEERING SOFTWARE, 347-435 Ellice Ave., Winnipeg, Man., Canada R3B 1Y6, Tel: 204-942-5636, FAX: 204-944-8010; Empl.: 14; *Sls. Mgr.:* Bennetta Benson

INTEGRATED MICROWAVE, 3422 Tripp Ct., San Diego, CA 92121-1009, Tel: 619-259-2600, FAX: 619-755-8679; FSC No.: 60656; Empl.: 75; *Sls. Mgr.:* Dennis R. Clark

INTEGRATED POWER DESIGNS, INC., 300 Stewart Rd., Wilkes-Barre, PA 18706, Tel: 717-824-4666, FAX: 717-824-4843; Empl.: 42; *Sls. Mgr.:* Steven Thompson .... **D•1747-1749**

Local Sales Offices & Reps

CA	Mountain View, Swanson Carlton	415-961-0565
CO	Boulder, Asrepco	303-442-6018
FL	Land O'Lakes, AJ's Power Source	813-996-2583
MD	Burtonsville, Chesapeake Technlg.	301-236-0530
MA	Wakefield, Howard Jappe Co.	617-245-9359
MI	Brighton, Reptronics	313-229-3066
MN	Eden Prairie, Professional Mktg.	612-934-5939
NJ	Madison, Venture Quest, Inc.	201-377-4922
NY	Fairport, Hi-Tec Sls.	716-223-5922
OH	Dayton, Electro-Mktg.	513-890-8322
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Plano, G.W. Prods.	214-422-1746
Can	Mississauga, Altus Technlgs.	416-670-0783

INTEGRATED SILICON SOLUTIONS INC., 680 Almanor Avenue, Sunnyvale, CA 94086, Tel: 408-733-4774, FAX: 408-245-4774

INTEGRATED SYSTEMS, INC., 3260 Jay St., Santa Clara, CA 95054, Tel: 408-980-1500, FAX: 408-980-0400; Empl.: 200; *Sls. Mgr.:* Dennis O'Donnell

FAX: 516-420-0453

INTEGRATED TECHNOLOGIES SOLUTIONS INC., 262 A Eastern Pkwy, Farmingdale, NY 11735, Tel: 516-420-9401; Empl.: 8; *Sls. Mgr.:* M. Lieber .... **D•2274-2275**

Local Sales Offices & Reps

CA	Chino, Deltatec Intl. Inc.	714-551-8546

INTEGRITY TECHNOLOGY CORPORATION, 1400 Coleman Ave., Ste. E15, Santa Clara, CA 95050, Tel: 408-262-8640, FAX: 408-262-1680; Empl.: 127; *Sls. Mgr.:* Larry Young

INTEK, INC., 751 Intek Way, Westerville, OH 43081, Tel: 614-895-0301, FAX: 614-895-0319; FSC No.: 6680; *Sls. Mgr.:* Robert Curry

INTEL CORPORATION, 3065 Bowers Ave., Santa Clara, CA 95051, Tel: 408-987-8080, TELEX: 34-6372, TWX: 910-338-0026

INTELLIGENT INSTRUMENTATION, A Burr-Brown Company, 1141 W. Grant Road.MS 131, Tucson, AZ 85705, Tel: 602-623-9801, FAX: 602-623-8965; *Sls. Mgr.:* Bill McGovern

INTELLIGENT INTERFACES, INC., P.O. Box 1486, Stone Mountain, GA 30086, Tel: 404-381-9891, 1-800-842-0888; FSC No.: OA4H9; Empl.: 3; *Sls. Mgr.:* Robert E. Jarvis

INTELLITECH, 1300 Shiloh Rd., N.W., Kennesaw, GA 30144, Tel: 404-514-7999, FAX: 404-514-1285; Empl.: 6; *Sls. Mgr.:* Sam Zamarripa

INTELLUTION, INC., 315 Norwood Park South, Norwood, MA 02062, Tel: 617-769-8878, FAX: 617-769-1990; *Sls. Mgr.:* John Curtis; *Dist. Mgr.:* John Curtis

INTERACTION SYSTEMS INC., 86 Coolidge Ave., Watertown, MA 02172, Tel: 617-923-6001, FAX: 617-923-2112 .... **D•1097**

Local Sales Offices & Reps

AL	Huntsville, E.G. Holmes & Assocs.	205-859-4199
FL	Orlando, E.G. Holmes & Assocs.	407-281-0067
GA	Atlanta, E.G. Holmes & Assocs.	404-451-6161
NC	Apex, E.G. Holmes & Assocs.	919-387-1072

INTERACTIVE CIRCUITS SYSTEMS LTD., 5430 Canotek Rd., Gloucester, Ont., Canada K1J 9G2, Tel: 613-749-9241, 1-800-267-9794, FAX: 613-749-9461; Empl.: 20

INTERACTIVE COMPUTER PRODUCTS, INC., 23482 Peralta, unit C, Laguna Hills, CA 92653, Tel: 714-770-5332, FAX: 714-770-8137; Empl.: 20; *Sls. Mgr.:* Pat Cooper

Local Sales Offices & Reps

MA	Medfield, Nortech Engrg. Sls., Inc.	508-359-6063

INTERCONNECT DEVICES, INC., 5101 Richland Ave., Kansas City, KS 66106, Tel: 913-342-5544, TELEX: 286767 IDIKC UR, FAX: 913-342-7043; Empl.: 150; *Sls. Mgr.:* Mike Richards; *Dist. Mgr.:* Carol Narr

INTERCONNECT SPECIALTIES, INC., 2861-B Saturn St., Brea, CA 92621, Tel: 800-752-4777, 714-961-7955, FAX: 714-996-9537; Empl.: 10; *Sls. Mgr.:* Diana Fitzpatrick

INTERELECTRONICS CORP., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920, Tel: 914-EL8-8000; Empl.: 82; *Sls. Mgr.:* M. H. Pintell; *Dist. Mgr.:* G. Sherwood .... **D•1750**

INTERFACE, INC., 7401 E. Butherus Dr., Scottsdale, AZ 85260, Tel: 602-948-5555, TELEX: 825-882, FAX: 602-948-1924; FSC No.: 32311; Empl.: 85; *Sls. Mgr.:* Irv Wilson

INTERFACE ENGINEERING INC., 300 Centre St., Holbrook, MA 02343, Tel: 617-986-2600, TELEX: 249-545, FAX: 617-986-8932; FSC No.: 14352; Empl.: 25; *Sls. Mgr.:* Thomas Scanlon

INTERFACE PRODUCTS, INC., 4630 North Ave., Oceanside, CA 92056, Tel: 619-945-0230, FAX: 619-945-0239; FSC No.: 55300; Empl.: 75; *Sls. Mgr.:* William Lang

INTERFACE TECHNOLOGY, Dynatech Corp., 196 University Parkway, Pomona, CA 91768-4300, Tel: 714-595-6030, TELEX: 4945489, FAX: 714-595-7177; *Sls. Mgr.:* Lee Davis

INTERFAN, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203, FAX: 415-340-1670; Empl.: 12; *Sls. Mgr.:* F. L. Nelson

INTERGRAPH CORP., Advanced Processor Division, 2400 Geng Rd., Palo Alto, CA 94303, Tel: 415-494-8800, FAX: 415-856-9224; *Sls. Mgr.:* James Pierce; *Dist. Mgr.:* James Pierce, Sls. Rep. Mgr.

INTERLOGIC INDUSTRIES, 85 Marcus Dr., Melville, NY 11747-4294, Tel: 516-420-8111, FAX: 516-420-8007; Empl.: 46; *Sls. Mgr.:* Bert Freifeld

INTERLOOP, 706 Charcot Ave., San Jose, CA 95131, Tel: 408-922-0520, FAX: 408-922-0545; Empl.: 3

INTER-MARKET, 1946 Lehigh Ave., Glenview, IL 60025, Tel: 708-729-5330, FAX: 708-729-4849; FSC No.: 34165; Empl.: 10; *Sls. Mgr.:* Phil Gardanier

INTERMATIC, Intermatic Plaza, Spring Grove, IL 60081, Tel: 815-675-2321, TELEX: 25-265, FAX: 815-675-2112; Empl.: 1000

INTERMETRICS MICROSYSTEMS SOFTWARE, INC., 733 Concord Ave., Cambridge, MA 02138, Tel: 617-661-0072, 800-356-3594, FAX: 617-868-2843; Empl.: 6000; *Sls. Mgr.:* Harry Erickson

INTER METRO INDUSTRIES CORP., North Washington St., Wilkes-Barre, PA 18705, Tel: 717-825-2741, TELEX: 831-833, FAX: 717-825-2852

INTERNATIONAL CMOS TECHNOLOGY, 2123 Ringwood Ave., San Jose, CA 95131, Tel: 408-434-0678, TWX: 910-997-1531

INTERNATIONAL COMPONENTS CORP., 105 Maxess Rd., Melville, NY 11747, Tel: 516-293-1500, TELEX: 221576, FAX: 516-293-4983; Empl.: 100; *Sls. Mgr.:* Ken Reed .... **D•1033-1038**

Local Sales Offices & Reps

AL	Huntsville, CIMS	205-881-6699
AZ	Phoenix, Santino Mktg., Inc.	602-866-2321
AR	Mabelville, Erickson Sls.	501-455-0618
CA	Campbell, Senah	408-374-1031
CA	Laguna Niguel, Aktron Sls.	714-496-5057
CO	Littleton, Romulus Elctrns.	303-770-4888
IL	Arlington Heights, MJ Petersen	708-577-8200
IN	Carmel, Current Elctrn. Mktg.	317-844-1770
IA	Cedar Rapids, Delltron Co.	319-393-0075
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MA	Framingham, Stone Comp. Sls.	508-875-3226
MA	Long Meadow, Stone Comp. Sls.	413-567-1019
MI	Brighton, AP Assocs.	313-229-6550
MN	Minneapolis, Intl. Elctrns. Inc.	612-571-0000
MO	Florissant, Delltron Co.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	Melville, ICC	516-293-1500
NY	N. Syracuse, Entec Grp. Inc.	315-458-7936
NC	Raleigh, Spears	919-790-7606
OH	Cincinnati, Bob Gilbert Assocs.	513-574-1932
OR	Portland, Adapt E2	503-297-2151
TX	Dallas, Erickson Sls. Inc.	214-739-5833
VA	Lynchburg, James A. Griffin Co.	804-237-0598
WA	Bellevue, Adapt E2	206-637-0302
Can	Markham, Ont., Kellock Sls. & Mktg. Ltd.	416-471-0202

Local Distributors

CA	Fremont, Kea Elctrns.	510-651-2600
CA	San Diego, Tauber Elctrns. Corp.	619-274-7242
CT	Bridgeport, Park Distr.	203-366-7200
CT	East Haven, JV Elctrns.	203-469-2321
FL	Ft. Lauderdale, Bros. Elctrns.	305-561-6700
FL	Ft. Lauderdale, National Resistor Co.	305-772-4500
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Bensenville, Voyager Elctrns. Corp.	312-860-1300
IL	Wheeling, Hawk Elctrns., Inc.	708-459-4030
IN	Indianapolis, RM Elctrns.	317-291-7110
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Chelmsford, Shelly Ragon	508-250-9666
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Sharon, Adcour Passive Comps.	617-784-8123
MI	Grand Rapids, R M Elctrns.	616-531-9300
MI	Southfield, R M Elctrns.	313-262-1582
MN	Eden Prarie, Cassidy Elctrns.	612-944-0100
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
MN	Minneapolis, Cassidy Elctrns.	612-835-7746
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Louis, Beckwith Elctrns.	314-343-6463
NJ	Bellmaur, Mid-Atlantic Elctrns.	609-931-5303
NJ	Clifton, Vantage Comps.	201-667-1840
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	Sparta, Instruments & Equip.	201-729-4293
NY	Commack, Vantage Comps. Corp.	516-543-2000
OH	Columbus, Thompson Elctrns.	614-228-6191
PA	Philadelphia, Mur'Tronics	215-632-4330
TN	Hixson, Techni-Tronics	615-842-0514
TX	Dallas, Wholesale Elctrns.	214-969-9400
TX	Fort Worth, Allied Elctrns.	817-336-7414
TX	Ft. Worth, C & W Supp. Co.	817-831-0395
WA	Seattle, Vesco	206-575-3607

INTERNATIONAL COMPONENTS CORP., 420 North May St., Chicago, IL 60622, Tel: 312-829-7101, FAX: 312-829-0422; Empl.: 92; *Sls. Mgr.:* David Schmidt

INTERNATIONAL CONFIGURATIONS, INC., 7 Moody Rd., P.O. Box 3374, Enfield, CT 06082, Tel: 203-749-6380, FAX: 203-749-2985; FSC No.: 62484; Empl.: 4-6; *Sls. Mgr.:* Ov. L. Baldwin .... **C•1353**

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FAX: 405-235-1904,1-800-322-9426

INTERNATIONAL CRYSTAL MFG., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126-0330, Tel: 405-236-3741, 1-800-725-1426; Empl.: 100; *Sls. Mgr.:* Michael Eastman; *Dist. Mgr.:* Michael Eastman .... **A•1409**

INTERNATIONAL DATA AQUISTION & CONTROL, INC., Box 397, Rte. 101 The Meeting Place, Amherst, NH 03031, Tel: 603-673-0765, FAX: 603-673-0767; Empl.: 7; *Sls. Mgr.:* Gene Calvano; *Dist. Mgr.:* Gerry Klein

INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518, FAX: 201-482-4958; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 708-358-4622, FAX: 708-358-4623; Empl.: 6; *Sls. Mgr.:* T. Pretto .... **D•1039**

Local Sales Offices & Reps

CA	Valley Center, Team Sls.	619-749-2033
MA	Still River, Still River Technlg.	508-456-3369

INTERNATIONAL EYELETS, INC., 5674 El Camino Real No. L, Carlsbad, CA 92008-9812, Tel: 619-931-1446, 1-800-333-9353, FAX: 619-931-8667; FSC No.: 5325; Empl.: 5; *Sls. Mgr.:* Sally Dalrymple

INTERNATIONAL INSTRUMENTATION, INC., 2282 Townsgate Rd., Westlake Vlg., CA 91361, Tel: 805-495-7673, FAX: 805-379-0701; Empl.: 32; *Dist. Mgr.:* John Mesenbring

INTERNATIONAL INSTRUMENTS, A PRIME TECHNOLOGY COMPANY, Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 150; *Dist. Mgr.:* Keith MacDowall .... **D•1354**

Local Sales Offices & Reps

CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	N. Branford, II Consult Factory	203-481-5721
FL	Lakeland, Munday Sls., Co.	813-858-5606
KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MO	Ferguson, Tech. Sls. Assocs.	314-725-5361
OH	Westlake, Advanced Tech. Assocs.	216-835-5050
PA	Malvern, Stitzer Assocs.	215-644-5500

Local Distributors

CA	Los Angeles, E.I.L. Instrs., Inc.	213-685-7020
CA	Palo Alto, Metermaster	415-960-8500
CA	San Diego, Metermaster	619-560-4841
CA	Sunnyvale, E.I.L. Instrs.	408-245-4320
CO	Denver, E.I.L. Instrs., Inc.	303-534-4160

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FL	Palm Bay, E.I.L. Instrs., Inc.	407-725-8300
GA	Kennesaw, CMI Metermaster	404-425-8902
IL	Bridgeview, E.I.L. Instrs., Inc.	312-430-2292
IL	Glendale Heights, CMI Metermaster	312-351-4554
IN	Indianapolis, E.I.L. Instrs., Inc.	317-545-1373
KY	Louisville, E.I.L. Instrs., Inc.	502-454-3420
LA	New Orleans, Industrial Instr. Works	504-733-8355
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Southbridge, CMI-Metermaster	508-765-1676
MI	Ferndale, Ram Meter Inc.	313-398-6767
MN	Minneapolis, Process Meas. Co.	612-544-4035
NJ	Pensauken, E.I.L. Instrs., Inc.	609-488-0474
NY	Clarence, E.I.L. Instrs.	716-634-8500
NY	Hauppauge, E.I.L. Instrs., Inc.	516-231-6333
NY	Long Island City, Metermod Instr. Corp.	718-726-4850
NY	Rochester, E.I.L. Instrs.	716-586-8251
NC	Charlotte, E.I.L. Instrs.	704-376-2237
OH	Cleveland, Process Measurement Corp.	216-587-3600
OH	Dayton, E.I.L. Instrs., Inc.	513-435-2134
PA	Pittsburgh, E.I.L. Instrs.	412-823-2255
TX	Dallas, E.I.L. Instrs., Inc.	214-357-0297
TX	Garland, CMI Metermaster	214-271-5671
TX	Houston, CMI Metermaster	713-644-1631
TX	Houston, E.I.L. Instrs., Inc.	713-271-3100
VA	Norfolk, E.I.L. Instrs., Inc.	804-855-9553
VA	Springfield, E.I.L. Instrs., Inc.	703-569-2611
WA	Redmond, E.I.L. Instrs., Inc.	206-882-3222
Can	Longueuil, Que., E.I.L. Instrs.	514-651-4844
Can	Mississauga, Toronto, E.I.L. Instrs.	416-624-6660
Can	Toronto, Ont., Versatile Measuring Instrs.	416-239-8161
AZ	Tempe, CMI Metermaster	603-431-0880

INTERNATIONAL LIGHT, 17 Graf Rd., Newburyport, MA 01950-4092, Tel: 508-465-5923, TELEX: 94-7135, FAX: 508-462-0759; Empl.: 19; *Sls. Mgr.:* Bob Angelo; *Dist. Mgr.:* Bob Angelo

INTERNATIONAL MACHINE & TOOL CORP., 115 Maple St., Warwick, RI 02888, Tel: 401-467-6905, FAX: 401-467-5885; Empl.: 35; *Sls. Mgr.:* Peter S. Piscopio

INTERNATIONAL MANUFACTURING SERVICES, 50 Schoolhouse La., Portsmouth, RI 02871-2418, Tel: 401-683-9700, FAX: 401-683-5571; FSC No.: 4$177; Empl.: 32; *Sls. Mgr.:* William Hall **A•1944-1945**

Local Sales Offices & Reps

FL	Satellite Bch., BWS Microwave Mktg.	407-773-6170
GA	Marietta, BWS Microwave Mktg.	404-499-7492
MA	Attleboro, Antex-Overseas Sls.	508-699-6911
PA	Downingtown, Grasso Tech. Sls.	215-458-8967
TX	Double Oak, Carolyn Bender Assoc.	214-539-9461

INTERNATIONAL MICROELECTRONIC PRODUCTS, 2830 N. First St., San Jose, CA 95134, Tel: 408-434-1489, FAX: 408-434-0335

INTERNATIONAL MICROELECTRONICS, P.O. Box 170415, Arlington, TX 76003, Tel: 817-473-1730, FAX: 817-473-0525

INTERNATIONAL MICROSYSTEMS, 521 Valley Way, Milpitas, CA 95035, Tel: 408-942-1001, FAX: 408-942-1051; Empl.: 10; *Sls. Mgr.:* Peter Schade

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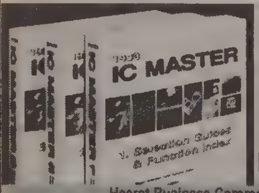

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Local Distributors

CA	Santa Ana, Tech-Ser, Inc.	408-496-1004
CA	Torrance, Tech-Ser, Inc.	213-370-7200
CO	Aurora, R&R Instrmn.	303-340-8728
IL	Chicago, Data Elctrns.	312-283-0300
MA	Waltham, Calibron/Burton Instr.	617-894-6440
MO	Manchester, Universal Precision Instr.	314-394-4693
NY	Rochester, Masline Elctrns.	716-546-5373
TX	Dallas, Textrol Inc.	214-637-6262

INTERNATIONAL POLARIZER, INC., 320 Elm Street, Marlborough, MA 01752, Tel: 508-481-7495, FAX: 508-481-0222; Empl.: 10; *Sls. Mgr.:* Donald Rickert

INTERNATIONAL POWER DC POWER SUPPLIES, INC., 360 Bernoulli Circle, Oxnard, CA 93030-5167, Tel: 805-981-1188, FAX: 805-981-1184; Empl.: 25; *Sls. Mgr.:* Ron Ostlund

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FAX: 617-782-7416

INTERNATIONAL POWER DEVICES INC., 20 Linden St., Boston, MA 02134, Tel: 617-782-3331; Empl.: 150; *Sls. Mgr.:* Russell Mitnik; *Dist. Mgr.:* Cathleen Joyce **D•1751-1755**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Chandler, ELEC-COM	602-893-2930
CA	Corona, Diane Ward	909-279-2838
CA	San Ramon, Synergy Sls.	510-830-0829
CO	Denver, Motion Technlg.	303-757-3003
FL	Maitland, Hawkins Fredrickson Assocs.	407-831-2474
FL	Pompano Beach, Hawkins Frederickson Assoc.	305-979-0330
FL	Tampa, Hawkins Frederickson Assoc.	813-651-1063
GA	Norcross, Macro Mktg.	404-662-5580
IL	Chicago, M. Gottlieb Assocs.	312-775-8620
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MA	Lexington, Kanan Technlgs.	617-861-7300
MN	Minneapolis, Stan Clothier Co.	612-944-6904
NJ	Glen Gardner, Daner-Hayes	800-225-8760
NJ	Haddonfield, Sunday O'Brien	609-429-4013
NY	Massapequa, Daner-Hayes	800-225-8760
NY	Rochester, Indl. Tech. Sls.	716-872-1628
NC	Raleigh, C-Tech Sls.	919-782-8100
OH	Dayton, Electro-Mktg., Inc.	800-338-6856
OR	Beaverton, Pacific Mktg. Specialists Inc.	503-641-9373
TX	Dallas, Seaton Corp.	214-980-9860
TX	Houston, Seaton Corp.	713-731-2649
VA	Richmond, Glasscock Assocs.	804-798-2125
Can	Kanata, Ont., Canadian Mktg. Techlgs.	613-591-9555
Can	Mississauga, Ont., Canadian Mktg. Technlgs.	416-612-0900
Can	Pointe Claire, Que., Canadian Mktg. Technlgs.	514-694-6088

Local Distributors

AL	Huntsville, Future Elctrns., Corp.	205-830-2322
AZ	Phoenix, Future Elctrns., Corp.	602-968-7140
AZ	Tempe, Bell Inds.	602-966-7800
CA	Agoura Hills, Bell Industries	818-879-9494
CA	Chatsworth, Future Elctrns., Corp.	818-772-6240
CA	Cypress, Bell Inds.	714-895-7801
CA	Irvine, Future Elctrns., Corp.	714-250-4141
CA	Los Angeles, Bell Inds.	310-826-6778
CA	Rocklin, Bell Inds.	916-652-0418
CA	San Diego, Future Elctrns., Corp.	619-625-2800
CA	San Jose, Future Elctrns., Corp.	408-434-1122
CA	Santa Anna, Foresight Elctrns.	714-833-2134
CA	Santa Clara, ForeSight Elctrns.	408-980-9700
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Bell Inds.	303-691-9270
CO	Denver, Future Elctrns., Corp.	303-232-2008
CT	Bethel, Future Elctrns., Corp.	203-743-9594
CT	Wallingford, Bell Inds.	203-269-6801
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Altamonte Springs, Future Elctrns., Corp.	407-767-8414
FL	Largo, Future Elctrncs.	813-530-1222
FL	Oldsmar, Applied Power	813-854-4004
GA	Norcross, Applied Power, Inc.	404-263-0421
GA	Norcross, Future Elctrns., Corp.	404-441-7676
IL	Elk Grove Village, Bell Inds.	708-640-1910
IL	Hoffman Estates, Future Electronics	708-882-1255
IL	Roselle, Foresight Elctrns.	708-980-9890
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Columbia, Bell Inds.	410-290-5100
MD	Columbia, Future Elctrns., Corp.	410-290-0600
MA	Andover, Bell Inds.	508-474-8880
MA	Bolton, Future Electronics	508-779-3000
MI	Brighton, Applied Power, Inc.	313-227-3604
MI	Detroit, Future Elctrns., Corp.	313-261-5270
MI	Livonia, L.W.C. Distributors	313-464-7700
MN	Eden Prairie, Future Elctrns., Corp.	612-944-2200
MO	St. Louis, Future Elctrns., Corp.	314-469-6805
NH	Windham, Orion Inds.	603-437-4446
NJ	Marlton, Future Elctrns., Corp.	609-596-4080
NJ	Parsippany, Future Elctrns.	201-299-0400
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Future Elctrns., Corp.	516-234-4000
NY	Rochester, Future Elctrns., Corp.	716-272-1120
NY	Syracuse, Future Elctrns., Corp.	315-451-2371
NC	Charlotte, Future Elctrns., Corp.	704-455-9030
NC	Raleigh, Future Elctrns., Corp.	919-790-7111
OH	Dayton, Bell Inds.	513-435-8660
OH	Mayfield Heights, Future Elctrns.	216-449-6996
OR	Beaverton, Bell Inds.	503-644-3444
OR	Beaverton, Future Elctrns., Corp.	503-645-9454
PA	Philadelphia, Future Elctrns., Corp.	609-778-7600
PA	Trevose, Bell Inds.	215-953-2800
TX	Dallas, Future Elctrns., Corp.	214-437-2437
TX	Dallas, Seaton Elctrns.	214-980-9860
TX	Houston, Future Elctrns., Corp.	713-556-8696
TX	Houston, Seaton Elctrns.	713-731-2649
UT	Midvale, Bell Inds.	801-561-9691
UT	Salt Lake City, Future Elctrns., Corp.	801-972-8489
WA	Bothell, Future Elctrns., Corp.	206-489-3400
WI	Waukesha, Bell Inds.	414-547-8879
WI	Waukesha, Future Elctrns., Corp.	414-786-1884
Can	Calgary, Alb., Future Elctrns., Corp.	403-250-5550
Can	Edmonton, Alb., Future Elctrns., Corp.	403-438-2858
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Can	Quebec City, Que., Future Elctrns., Corp.	418-877-6666
Can	Vancouver, B.C., Future Elctrns., Corp.	604-294-1166

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, FAX: 214-494-2690; Empl.: 200; *Sls. Mgr.:* Barry Papermaster, Mktg. VP

International
Power Sources, Inc.

FAX: 508-879-8669

INTERNATIONAL POWER SOURCES, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7434 **D•2110-2111**

Local Sales Offices & Reps

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CA	Dana Point, Electro Venture South	714-496-5225
CA	Los Altos Hills, H B Mktg.	415-941-4080
FL	Palm Beach Gardens, Graham Assocs., Inc.	407-622-4049
IL	Arlington Hgts., Phoenix Elctrn. Sls.	708-394-4422
KS	Olathe, Tech. Sls. Assocs.	913-829-2800
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Brighton, A P Assocs.	313-229-6550
MN	Minneapolis, Engineering Prods. Assoc., Inc.	612-835-9022
MO	St. Louis, Tech. Sls. Assocs.	314-521-2044
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Jericho, J-Square Mktg.	516-935-3200
NY	Manlius, Smith Tech. Sls.	315-682-1777
NC	Winston-Salem, Murcota	919-722-9445
OH	Cincinnati, KCH Co.	513-931-1686
OR	Portland, Caruso & Camelleri Assocs.	503-246-5439
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9570
WA	Bellevue, Caruso & Camelleri Assoc.	206-455-8811
WI	Brookfield, McMahon Sls., Inc.	414-782-3335

Local Distributors

CA	Redwood City, HdB Elctrns.	415-368-1388
GA	Norcross, Applied Power, Inc.	404-263-0421
MI	Brighton, Applied Power, Inc.	313-227-3604
NH	Windham, Orion Inds., Inc.	603-437-4446
TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Tomball, Wofford Elctrns. Inc.	713-351-2255

International IOR Rectifier

FAX: 310-322-3332

INTERNATIONAL RECTIFIER CORP., 233 Kansas St, El Segundo, CA 90245, Tel: 310-322-3331; Empl.: 2400; *Sls. Mgr.:* Curtis Jones, V.P.; *Dist. Mgr.:* Don Prescott, V.P. .... **B•1526**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Phoenix, Sun State Tech. Sls.	602-220-0595
CA	Fair Oaks, Brooks Tech. Grp.	916-965-3255
CA	Gilroy, Intl. Rectifier	408-848-8467
CA	Mtn. View, Brooks Tech. Grp.	415-960-3880
CA	San Diego, Harvey King, Inc.	619-695-9300
CA	Westlake Village, First Rep	805-373-0887
CO	Englewood, Thorson Rocky Mountain, Inc.	303-773-6300
CT	Fairfield, N.R.G. Ltd., Inc.	203-384-1112
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
FL	Kissimmee, Intl. Rectifier	407-933-2383
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Rolling Meadows, International Rectifier	708-934-0020
IL	Rolling Meadows, Phase II Mktg., Inc.	708-806-1330
IN	Carmel, Tech. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Tech. Mktg. Corp.	219-432-5553
IN	Kokomo, Tech. Mktg. Corp.	317-459-5152
KY	Louisville, Tech. Mktg. Corp.	502-245-7411
MA	Burlington, Nova Sls., Inc.	617-272-5221
MA	Tewksbury, A/D Sls., Inc.	508-851-5400
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	Bridgeton, Hitec Central, Inc.	314-291-5920
MO	Independence, Hitec Central, Inc.	816-796-6684
NJ	W. Caldwell, Tech. Mktg. Grp.	201-226-3300
NM	Albuquerque, Reptronix Ltd.	505-292-1718
NY	Bohemia, Intl. Rectifier	516-244-8047
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NY	Fishkill, Intl. Rectifier	914-896-4262
NY	Melville, Tech. Mktg. Grp.	516-351-8833
NC	Burlington, Intl. Rectifier	919-584-0340
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
NC	Raleigh, Montgomery Mktg., Inc.	919-851-0010
OH	Cincinnati, Luebbe Sls. Co.	513-530-0600
OH	Dayton, Luebbe Sls. Co.	513-438-0490
OH	Northfield, Intl. Rectifier	216-467-0852
OH	Westlake, Luebbe Sls. Co.	216-899-0071
OR	Beaverton, Electra Tech. Sls., Inc.	503-643-5074
PA	Boothwyn, Intl. Rectifier	215-494-5080
PA	Broomal, L. D. Lowery, Inc.	215-356-5300
PA	Pittsburgh, Luebbe Sls. Co.	412-364-0490
TX	Austin, BP Sls.	512-346-9186
TX	Houston, BP Sls.	713-782-4144
TX	Richardson, BP Sls.	214-234-8438
UT	Salt Lake City, Thorson Rocky Mtn., Inc.	801-942-1683
WA	Kirkland, Electra Tech. Sls., Inc.	206-821-7442
WI	Brookfield, International Rectifier	414-784-2480
WI	Wauwatosa, Phase II Mktg., Inc.	414-771-9986
Can	Markham, Ont., Intl. Rectifier	416-475-1897

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902, FAX: 704-264-8865; Empl.: 1700; *Sls. Mgr.:* Hugh Bolen; *Dist. Mgr.:* Hugh Bolen

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, FAX: 305-885-3127; Empl.: 5; *Sls. Mgr.:* Richard L. Winn

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111, FAX: 402-694-6180; Empl.: 45; *Sls. Mgr.:* Wayne Roblee .... **A•1704-1705**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Mission Viejo, EAB Assocs. Inc	714-859-7701
CO	Longmont, Tri-Tech Sls.	303-440-7862
IL	Lemont, Trend Tronics, Inc.	708-972-1166
MD	Laurel, CSDS	301-953-7884
MA	Scituate, Olsen Tech Sls. Inc.	617-545-5101

MI	Milford, Elctrn. Comp. Sls.	313-360-3790
MN	Elk River, Ertech, Inc.	612-441-0602
NE	Omaha, IONEB	402-895-4431
NJ	Manalapan, DMR Mktg.	908-303-0510
NC	Summerfield, Harrington Inds.	919-643-9293
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	Southampton, Campbell Assocs.	215-322-6630
TN	McMinnville, B & D Mktg.	615-473-7155
TX	Ft. Worth, Merlin Elctrns.	817-429-4420

INTERNATIONAL SENSOR TECHNOLOGY, 17771 Fitch St., Irvine, CA 92714, Tel: 714-863-9999, FAX: 714-474-7417; *Sls. Mgr.:* Jack McCann

INTERNATIONAL TECHNOLOGIES, INC., 68 Albany Rd., Warwick, RI 02888, Tel: 401-781-5595, FAX: 401-467-5885; Empl.: 15; *Sls. Mgr.:* R.W. Elsdoerfer

INTERNATIONAL TELECOMMUNICATIONS COMPONENTS, INC., 94 B East Jefryn Blvd., Deer Park, NY 11729, Tel: 516-243-1444, FAX: 516-595-9160; FSC No.: 0E6J8; Empl.: 10; *Sls. Mgr.:* Lloyd Estin

INTERNATIONAL TEST INSTRUMENTS, 3002 Dow Ave., Ste. 110, Tustin, CA 92680, Tel: 714-573-9000, FAX: 714-573-9500; Empl.: 10; *Sls. Mgr.:* Hank Pselos

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495, FAX: 805-967-8199; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth, Mktg. Mgr.

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW), FAX: 415-340-1670; Empl.: 35

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FAX: 206-882-1990

INTERPOINT CORPORATION, 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98052, Tel: 206-882-3100; FSC No.: 50821; Empl.: 500; *Sls. Mgr.:* D.T. Baughman, Dir. of Sls. .... **A•1706-1707; D•2112-2123**

Local Sales Offices & Reps

AL	Huntsville, Novus Grp.	205-534-0044
AZ	Tempe, Gassner & Clark	602-968-9037
TX	Irving, Kite Elctrn. Sls.	214-986-0321
CA	Los Altos, Cain-White & Co.	415-948-6533, 415-948-0115
CA	San Diego, Varigon San Diego	619-576-0100
CA	Woodland Hills, Varigon Inc.	818-594-5080
CO	Parker, TMA/Colorado	303-841-3435
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
GA	Norcross, Novus Grp.	404-263-0320
IL	Elgin, Elctrn. Comp. Intl. Ltd.	708-888-0099, 708-888-0998
IN	Ft. Wayne, Corrao Marsh Inc.	219-482-2725
IN	Greenfield, Corrao Marsh Inc.	317-462-4446
FL	Maitland, Jack Krutek & Assoc.	407-628-4837
MD	Marriotsville, Neal Deoul Assoc.	410-795-5775
MD	Owings Mills, Neal Deoul Assocs.	410-363-4311
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MN	Minneapolis, Intertec	612-921-8443
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
NJ	Flanders, K & R Engrg. Sls.	201-584-5235, 800-631-9362
NY	Quality Comps.	315-682-8885
NC	Cary, Novus Grp.	919-460-7771
OH	Mayfield Village, Arthur H. Baier Co.	216-292-7500
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Houston, Kite Electrn. Sls.	713-469-6729
Can	Calgary, Alb., Cana Rep. Grp. Inc.	403-243-5148
Can	Montreal, Que., Cana Rep Grp. Inc.	514-276-4477
Can	Surrey, BC, Cana Rep Grp. Inc.	604-589-8595
Can	Willowdale, Ont., Cana Rep. Grp. Inc.	416-250-6683

Local Distributors

IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
MO	Earth City, Midwest Tech. Sls.	314-298-8787
UT	Salt Lake City, TMA/Colorado	801-483-1009

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INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (Purdy UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce

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Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Arvada, Arrowhead Sls. Corp.	303-423-5556
FL	Largo, Electrocraft, Inc.	813-544-1766
IL	Palatine, North Central Sls.	708-359-5556
IN	Indianapolis, Gen II Mktg., Inc.	317-848-3083
MA	Milford, Selmark Assocs., Inc.	508-478-9088
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	Bridgeton, AEM, Inc.	314-298-9900
NY	Manhasset, Win-Cor Elctrn. Sls. Corp.	516-627-9474
NY	Rochester, BKT Assocs., Inc.	716-461-9880
OH	Cincinnati, Applied Data Management	513-579-8108
PA	Allison Park, Elctrn. Mktg. Consultant, Inc.	412-366-7187
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
CA	Milpitas, Kent Elctrn. Corp.	408-956-5300
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CO	Littleton, Indelco, Inc.	303-795-3431
CT	Bridgeport, Park Distrs. Inc.	203-366-7200
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Melbourne, Pridmore Corp.	407-727-2491
IL	Rosemont, Advent Elctrns., Inc.	708-297-6200
MA	Ashland, March Elctrns.	508-881-6715
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	Roseville, Chris Elctrns. Distr.	612-631-2647
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	East Brunswick, Brothers Elctrns.	908-238-2200
NM	Albuquerque, Betatron Elctrns.	505-821-1122
NY	Bohemia, March Elctrns.	516-563-6000
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
OH	Englewood, Argent Inds., Inc.	513-836-8633
OH	Englewood, ADS Electra, Inc.	513-836-8636
PA	Exton, VSH Elctrns.	215-363-2250
PA	McKean, Advacom, Inc.	800-678-0512
PA	North Versailles, CMD Elctrns., Inc.	412-678-6020
TX	Allen, Prime Distrbg. Co.	214-231-0170
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Oconomowoc, GW Elctrns. Ltd.	414-567-9445

INTRA-COMPUTER INC., 87-46 Van Wyck Expwy., Jamacia, NY 11418, Tel: 718-297-5500, FAX: 718-297-5518; Empl.: 9; *Sls. Mgr.:* Art Yaglian

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Local Sales Offices & Reps

AL	Huntsville, Currier, Peak & Frazier	205-536-1506
AZ	Phoenix, Shefler-Kahn	602-581-0884
CA	Los Alamitos, Power Specialists	213-594-9418
CA	San Jose, O'Donnell Assocs.	408-456-2950
FL	Orlando, Currier, Peak & Frazier	407-855-0843
GA	Duluth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
MD	Columbia, Delta III	301-730-4700
MA	Canton, Intronics	617-828-4992
MO	Webster Grove, EPI, Inc.	314-962-1411
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Dayton, Thompson & Assocs.	513-435-7733
PA	Camp Hill, Quick Response Tech Sls.	717-763-9577
PA	Camp Hill, Quick Response Tech. Sls.	717-763-9577
TN	Smyrna, Currie, Peak & Frazier	615-459-0743
TX	Richardson, Scientific Sls.	214-231-6541
VA	Midlothian, Delta III	804-379-1816
WI	Milwaukee, Coombs Assoc.	414-351-6123
Can	Toronto, Strategic Elctrns.	416-620-5381

ION PHYSICS CORPORATION, 11 Industrial Way, Atkinson, NH 03811, Tel: 603-893-6687, FAX: 603-893-6729

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935, FAX: 412-831-9580; Empl.: 50; *Sls. Mgr.:* Larry Swift

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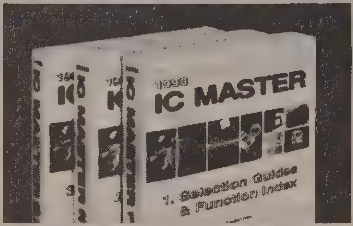

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Local Sales Offices & Reps

AL	Huntsville, RO Whitesell	205-883-5110
AZ	Mesa, SW Sls.	602-345-8080
CA	Los Gatos, Luscombe Engrg. Co. North	408-370-2020
CA	Montrose, Luscombe Engrg. Co. South	818-249-9000
CO	Westminster, Straube	303-426-0890
CT	Branford, Coakley Boyd & Abbett Inc.	203-481-2218
FL	Boca Raton, South Atlantic Comp. Sls.	407-391-1034
FL	Orlando, South Atlantic Comp. Sls.	407-857-3650
FL	Seminole, South Atlantic Comp. Sls.	813-595-6397
GA	Norcross, South Atlantic Comp. Sls.	404-447-6154
IL	Itasca, Circuit Sls. Inc.	708-773-0200
IN	Ft. Wayne, RO Whitesell	219-489-0588
IN	Indianapolis, RO Whitesell	317-876-9000
IN	Kokomo, RO Whitesell	317-457-9127
IA	Cedar Rapids, CH Horn & Assocs.	319-393-8703
KS	Lenexa, Midtec Assocs. Inc.	913-541-0505
MA	Framingham, Coakley Boyd & Abbett Inc.	508-820-0800
MA	W. Bridgewater, Coakley Boyd & Abbett Inc.	508-559-6700
MI	Grand Blanc, RO Whitesell	313-695-0770
MI	Grand Rapids, RO Whitesell	616-942-5420
MI	Southfield, RO Whitesell	313-352-5454
MI	St. Joseph, RO Whitesell	616-983-7337
MN	Minneapolis, Tecteam Sls.	612-854-6616
MO	St. Louis, J G Macke Co.	314-432-2830
NJ	Hackensack, Coakley Boyd & Abbett Inc.	201-440-4114
NM	Albuquerque, SW Sls.	505-899-9005
NY	E. Syracuse, Electra Sls. Corp.	315-463-1248
NY	Rochester, Electra Sls. Corp.	716-427-7860
NC	Charlotte, South Atlantic Comp. Sls.	704-525-0510
NC	Raleigh, South Atlantic Comp. Sls.	919-859-9970
OH	Cincinnati, RO Whitesell	513-528-5644
OH	Cleveland, RO Whitesell	216-447-9020
OH	Columbus, RO Whitesell	614-888-9396
OH	Dayton, RO Whitesell	513-298-9546
OR	Tigard, Halbar-RTS Inc.	503-624-6862
PA	Broomall, LD Lowery Inc.	215-356-5300
PA	Pittsburgh, RO Whitesell	412-963-6161
TN	Knoxville, RO Whitesell	615-694-9476
TX	Arlington, ION Assocs., Inc.	817-695-8000
TX	Austin, ION Assocs., Inc.	512-794-9006
TX	Houston, ION Assocs., Inc.	713-537-7717
UT	Salt Lake City, Straube	801-263-2640
WA	Redmond, Halbar-RTS Inc.	206-882-0990
WI	Brookfield, Circuit Sls. Inc.	414-784-7773
Can	Mississauga, Ont., CMT Renmark	416-612-0900

Local Distributors

AZ	Scottsdale, Spirit Elctrns. Inc.	602-998-1533
CA	Chatsworth, Passive Comps. Inc.	800-634-3462
CA	San Diego, Neumann Elctrns.	619-695-3005
CO	Aurora, Capstone	303-375-1300
FL	Boca Raton, NRC	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Hillside, Schuten Elctrns.	708-544-9600
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, JACO Elctrns.	301-995-6620
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
NJ	Moorestown, Marlac Elctrns.	609-234-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, JACO Elctrns., Inc.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Rome, Rome Elctrns. Inc.	315-337-5400
NY	Valley Stream, L&S Elctrns.	516-561-2474
NC	Wilmington, Justin Elctrns.	919-763-1234
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Bell Inds. Inc.	513-435-8660
OH	Dayton, Stotts Friedman	513-298-5555
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Addison, JACO Elctrns.	214-733-4300
TX	Richardson, Bell Inds. Inc.	214-690-0466
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Pointe-Claire, Que., Future Elctrns.	514-694-7710
KY	Versailles, RO Whitesell	605-873-1182

IRC-SHALLCROSS, U.S. Hwy. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463, FAX: 919-934-5186; FSC No.: 54294; Empl.: 150; *Sls. Mgr.:* Hugh Bolen

See IRC-Shallcross for Local Sales Reps. and Distributors

IRONWOOD ELCTRNS., INC., P.O. Box 21-151, St. Paul, MN 55121, Tel: 612-431-7025, FAX: 612-432-8616; Empl.: 6; *Sls. Mgr.:* Betty F. Fedde; *Dist. Mgr.:* Paul Jasmin

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 508-667-7110; Empl.: 10

ISC CARDIAN ELECTRONICS INC., See Cardion, Inc., A Siemens Co.

ISKRA ELECTRONICS, INC., 155 Dupont St., Plainview, NY 11803, Tel: 516-349-0222, TELEX: 221527, FAX: 516-349-7642; *Sls. Mgr.:* Debbie Gremito ... **A•1085, 2146; B•1364**

Local Sales Offices & Reps

CA	Chula Vista, Inter Elctrns.	619-476-0577
CT	Groton, Primary Source	203-445-4968
NM	Albuquerque, FP Sls.	505-345-5553
IN	Indianapolis, Insul Reps.	317-251-1994
LA	Hammond, Design Mktg. of LA, Inc.	504-542-1115
MA	Lawrence, Primary Source	508-682-5600
AZ	Tempe, F P Sls.	602-894-5303
MO	Grandview, R.R. Burton & Assoc.	816-763-5385
NH	Hampton, Primary Source	603-926-8044
GA	Alpharetta, R A Sls.	404-442-6749
NY	North Port, R. P. Luce & Co.	516-754-5064
NC	New Bern, R A Sls.	919-244-2672
OH	Mentor, Sales Plus	216-942-7811
PA	Montgomeryville, Quick Response	215-362-9225
SC	Easley, R A Sls.	803-859-1859
TN	Knoxville, Insul Reps	615-691-7586

Local Distributors

MA	Billerica, Baldwin Comps. Ctr.	508-667-6710
NJ	Westwood, Seacor	201-666-5600
NY	Ronkonkoma, Baldwin Comps.	516-588-5700

ISLAND COMPONENTS GROUP, 340-A Central Ave., Bohemia, NY 11716, Tel: 516-563-4224, FAX: 516-563-4363; Empl.: 10; *Sls. Mgr.:* Roy A. Koch

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FAX: 516-937-3840

ISL PRODUCTS INT'L, LTD., 235 Robbins La., Ste. 270, Syosset, NY 11791-6093, Tel: 516-937-3475, 800-626-6116; Empl.: 10; *Sls. Mgr.:* Ken Kawaller .... **A•2087, 2362; C•1354, 1753; D•1041**

Local Sales Offices & Reps

IN	Indianapolis, C.C. Electro Sales	317-921-5000, 800-423-7799
KS	Chanute, Mi Ja Sls. Co.	316-431-1444
MN	St. Paul, Countryman Assoc.	612-645-9151

ISOCOM INC., 274 E. Hamilton Ave., Ste.E, Campbell, CA 95008, Tel: 408-370-2212, FAX: 408-370-2309; *Sls. Mgr.:* Stephen Parry; *Dist. Mgr.:* Glenda Rees

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOTEK CORPORATION, 566 Wilbur Ave., Swansea, MA 02777, Tel: 508-673-2900, FAX: 508-676-0885; Empl.: 4; *Sls. Mgr.:* William Poisson .... **A•1953-1955**

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ISOTEMP RESEARCH, INC., P.O. Box 3389, Charlottesville, VA 22903, Tel: 804-295-3101; FSC No.: 031785; Empl.: 65; *Sls. Mgr.:* Andrew Bell .... **A•1410-1411**

Local Sales Offices & Reps

CA	Fremont, Edward Blake Assocs.	510-770-9058
CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	San Diego, Qualtronics	619-695-0118

IL	Lemont, Trend-Tronics	708-972-1166
IL	Woodridge, Trend-Tronics	312-985-0626
KS	Lenexa, Mid-Tec Assocs.	913-541-0505
MD	Columbia, G Squared Technologies	410-730-9209
MN	Columbia, G Squared Technlgs.	301-730-9209
MO	St. Louis, Mid-Tec Assocs.	314-275-8666

ITEK ENCODER, See BEI Motion System/ITEK Encoder Div.

ITF CORP., P.O. Box 543, Buford, GA 30518, Tel: 404-945-3844, FAX: 404-945-7766; Empl.: 2; *Sls. Mgr.:* Michael Wegner; *Dist. Mgr.:* Michael Wegner

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, FAX: 607-272-4550; Empl.: 100

ITI FERROTEC, 131 Stedman St., Chelmsford, MA 01824, Tel: 508-452-0212, FAX: 508-452-0104 .... **C•1597**

ITL CIRCUITS, 90 Don Park Road, Markham, Ontario, Canada L3R 1C4, Tel: 416-475-6658, 416-492-9307, FAX: 416-475-5097; FSC No.: FSCM 38747; Empl.: 104; *Sls. Mgr.:* Derk Wissink

ITT CANNON, 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, TELEX: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 1500; *Sls. Mgr.:* Richard Torson; *Dist. Mgr.:* Richard Torson

ITT CANNON/SEALECTRO, 585 East Main St., New Britian, CT 06051, Tel: 203-223-2700, TELEX: 71-425-501, FAX: 203-225-2781; FSC No.: 98291; Empl.: 350; *Sls. Mgr.:* Ray Champi; *Dist. Mgr.:* Karen Muratori

ITT

FAX: 714-727-2109

ITT COMPONENTS, ITT Corporation, 18 Technology Dr., Ste. 200, Irvine, CA 92718, Tel: 714-727-3001; FSC No.: 61725; Empl.: 10; *Dist. Mgr.:* J. Harrison .... **A•2147; B•1527-1535**

Local Sales Offices & Reps

AL	Huntsville, Mtn. Mktg.	205-881-3937
AZ	Phoenix, Shefler-Kahn	602-581-0884
CA	Burbank, Darco	818-504-2425
CA	San Jose, Vernexx	408-972-9072
CA	San Marcos, Falcon	619-591-0504
CO	Denver, Promotech	303-692-8484
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Orlando, Bolton	407-856-0612
FL	St. Petersburg, Bolton	813-864-2294
GA	Norcross, Mtn. Mktg.	404-448-5594
IL	Inverness, Heartland Tech. Sls.	708-358-6622
IN	Ft. Wayne, M/S Sls.	219-436-3023
IN	Indianapolis, M/S	317-881-0110
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MD	Lutherville, DGR	301-583-1360
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, Elctrn. Sources Inc.	313-227-3598
MN	St. Louis Pk., Neotech	612-545-5656
MO	Maryland Hgts., Thunderbird Tech. Sls.	314-298-8940
NJ	Mt. Laurel, Wyck Mktg.	609-727-1070
NY	Manhasset, Win Cor Elctrns.	516-627-9474
NY	Victor, Net Sls. Co.	716-924-1844
NC	Chapel Hill, Mtn. Mktg.	919-933-0388
OH	Centerville, Omega Sls.	513-434-5507
OH	Cleveland, Omega Sls.	216-360-9400
OK	Broken Arrow, DJ Sls.	918-258-1445
TX	Austin, DJ Sls.	512-258-3002
TX	Dallas, DJ Sls.	214-783-8876
TX	Houston, DJ Sls.	713-690-2640
UT	Bountiful, Anderson Assoc.	801-292-8991
WA	Camas, EMG	206-834-6548
WA	Redmond, EMG	206-882-0962
WI	Brookfield, Heartland	414-789-6860

Local Distributors

AL	Huntsville, Time	800-772-8638
AL	Madison, Gateway Megatech	205-464-9300
AZ	Tempe, Cypress	602-966-2256
AZ	Tempe, Richey Impact Elctrns.	800-421-7258
AZ	Tempe, Time	800-772-8638
CA	Agoura Hills, Cypress	818-597-9491
CA	Costa Mesa, Cypress	714-549-2424
CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, Richey Impact Elctrns.	714-895-0060
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Irvine, ITT Multi Comps.	714-727-4001
CA	Milpitas, Sierra West	408-945-1050
CA	Oakland, Brill	510-834-5888
CA	Sacramento, Integrated Elctrns.	916-363-6030
CA	San Diego, Cypress	619-535-0011
CA	San Diego, Richey Impact Elctrns.	800-772-8638
CA	San Diego, Time/Harper	800-772-8638
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	San Jose, ITT Multicomps.	408-453-1404
CA	Santa Clara, Cypress	408-980-8400
CA	Santa Clara, Richey Impact Elctrns.	408-727-7411
CA	Santa Monica, Master Distrs.	310-452-1229
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Sunnyvale, Time	800-772-8638
CA	Tustin, Time	800-772-8638
CA	Woodland Hills, Time	800-772-8638
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Time	800-772-8638
CT	New Haven, Greene Shaw Co.	203-265-3333
CT	Southbury, Time	800-772-8638
FL	Ft. Lauderdale, Time	800-772-8638
FL	Orlando, Time	800-772-8638
FL	Pompano Bch., Peerless Radio	305-973-4141
FL	Sunrise, All American	305-572-7999
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GA	Roswell, Gateway Megatech	404-642-8787
IL	Chicago, Leeds Electro Comps.	312-625-3800
IL	Hoffman Estates, Integrated Elctrns.	708-843-2040
IL	Schaumberg, Time	800-772-8638
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, CSE	317-879-9119
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Columbia, Peerless Radio	410-997-1717
MD	Columbia, Time	800-772-8638
MD	Jessup, TREEKO Sls.	301-470-3300
MD	Rockville, All American	301-251-1205
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Peabody, Time	800-772-8638
MA	Wakefield, All American	617-246-2300
MA	Walpole, Richey Impact Elctrns.	508-668-8200
MA	Woburn, Control Design Supp.	617-932-9404
MI	Livonia, Key Elctrns.	313-489-5455
MN	Eden Prairie, All American	612-944-2151
MN	Eden Prairie, Cypress	612-934-2104
MN	Edina, Time	800-772-8638
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Control Design Supp.	612-721-1628
MN	Plymouth, Leeds	612-557-1277
MO	Manchester, Time	800-772-8638
NH	Merrimac, Brevan Elctrns.	603-429-1900
NJ	Marlton, Time	800-772-8638
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	W. Berlin, GCI	609-768-6767
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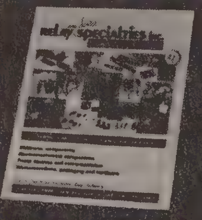

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TX	Dallas, Electra Reps, Inc.	214-248-3852
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GA	Norcross, Future Elctrns., Inc.	404-441-7676
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IL	Schaumburg, Future Elctrns.	312-882-1255
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NY	New York, Breen Assocs.	201-696-8683
OH	Columbus, MacKellar Assoc.	614-848-3552
OR	Portland, TAC Assoc.	503-648-6110
TX	Dallas, REM Comps.	214-234-1069

JAYCOR, P.O. Box 85154, San Diego, CA 92186, Tel: 619-453-6580, FAX: 619-535-9763; FSC No.: 3M687; Empl.: 800; *Sls. Mgr..* Steven Lutjens

JB ELECTRONIC TRANSFORMERS INC., 2310 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, FAX: 312-342-9098; FSC No.: 11700; Empl.: 150; *Sls. Mgr.:* Donald M. Gould

JBM ELECTRONICS, INC., 1 Commerce Drive, Bedford, NH 03110-6802, Tel: 603-623-0222, FAX: 603-623-0446; FSC No.: 62694; Empl.: 40; *Sls. Mgr.:* Susan Bennett; *Dist. Mgr.:* Susan Bennett .... **A•1567, 2363; D•2127**

Local Distributors

FL	Casselberry, Aerco, Inc.	407-695-0600
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
NH	Atkinson, Astrum Elctrns.	603-898-3399
SC	Lamar, Aerco, Inc.	803-326-5463
Can	Markham, Ont., SEMAD;Div. of DGW	416-475-8500

J-B-T INSTRUMENTS, INC., Box 1818, New Haven, CT 06508-1818, Tel: 203-776-1111, FAX: 203-624-8142; Empl.: 25; *Sls. Mgr.:* Lillian Sharron

JC SYSTEMS, INC., 11535 Sorrento Valley Rd. Ste. 400, San Diego, CA 92121, Tel: 619-793-7117, FAX: 619-793-1931; Empl.: 12; *Sls. Mgr.:* Ralph Aniunas

JDK CONTROLS, INC., 424 Crown Point Circle, Grass Valley, CA 95945-0512, Tel: 916-273-4608, FAX: 916-273-0769; Empl.: 50; *Sls. Mgr.:* Reece Kendall .... **A•2088-2091**

Local Sales Offices & Reps

NJ	Matawan, Tim Reilly Assocs.	908-566-4555

JEFFERS ELECTRONICS, 1331 W. Fairway Dr., Nogales, AZ 85621, Tel: 602-281-4925, FAX: 602-281-0090; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

JEMA

FAX: 708-251-3738

JEMA, 1000 Skokie Blvd., Wilmette, IL 60091, Tel: 708-251-3600; Empl.: 10; *Sls. Mgr.:* Dale R. Thompson; *Dist. Mgr.:* Chris Gantz .... **D•1024-1025, 1042-1047**

JEMTEC ELECTRONICS CO.,SEE SCIENTIFIC COLUMBUS CO.

W. S. JENKS & SON, 1933 Montana Ave. NE, Washington, DC 20002, Tel: 202-529-6020, 800-673-8199, FAX: 202-832-3411

JENSEN TOOLS, INC., Stanley Works, 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, FAX: 800-366-9662; Empl.: 250; *Sls. Mgr.:* Patrick Acton

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 908-353-5700, FAX: 908-353-1021; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo .... **D•1756-1760**

JERSEY SPECIALTY CO., See JSC Wire & Cable

JETA
POWER SYSTEMS, INC

FAX: 310-426-2417

JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 310-427-0095; Empl.: 110 .... **D•1762-1763**

Local Sales Offices & Reps

AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Santa Clara, Gagner-Toomey Assoc.	408-244-2200
CO	Golden, J.F. Hurlbut Co.	303-279-7796
CT	Vernon, George Urban & Assocs.	617-329-4068
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280
KS	Olathe, ATS, Inc.	913-782-8702
MA	Dover, The Urban Grp.	617-329-4068
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
MO	Bridgeton, Advanced Tech. Sls.	314-291-5003
NY	Fairport, Hi-Tec Sls.	716-223-5922
NY	Franklin Square, Cooper-Simon Emtec	516-489-0404
OH	Mentor, Sls. Plus	216-942-7811
TX	Dallas, MGR Elctrns.	214-238-5246
Can	Montreal, Empro Sls.	514-341-6420

JETTRON PRODUCTS INC., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571, FAX: 201-887-4182; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* Ben Latawiec **C•1358-1359**

Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301-9619, Tel: 509-297-4294, 800-532-2737; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 125; *Sls. Mgr.:* Carrie Glover **A•1722-1723; D•1275**

Local Sales Offices & Reps

AZ	Scottsdale, TDSI/AZ	602-998-2444
CA	Coronado, RF Assocs.	619-575-9011
CA	San Jose, MC Microwave, Inc.	408-446-4100
CO	Franktown, Exelcis	303-841-4305
FL	Stuart, Microwave Comps.	407-286-4455
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Chelmsford, Matrix Sls.	508-459-4000
NY	Melville, RF Elctrn. Sls.	516-420-8890
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Clifton Elctrns.	703-360-9129
WA	Seattle, Datacom Assocs.	206-285-2525
Can	Ottawa, Ont., Giga-Tron Assocs., Ltd.	613-225-4090

Local Distributors

MA	New England Area, East Coast Microwave	617-279-0900

JH AMERICA, INC., JBT International, Inc., 20809 Higgins Court, Torrance, CA 90501, Tel: 310-328-0051, FAX: 310-328-0057; *Sls. Mgr.:* Mark Zimmermann **C•1754-1755**

Local Sales Offices & Reps

CA	Palm Springs, R D Sls.	619-324-5044
CA	Sunnyvale, Logan Sls.	408-732-6020
FL	Longboat Key, VSI, Inc.	813-383-1440
MI	Ann Arbor, VSI, Inc.	313-995-1200
NY	Rochester, VSI, Inc.	
NC	Raleigh, VSI, Inc.	919-870-0060
RI	Coventry, VSI, Inc.	401-826-0040

Local Distributors

AZ	Scottsdale, Memory Plus Dist.	602-820-8819
AZ	Tempe, Comtel Corp.	602-829-9471
CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Chula Vista, Sonika Elctrn.	619-424-9190
CA	San Diego, Deco Elctrns.	619-693-1595
FL	Orlando, Computel	407-682-3957
IL	Elk Grove Vlg., Lutubusiness Sys.	708-803-6466
NJ	Kennilworth, Computel	201-241-5400
NC	Charlotte, Computel	704-376-4414
OH	Dayton, Tech. Dvc.	513-890-6811

JKL
COMPONENTS
CORPORATION

FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St., Pacoima, CA 91331-2376, Tel: 818-896-0019; FSC No.: 55335; Empl.: 35; *Sls. Mgr.:* Ernie Soares; *Dist. Mgr.:* Ernie Soares **B•1168**

Local Sales Offices & Reps

AL	Huntsville, Southern Sls.	205-830-9322
CA	Burbank, Darco Elctrn. Sls.	818-504-2425
CT	W. Hartford, Conti-Younger & Assoc.	203-521-0602
IL	Elk Grove, Control Sls.	708-595-2110
NY	Henrietta, CMJ, Inc.	716-334-3277
MD	Baltimore, Universal Elctrns.	301-461-9946
MA	Burlington, Conti-Younger	617-273-1582
MI	Farmington Hills, Clark Sls.	313-553-0610
MN	Bloomington, Mumco	612-854-4161
OH	Cincinnati, Clark Sls. Co.	513-922-7555
OH	Painsville, Clark Sls. Co.	216-247-7848
PA	Philadelphia, Check Assoc.	215-487-3007
TX	Irving, Kite Elec. Sls.	214-986-0321

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
CA	San Diego, Richie/Impact Sls.	619-271-4511
AZ	Phoenix, Capital Elctrns.	602-252-5897
CA	Garden Grove, Richey Western	714-895-0060
CA	Gardena, Cal. Switch & Signal	213-770-2330
CA	San Diego, Richie/Impact Sls.	619-271-4511
CA	Santa Clara, Richey/Western Elec.	408-727-7411
CA	Sunnyvale, Target Elec.	415-961-1170
CT	Wallingford, Sager Elec.	203-265-4600
FL	Ft. Lauderdale, Powell Elec.	305-484-8377
GA	Norcross, Specialty Distrbg. Co.	404-446-3190
IL	Wheeling, Hawk Elec.	312-459-4030
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KS	Lenexa, Amer. Elec. & Cable	913-469-0099
MD	Kensington, Marine Air Supp.	301-949-1353
MD	Rockville, M S Elctrns.	301-340-6400
MA	Hingham, Sager Elec.	617-749-6700
MA	Westborough, Powell Elec.	617-366-6100
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Richland, ATR Ent.	314-765-5219
MN	Fridley, Voyager Elec.	612-571-7766
NJ	Clifton, Vantage Comps.	201-777-4100
NM	Albuquerque, Walker Elec. Supply	505-883-2992
NY	Apalachin, Rogan Elec.	607-625-2949
NH	Salem, Sager Elec.	603-898-1348
NC	Greensboro, Hammond	919-275-6391
OH	Cincinnati, Schuster Elec.	216-425-8134
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	Bristol, Aim Elec.	215-785-3500
PA	Philadelphia, Powell Elec.	215-365-1900
TN	Chattanooga, Specialty Distr. Co.	615-624-1040
OH	Yellow Springs, Electro-Shield	513-767-1054
TX	Ft. Worth, T & S. Supp.	817-248-4781
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Oshkosh, Electronic Inds.	414-235-8930

JMJ TECHNICAL PRODS., 517 Kimball Turn, Westfield, NJ 07090, Tel: 201-589-4257, FAX: 908-789-2447; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut **C•1531**

JMK
INCORPORATED

FAX: 603-886-4115

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: 603-886-4100; Empl.: 100; *Sls. Mgr.:* J. Kennedy **A•1596-1597**

Local Sales Offices & Reps

CA	Woodland Hills, Cummings & Assoc. South	818-340-6035
MN	St. Paul, Arko Sls.	612-777-7454

JM TRANSFORMER CO., INC., 112 Florida St., Farmingdale, NY 11735, Tel: 516-293-0475, FAX: 516-293-3923; Empl.: 18; *Sls. Mgr.:* J. Millman **A•2364-2369**

JOBMASTER CORP., 9010 Liberty Rd., P.O. Box 207E, Randallstown, MD 21133-0207, Tel: 410-655-1400, 1-800-642-1400, FAX: 410-521-5461; Empl.: 16 **A•1320**

JOEMEX ELECTRICS, 19 Hammond 508, Irvine, CA 92718, Tel: 714-855-4472

JOHANSON DIELECTRICS, INC., 15191 Bledsoe St., Sylmar, CA 91342, Tel: 818-364-9800, FAX: 818-364-6100; Empl.: 300 **A•1089**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls. Inc.	205-533-1735
AZ	Tempe, Reptronix, Inc.	602-230-2630
CA	Costa Mesa, Richland Tech. Sls.	714-646-6640
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
CT	Waterbury, Compak Inc.	203-753-6431
FL	Ft. Lauderdale, VG Sales Co.	305-938-4333
FL	Altamonte Springs, VG Sales Co.	407-831-8688
FL	Largo, VG Sales Co.	813-536-7787
GA	Norcross, Elctrn. Sls. Inc.	404-448-6554
IL	Lisle, WG Controls	708-963-5954
IN	Indianapolis, M & L Elctrns.	317-359-4742
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Columbia, PSA South	301-730-0359
MA	Hudson, Compak Inc.	508-568-0331
MI	Farmington, JP Bergin Assocs.	313-471-7940
MN	St. Paul, Cahill, Schmitz & Cahill, Inc.	612-646-7217
MO	Florissant, Spectrum Sls.	314-921-1313
NM	Albuquerque, Reptronix, Inc.	505-292-1718
NY	Apalachin, T Squared Elctrns.	607-625-3983
NY	Bellmore, Compar New York Inc.	516-221-7300
NY	Syracuse, T Squared Elctrns.	315-463-8592
NY	Victor, T Squared Elctrns.	716-924-9101
NC	Cary, Elctrn. Sls., Inc.	919-467-8486
NC	Charlotte, Elctrn. Sls., Inc.	704-543-8705
OH	Columbus, Dolfuss-Root & Co.	614-885-4844
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Westlake, Dolfuss-Root & Co.	216-899-9370
OR	Portland, Caruso & Camelleri Assoc.	503-246-5439
PA	Trevose, PSA, Inc.	215-245-0513
TX	Arlington, Ion Assocs., Inc.	817-695-4905
TX	Austin, Ion Assocs., Inc.	512-794-9006
TX	Houston, Ion Assocs., Inc.	713-537-7717
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Oakton, PSA South	703-281-1806
PR	Mayaquez, V.G. Sls.	809-831-4050
Can	Kanata, Ont., J-Squared Technlgs.	613-592-9540
Can	Rexdale, Ont., J-Squared Technlgs.	416-674-0927

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
CA	Agoura Hills, Bell Inds.	818-879-9494
CA	Carson, Newark Elctrns.	213-516-6511
CA	Cypress, Bell Inds.	714-895-7801
CA	El Toro, Pace Elctrns.	714-588-2345
CA	Foster City, Newark Elctrns.	415-572-8300
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	Irvine, Kelex	714-863-1230
CA	Los Alamitos, SEMI DICE	213-594-4631, 714-952-2216
CA	Los Angeles, Penstock	213-383-6100
CA	Rocklin, Bell Inds.	916-652-0414
CA	San Diego, Bell Industries	619-268-1277
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Jose, Co-Linear Sls.	408-441-6566
CA	Santa Clara, Pace Elctrns.	408-748-3748
CA	Santa Clara, SEMI DICE	408-980-9777
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Capacitor Connection	408-737-8985
CA	Sunnyvale, Penstock	408-730-0300
CA	Van Nuys, C.W. Swift	818-989-1133
CA	Yorba Linda, Corona Elctrns.	714-283-8185
CO	Denver, Bell Inds.	303-691-9010
CO	Denver, Newark Elctrns.	303-757-8531
CT	Bloomfield, Newark Elctrns.	203-243-1731
CT	Wallingford, Bell Inds.	203-269-6801
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Orlando, Newark Elctrns.	407-896-8350
FL	Palm Bay, Penstock	407-724-5300
FL	Pompano Bch., ASAP Elctrns.	305-975-2477
GA	Atlanta, Penstock	404-951-0300
GA	Norcross, Bell Inds.	404-446-7167
IL	Chicago, Newark	312-784-5100
IL	Elk Grove Village, Bell Inds.	708-640-1910
IL	Palatine, Penstock	708-934-3700
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
KS	Olathe, Penstock	913-829-9330
MD	Columbia, Bell Inds.	410-290-5100
MA	Andover, Bell Inds.	508-474-8880
MA	Marborough, Penstock	508-624-7300
MA	Middleboro, Glynn Elec. Inc.	508-947-4262
MA	South Easton, Semi Dice	508-238-8344
MN	Hibbins, Minntech	218-262-5227
MN	Minneapolis, Newark Elctrns.	612-331-6350
MS	Jackson, Newark Elctrns.	601-956-8300
NH	Atkinson, Astrum	603-898-3399
NJ	Fairfield, Bell Inds.	201-625-7777
NJ	Fairfield, Micross Comps.	201-227-8007
NJ	Fairfield, Penstock	201-808-1414
NJ	Fairfield, Prime Comps.	516-244-8190
NJ	Rockaway, NASCO	201-227-6060
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Central Islip, Semi Dice, Inc.	516-234-7676
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727, 415-961-5414
NY	Sodus, Pace Elctrns.	800-228-7223
OH	Dayton, Bell Inds.	513-435-8660
OR	Beaverton, Bell Industries	503-644-1500
PA	Trevose, Bell Inds.	215-953-2800
TX	Allen, Prime Distr.	214-542-7915
TX	Allen, Prime Distribution	214-542-7915
TX	Dallas, Penstock	214-701-9555
TX	Garland, Newark Elctrns.	214-487-8144
TX	Richardson, Bell Inds.	214-690-0466
UT	Midvale, Bell Inds.	801-561-9691
WA	Bellevue, Penstock	206-454-2371
WA	Redmond, Bell Inds.	206-867-5410
WI	Waukesha, Bell Industries	414-547-8879

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 **A•1088**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Reptronix, Ltd.	602-230-2630
CA	Los Angeles, RF Assocs., Inc.	213-478-1586
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890,801-263-2640(UT
CT	Waterbury, Compak, Inc.	203-753-6431
FL	Ft. Lauderdale, VG Sls.	305-938-4333
FL	Largo, VG Sls.	813-536-7787

IL	Lisle, W.G. Controls	708-963-5954
IN	Kokomo, Schillinger Assocs.	317-457-7241
IA	Hiawatha/Cedar Rapids, ARD Sales Co.	319-393-6392
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Hudson, Compak, Inc.	508-568-0331
MN	St. Paul, Cahill, Schmirz & Cahill, Inc.	612-646-7217
MO	St. Louis, Midtec Assocs.	314-275-8666
NM	Albuquerque, Reptronix Inc.	505-292-1718
NY	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Syracuse, L.D. Allen, Inc.	315-487-8387
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Dayton, Scott Elect. Inc.	513-294-0539
PA	Trevose, P.S.A.	215-245-0513
TX	Austin, W. Pat Fralia & Assocs.	512-835-7911
TX	Euless/Ft. Worth, W. Pat Fralia & Assocs.	817-267-3577
TX	Houston, W. Pat Fralia & Assocs.	713-772-1572
VA	Oakton, PSA South	301-953-4884
WA	Seattle, Northmar	206-524-5170
Can	Montreal, A. C. Simmonds, LTD.	514-466-5250
Can	Toronto, A. C. Simmonds, LTD.	416-839-8041

Local Distributors

CA	Sunnyvale, Penstock	408-730-0300
CA	Van Nuys, C.W. Swift	818-989-1133
FL	Miami, All American	305-621-8282
FL	Winter Pk., Pelcor	407-644-1594
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Indianapolis, Bell Inds.	317-875-8200
MD	Beltsville, Resco/Washington	301-937-9100
MA	Seekonk, M-Squared	508-761-5490
MO	Baltimore, Resco/Baltimore	301-931-8200
NJ	Rockaway, Tonar	201-586-9000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Ft. Worth, PATCO Supplies	817-429-8596
Can	St. Laurent, Q.C., Braydon Elctrns.	514-332-5650
Can	Willowdale, Electro Sonic	416-494-1555

JOHNSON, E. F., CO., 299 Johnson Ave., Waseca, MN 56093, Tel: 1-800-247-8256, FAX: 507-835-6287; Empl.: 800; *Sls. Mgr.:* Kevin Lohmann; *Dist. Mgr.:* Kevin Lohmann

JOHNSON CONTROLS BATTERY GROUP, INC., 900 East Keefe Ave., Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 250; *Sls. Mgr.:* James L. Winistorfer, Dir. Sls. & Mktg.

JOHNSON YOKOGAWA CORP., 4 Dart Road, Newnan, GA 30265, Tel: 404-254-0400, FAX: 404-254-0928; Empl.: 700; *Sls. Mgr.:* Chuck Micallef

JOLO INDUSTRIES, INC., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, FAX: 714-554-0306; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. .... **C•1360-1361**

Local Sales Offices & Reps

AZ	Scottsdale, JK & Assocs.	602-990-8804
CA	Los Angeles, Quattro Sls. Assocs.	213-372-4221
CA	Orange County, Quattro Sls. Assocs.	800-735-4510
CA	Pleasanton, Leddy Assocs.	510-417-1033
CA	San Diego, Quattro Sls. Assocs.	619-581-3093
CA	San Fernando Valley, Quattro Sls. Assocs.	805-523-2978
FL	Longwood, Mathias Assocs., Inc.	407-682-1700
IL	Schaumburg, Terry McNulty & Assocs.	708-980-9868
MA	Reading, Lincoln Tech. Sls.	617-944-9594
MI	Rochester Hills, Geotronix, Inc.	313-373-4334
NJ	Fairfield, Brunetta Mktg. Svcs.	201-227-2522
OH	Cleveland, Geotronix Mktg. Assocs.	216-659-6100
OH	Trotwood, Geotronix, Inc.	513-854-5939
OR	Portland, Evergreen Mktg. Grp.	503-598-7667
PA	Allison Park, Geotronix, Inc.	412-487-1770
WA	Edmonds, Evergreen Mktg. Grp. Inc.	206-485-8063
Can	Nepean, Ont., Tech-Trad, Inc.	613-727-1272

Local Distributors

FL	Miami, Elec. Equip.	305-526-6060
OH	Richfield, Alpha Distr. Corp.	216-659-7100

JONARD INDUSTRIES CORP., 134 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-0700, FAX: 914-793-4527; Empl.: 65; *Sls. Mgr.:* Rich Gerszberg

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, FAX: 714-773-5582; Empl.: 275; *Sls. Mgr.:* Todd Leverich

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266, FAX: 805-642-5978; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS CORP., P.O. Box 817, 6868 Cortona Dr., Goleta, CA 93116, Tel: 800-752-8068, 805-968-3551, FAX: 805-968-2335; FSC No.: 23663; Empl.: 240; *Sls. Mgr.:* M. Young

JOSLYN **JENNINGS CORPORATION**

FAX: 408-286-1789

JOSLYN JENNINGS CORPORATION, 970 McLaughlin Ave., San Jose, CA 95122-2696, Tel: 408-292-4025, TELEX: 34-6311, TWX: 910-338-0159; FSC No.: 73905; Empl.: 350; *Sls. Mgr.:* Dwane Gisi ...... **A•1090; B•1536-1538; D•1277**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Crown Systems	602-274-3180
CA	Encino, King-Way Assocs.	818-788-4124
CA	San Jose, H. W. Assocs.	408-996-9940
CO	Denver, Lindberg Co.	303-758-9033
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Arlington Hgts., Berndt Assocs.	312-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Haverhill, L.K. Assocs.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Flanders, K&R Engrg. Sls.	201-584-5235
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Kingston, Leonard D. Allen, Inc.	914-338-7588
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Centerville, Bear Mktg., Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
PA	Huntingdon Valley, Omega Elctrns.	215-947-4135
PA	Pittsburgh, Bear Mktg., Inc.	412-531-2002
TX	Houston, Barry Sales	713-784-5860
TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

CA	Carlsbad, Surcom Assocs.	619-438-4420
IL	La Fox, Richardson Elctrns., Ltd.	312-456-0600
TN	Bristol, Kintronics	615-878-3141

JOULE POWER, INC., Joyce Industrial Pk., Summer Rd., Boxborough, MA 01719, Tel: 508-263-9712, FAX: 508-263-9071 .... **D•1765**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Scottsdale, Sun Tech Mktg.	602-483-1082
CA	San Jose, Silicon Valley Sls.	408-432-1967
FL	Altamonte Springs, Over & Over	407-332-1222
GA	Norcross, Over & Over	404-449-6205
MA	Tyngsboro, AMS Mktg.	508-649-3383
NY	Commack, RC Eng. Sls.	516-543-3325
NC	Raleigh, Over & Over	919-876-7338
OH	Cincinnati, Century Tech. Sls.	513-677-5088
PA	Wayne, John Lyons Mktg.	215-687-2277
TX	Plano, Aticus	214-964-0663
UT	Ogden, Doug Taylor & Assocs.	801-546-9570
VA	Alexandria, Mid-States Mktg.	703-370-2600
WA	Lake Oswego, SPS Elctrns.	503-697-7768
Can	Montreal, Que., Solid State Engrg.	514-481-3313

JOVIL MANUFACTURING CO., INC., Precision Rd., Danbury, CT 06810, Tel: 203-792-6700, TELEX: 969634, FAX: 203-790-8645; Empl.: 25; *Sls. Mgr.:* Keith Fredlund

JRW INDUSTRIES, INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418, FAX: 717-236-1895; Empl.: 4; *Sls. Mgr.:* Kevin J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07474-0248, Tel: 201-694-6200, 1-800-572-9473, FAX: 201-694-8297; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

J.S.T. CORP., 1200 Business Ctr. Dr., Ste. 400, Mt. Prospect, IL 60056, Tel: 1-800-947-1110, FAX: 708-803-4918; *Sls. Mgr.:* Ron Lesky; *Dist. Mgr.:* Ron Lesky .... **C•1363**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc	205-837-7105, FAX:205-837-7305
AZ	Scottsdale, Carefree Elctrns.	602-951-9121, FAX:602-951-1381
CA	Canyon Country, Interconn Tech. Mktg.	805-298-3199,FAX:805-298-3883
CA	Cupertino, Prism Tech. Sls. Co.	408-257-6766, FAX:408-257-8847
CA	Newsbury Park, Interconn Tech. Mktg.	805-499-4024,FAX:805-499-7937
CA	San Marcos, Falcon Sls. & Technlg.	619-591-0504, FAX:619-591-4241
CA	Trabuco Canyon, Interconn Tech. Mktg.	714-589-4655,FAX:714-589-3793
FL	Altamonte Spgs., Over & Over, Inc.	407-332-1222, FAX:407-332-4433
FL	Brandon, Over & Over, Inc.	813-684-6486, FAX:813-684-6486
FL	Ft. Lauderdale, Over & Over, Inc.	305-485-0115, FAX:305-484-8131
GA	Norcross, Over & Over, Inc.	404-449-6205, FAX:404-449-6177
IL	Itasca, Circuit Sls.	708-773-0200, FAX:708-773-2721
IN	Indianapolis, Elctrn. Sls. & Engrg. Co.	317-849-4260,FAX:317-841-0231
IA	Blue Grass, Acorn Elctrns.	319-381-2702, FAX:319-381-2702
KS	Overland Pk, Acorn Elctrns.	913-649-6402, FAX:913-649-8005
MA	Canton, The T.M.R. Grp.	617-828-1848, FAX:617-828-2459
MI	Bloomfield Hills, Trilogy Mktg., Inc.	313-338-2470, FAX:313-338-6720
MN	St. Paul, Countryman Assoc. Co.	612-645-9151, FAX:612-641-6153
MO	St. Louis, Acorn Elctrns.	314-421-1751, FAX:314-421-1752
NJ	Madsion, Venture Quest, Inc.	201-377-4922, FAX:201-377-0453
NY	Holbrook, Venture Quest, Inc.	516-588-5130, FAX:516-588-4424
NY	Marcellus, Franklin Sls. Corp.	315-673-1009, FAX:315-673-4428
NY	New Hartford, Franklin Sls. Corp.	315-793-3161, FAX:315-793-3139
NY	Pittsford, Franklin Sls.	716-248-8251, FAX:716-248-3866
NC	Charlotte, Over & Over, Inc.	704-542-9111, FAX:704-542-9937
NC	Raleigh, Over & Over	919-876-7338, FAX:919-876-8098
OH	Cincinnati, Stegman Blaine Mktg., Inc.	513-729-1969,FAX:513-729-1984
OH	Cleveland, Stegman Blaine Mktg., Inc.	216-572-0003,FAX:216-238-3229
OH	Stow, Stegman Blaine Mktg., Inc.	216-688-9603, FAX:216-688-6421
OH	Vandalia, Stegman Blaine Mktg., Inc.	513-890-7975,FAX:513-890-5191
OR	Aloha, Turn-A-Round Sls.	503-649-1007, FAX:503-649-1008
OR	Hillsboro, Turn-A-Round Sls.	503-640-4641, FAX:503-640-4640
PA	Fort Washington, SMC Inc.	215-628-3394, FAX:215-628-3395
TX	Arlington, T-Tec Sls.	817-274-0505, FAX:817-274-9662
TX	El Paso, T-Tec Sls.	915-581-7920, FAX:915-585-1886
TX	Gilmer, T-Tec Sls.	903-734-4526, FAX:903-734-5316
TX	Houston, T-Tec Sales	713-578-9666, FAX:713-578-5666
VA	Fairfax Station, Sac Communications Inc.	703-643-2344,FAX:703-643-1842
WA	Kirkland, Turn-A-Round Sls.	206-822-4634, FAX:206-828-0633
WI	Brookfield, Circuit Sls.	414-784-7773, FAX:414-784-4528
EXP	Mexico, Guadalajara, T-Tec Sls.	011-523-6353
Can	St. Lazare, Que, Atkinson & Ross Assoc.	514-424-5679,FAX:514-424-5678
Can	Vancouver, BC, Fairwest Sls.	604-685-1473, FAX:604-681-7712
Can	Whitby, Ont., Atkinson & Ross Assoc.	416-666-8359,FAX:416-666-8360

Local Distributors

AL	Huntsville, Comp. Distrs. Inc.	205-851-7800, FAX:205-859-2249
AZ	Tucson, SWS Elctrns; Inc.	602-628-1613, FAX:602-628-1921
CA	Brea, I.S.I.	714-961-7955,FAX:714-996-9537
CA	Campbell, Prime Electro	408-374-0707, FAX:408-374-7711
CA	Fremont, Vic/Tal Sls.	510-651-6420, FAX:510-651-8795
CA	Huntington Bch., On-Line Elctrns.	714-847-5111, FAX:714-847-4485
CA	Irvine, Kensington Elctrns.	714-588-0575, FAX:714-588-0176

CA	Manhattan Bch., Prime Electro.	310-379-3642,	FAX:310-379-7768
CA	Norwalk, Myco Elctrn. Supp.	213-404-2053,	FAX:310-926-8536
CA	S. San Francisco, Peters-De Laet Inc.	415-873-6671,	FAX:415-873-1680
CA	San Carlos, Logan Elctrns.	415-594-0700,	FAX:415-594-1687
CA	San Diego, Deco Elctrns.	619-693-1595,	FAX:619-693-0245
CA	San Diego, Mock III	619-693-8230,	FAX:619-693-3355
CA	San Diego, Western Fastener	619-292-5115,	FAX:619-292-0427
CA	San Jose, Spectra Elctrns.	408-955-7800,	FAX:408-955-7810
CA	Santa Clara, Bravo Foresight Elctrns.	408-980-9700,	FAX:408-980-8805
CA	Santa Clara, Trinty Elctrns.	408-980-9011,	FAX:408-980-9014
CO	Englewood, Comp. Distrs. Inc.	303-770-6214,	FAX:303-770-6057
CO	Littleton, Indelco	303-795-3431,	FAX:303-794-8298
CT	Wallingford, Midstate Elctrns.	203-265-9900,	FAX:203-269-2374
FL	Clearwater, Comp. Distrs. Inc.	813-796-0466,	FAX:813-796-0846
FL	Ft. Lauderdale, Comp. Distrs.	305-973-6175,	FAX:305-973-6915
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900,	FAX:305-977-0489
GA	Athens, Dixie Elctrns.	706-613-7755,	FAX:706-613-7856
GA	Atlanta, KSM Elctrns.	404-458-2013,	FAX:404-451-0891
GA	Norcross, Comp. Distrs. Inc.	404-441-3320,	FAX:404-449-1712
IL	Addison, Belford Elctrns.	708-691-1100,	FAX:708-691-1118
IL	Bensenville, Voyager I	708-860-1300,	FAX:708-860-1572
IL	Glendale Hgts., KSM Elctrns.	708-529-1700,	FAX:708-529-3668
IL	Palatine, OHM Elctrns.	708-359-5500,	FAX:708-359-9686
IL	Wood Dale, NEP Elctrns.	708-595-8500,	FAX:708-595-8706
IN	Beech Grove, Wire Supp. Inc.	317-786-4485,	FAX:317-787-0706
IN	Carmel, Altex Elctrns.	317-848-1323,	FAX:317-844-6593
IN	Indianapolis, Mar Elctrns.	317-633-6699,	FAX:317-633-6687
IA	Cedar Rapids, Dee Elctrns.	319-365-7551,	FAX:319-365-8506
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640,	FAX:301-840-9299
MA	Franklin, JEM Elctrns.	508-520-3105,	FAX:508-520-3109
MA	Nutting Lake, QPL Elctrns. Distrs.	508-671-9473,	FAX:508-671-0006
MA	Westborough, In-Stock Prods.	508-870-5750,	FAX:508-898-3616
MI	Grand Rapids, S.F. Elctrn. Supp. Inc.	616-459-0216,	FAX:616-459-5601
MI	Livonia, Michigan Lectrols Corp.	313-427-0300,	FAX:313-427-4045
MI	Wyoming, E.C. Elctrns.	616-530-0576,	FAX:616-530-8598
MN	Fridley, Voyager II	612-571-7766,	FAX:612-571-9519
MN	Roseville, Chris Elctrn. Distrs.	612-631-2647,	FAX:612-631-3071
MN	Roseville, TLC Distbn.	612-483-2226,	FAX:612-481-0287
MO	Earth City, Lectronix Distr. & Svc. Ctr.	314-344-1166,	FAX:314-344-1131
NE	Lincoln, Scott Elctrns.	402-466-8221,	FAX:402-466-4187
NE	Omaha, Scott Elctrns.	402-734-6750,	FAX:402-734-1442
NV	Reno, Peters-De Laet Inc.	702-827-5599,	FAX:702-827-4150
NJ	Cherry Hill, Jeta Corp.	609-663-7272,	FAX:609-663-1688
NJ	Moorestown, Marlac Elctrns.	609-234-4200,	FAX:609-239-0672
NJ	Woodbridge, Calmm Elctrns.	908-750-4497,	FAX:908-750-4212
NM	Albuquerque, Betatron Elctrns.	505-821-1122,	FAX:505-828-0450
NM	Albuquerque, TMA, Inc.	505-345-8921,	FAX:505-344-1113
NY	Penn Yan, Advacom	315-536-2221,	FAX:315-536-0828
NY	Rochester, Simcona Elctrns.	716-328-3230,	FAX:716-436-5926
NY	Ronkonkoma, Jet Comps.	516-471-3124,	FAX:516-981-1521
NY	Ronkonkoma, Spectrum Comp. Supp. Corp.	516-737-6900,	FAX:516-737-6642
NC	Charlotte, Dixie Elctrns.	704-521-0602,	FAX:704-558-4696
NC	Hickory, Dixie Elctrns.	704-328-1130,	FAX:704-328-8318
NC	Raleigh, Dixie Elctrns.	919-829-0704,	FAX:919-829-0375
NC	Winston-Salem, Dixie Elctrns.	919-724-5961,	FAX:919-723-7024
OH	Columbus, Spectra Elctrns.	614-885-8881,	FAX:614-885-3233
OH	Dayton, Advacom	513-274-5900,	FAX:513-274-9124
OH	Midpark, Advacom	216-826-3300,	FAX:216-826-1669
OH	South Euclid, Circuit Elec.	216-382-0330,	FAX:216-382-4411
OK	Tulsa, Wofford Elctrns.	918-622-9555,	FAX:918-622-3999
OR	Beaverton, Micro Power Elctrns.	503-626-7086,	FAX:503-643-1556
PA	East York, Advacom	717-741-9277,	FAX:717-741-9462
PA	Export, Advacom	412-325-7551,	FAX:412-733-9826
PA	McKean, Advacom	814-476-7774,	FAX:814-476-7724
PA	Philadelphia, Shap Elctrns.	215-969-3300,	FAX:215-934-5539
SC	Columbia, Dixie Elctrns.	803-779-5332,	FAX:803-765-9276
SC	Greenville, Dixie Elctrns.	803-297-1430,	FAX:803-297-1439
SC	N. Charleston, Dixie Elctrns.	803-552-2671,	FAX:803-552-2676
TN	Gray, Dixie Elctrns.	615-477-2131,	FAX:615-477-4407
TN	Oak Ridge, Dixie Elctrns.	615-481-3393,	FAX:615-481-3397
TX	Austin, Wofford Elctrns.	512-339-1131,	FAX:512-853-7351
TX	Dallas, Comp. Distrs. Inc.	214-644-0373,	FAX:214-644-1115
TX	Dallas, Wofford Elctrns.	214-320-0294,	FAX:214-320-2017
TX	El Paso, Schick Entprs.	915-772-3283,	FAX:915-772-3034
TX	Laredo, Indux S.A. Mexico	512-727-5935	
TX	N. Richland Hills, Swieco Elctrns (Dixie)	817-281-1811,	FAX:817-281-1783
TX	Tomball, Wofford Elctrns.	713-351-2255,	FAX:713-351-2722
WA	Redmond, Priebe Elctrns.	206-881-2363,	FAX:206-881-0508
WI	New Berlin, NEP Elctrns.	414-785-9100,	FAX:414-785-9131
Can	Burnaby, BC, Brockton Elctrns. Ltd.	604-291-6665,	FAX:604-291-6664
Can	Darthmouth, NS, Arcom Elctrns.	902-464-1600,	FAX:902-469-6825
Can	Edmonton, AB, Elctrn. Connections	403-469-7222,	FAX:403-463-8149
Can	Markham, Ont., ARMA Elctrns. Sls., Inc.	416-475-1858,	FAX:416-475-2019
Can	Markham, Ont., Fastronics, Inc.	416-474-0808,	FAX:416-474-1994

J.S.T. Corp. PIPS Distributors

AZ	Marana, The Paul Co.	602-682-4330,	FAX:602-682-2264
AZ	Tempe, Optimum Assembly	602-968-2335,	FAX:602-968-2337
CA	Anaheim, Sophic Inds.	714-632-2460,	FAX:714-632-1941
CA	Santa Ana, Paul Kaplin Co.	714-556-7007,	FAX:714-751-6003
CA	Tracy, Ferreira Inds.	209-832-0114,	FAX:209-832-0412
IL	Addison, Belford Elctrns.	708-691-1100,	FAX:708-691-1118
IN	Plainfield, AES Interconnections	317-272-2551,	FAX:317-272-3082
MD	Columbia, Custom Cables	301-290-9777,	D:301-381-2036
MA	Westborough, In-Stock Prods.	503-970-5750,	FAX:503-898-3616
MI	Livonia, Michigan Lectrols Corp.	313-427-0300,	FAX:313-427-4045
MN	Roseville, TLC Distbn.	612-483-2226,	FAX:612-481-0287
NJ	Madison, Pyxis Corp.	201-377-4922,	FAX:201-377-0453
NJ	Pennsauken, Ram Elctrns. Inds., Inc.	609-488-0601,	FAX:609-488-9196
NY	Dryden, Sturges Elctrns.	607-844-8604,	FAX:607-844-8416
NC	Kernsville, EDC Inc.	919-993-0468,	FAX:919-993-0368
OH	Dayton, Cables To Go	513-224-8646,	FAX:800-331-2841
OR	Beaverton, ACA Mfg.	503-646-3377,	FAX:503-646-1671
TN	Franklin, Telco	615-377-9910,	FAX:615-377-9940
TN	Greenville, Precision Wire Assemblies Inc.	615-636-1416,	FAX:615-638-9078
TX	El Paso, Border Grp.	915-581-7920,	FAX:915-585-1886
WA	Vancouver, Unitrek Corp.	206-699-2765,	FAX:206-694-9230
Can	Mississauga, Ont., Sycor Technlg.	416-821-3591,	FAX:416-821-7260

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JUDCO MFG. INC., P.O. Box 487-E84, 1429 240th St., Harbor City, CA 90710, Tel: 310-534-0959; *Sls. Mgr.:* Kevin Johnson

JUDD WIRE INC.
1-800-545-5833
FAX: 413-863-2305

JUDD WIRE INC., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, 800-545-5833; FSC No.: 3357; Empl.: 148 .... **C•1756**

Local Sales Offices & Reps

AL	Huntsville, Innovative Sls.	205-772-7500
AZ	Phoenix, O'Donnell Associates	602-944-9542
CA	Laguna Hills, Bart Budge Assoc.	714-582-8720
CA	Los Altos, Ewing Foley	415-941-4525
CO	Boulder, Stratford Grp.	303-530-3194
FL	Largo, Q Rep.	813-397-8431
ID	Boise, Jas. J. Backer	208-378-4680
IL	Arlington Heights, Rozner Sls. Co.	708-577-0067
IA	Cedar Rapids, Lowell-Kangas	319-362-9290
KS	Shawnee, Lowell-Kangas	913-631-3515
MD	Baltimore, Spindler & Wafer	301-744-1133
MA	Hudson, O.K. Engrg.	508-562-1010
MN	Hopkins, Pathway Sls.	612-933-8267
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Middletown, Elctrn. Mktg.	908-615-9484
NM	Albuquerque, O'Donnell Assocs.	505-889-4522
NY	Fairport, Senntec Sls.	716-425-3954
NC	Greensboro, Reynolds Whitlock	919-691-1138
OH	Worthington, Simcox Assocs,	614-885-8776
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Willow Grove, Meldena Sls.	215-657-7760
SC	Greenwood, Reynolds Whitlock	803-229-6801
TX	Dallas, Stevens Sls. Co.	214-702-0132
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	Concord, Control Master	415-939-3600
CA	Menlo Park, Bay Associates	415-321-2940
CT	Manchester, I.M.S.	203-649-4415
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Pacer Elctrns.	305-749-1910
MA	Lowell, Colonial	508-459-6400
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Bloomington, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NY	Rochester, Simcona Elctrn.	716-328-3230
NC	Raleigh, Wholesale Electric	919-878-9400
OH	Dayton, Astro Inds.	513-429-5900

PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Tukwila, Carlyle Inc.	206-251-0700
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2255

JUDD WIRE INC., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, 800-344-5251, FAX: 619-744-6089; FSC No.: 3357 .... **C•1756**

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JRL JULIE RESEARCH LABORATORIES, INC.

FAX: 212-691-3320

JULIE RESEARCH LABS., 508 West 26 Street, New York, NY 10001, Tel: 212-633-6625; FSC No.: 07062; Empl.: 35; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer .... **A•1956; D•1278-1281**

JUMO PROCESS CONTROL, INC., 735 Fox Chase, Coatsville, PA 19320, Tel: 215-380-8002, FAX: 215-380-8009; *Sls. Mgr.:* Gunnar Oberg

KAHLE ENGINEERING, 50 S. Center St. Bldg. No. 1, Orange, NJ 07050, Tel: 201-678-2020, FAX: 201-678-0326; Empl.: 50; *Sls. Mgr.:* Daniel Fowler

KSI

FAX: 508-922-8374

KAISER SYSTEMS, INC., Inductotherm Industries, Inc., 126 Sohier Road, Beverly, MA 01915, Tel: 508-922-9300; FSC No.: IFD78; Empl.: 100; *Sls. Mgr.:* Steve Swech .... **D•1766-1769**

Local Sales Offices & Reps

AZ	Tempe, Groit Group Inc.	602-968-4428
CA	Agoura Hills, Griot Group Inc.	818-706-7601
CA	Irvine, Griot Group Inc.	714-727-4110
CA	Santa Clara, Groit Group Inc.	408-727-2880
CO	Denver, Griot Group Inc.	303-427-1111
NM	Albuquerque, Griot Group Inc.	505-883-1022
OR	Beaverton, Griot Group Inc.	503-646-5627
UT	Salt Lake City, Griot Group Inc.	801-328-9471
WA	Seattle, Griot Group Inc.	206-454-8592

KALAMAZOO TECHNICAL FURNITURE, See TECLAB

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359, Tel: 215-837-0700, TWX: 510-651-2101, FAX: 215-837-7978; FSC No.: 64521; Empl.: 8; *Sls. Mgr.:* Charles Kerchner; *Dist. Mgr.:* Charles Kerchner

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Broadview, IL 60153, Tel: 708-343-7004, FAX: 708-343-7016; Empl.: 250; *Sls. Mgr.:* Kent Prather

KAMAN INSTRUMENTATION, 1500 Garden of the Gods, P.O. Box 7463, Colo Springs, CO 80907, Tel: 719-599-1132, FAX: 719-599-1823; FSC No.: 21732; Empl.: 100; *Sls. Mgr.:* Steve Perry

KAM COMPONENTS, INC., P. O. Box 192-EEM, Nesconset, NY 11767, Tel: 516-585-0666, FAX: 516-585-1580; Empl.: 29; *Sls. Mgr.:* Cheryl Day

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 410-749-2424, FAX: 410-749-5725; FSC No.: 50140; Empl.: 425; *Sls. Mgr.:* Jim Price

K & L OSCILLATEK, A DOVER TECHNOLOGY CO., See Oscillatek, A Dover Technology Co.

K & M ELECTRONICS INC., 11 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350, FAX: 413-737-0608; FSC No.: 66613; Empl.: 300 o; *Sls. Mgr.:* Robert Patrick .... **A•1957**

Local Sales Offices & Reps

CA	Fremont, C/G Assocs., Inc.	415-790-1193
OH	Akron, Augnat Assoc.	216-666-2819

KAPPA TECHNOLOGIES INC

FAX: 908-388-4786

KAPPA TECHNOLOGIES, INC., 1443 Pinewood St., Rahway, NJ 07065, Tel: 908-396-9400, 1-800-223-0603; FSC No.: 20933; Empl.: 175; *Sls. Mgr.:* D. Pearl .. **A•1568-1569, 1642-1645, 2370-2373; D•2128-2129**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
CA	Sunnyvale, Matek Sls.	408-245-5300
CA	West Hills, Bennet Tech. Sls.	818-385-8974
CO	Wheatridge, Wescom Mktg.	408-422-8957
CT	Plainville, Northeast Reps.	203-747-2423
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
KS	Andover, QDC Inds.	316-733-9756
KS	Overland Park, QDC Inds.	913-341-2214
MD	Middletown, S.T. Woolard Co.	301-371-4500
MD	Middletown, S.T./Woolard Co., Inc.	301-371-4500
MA	Hingham, Northeast Reps.	617-749-8700
MN	Eagan, QDC Inds.	612-454-0893
MO	Ballwin, QDC Inds.	314-458-1896
NH	Mt. Vernon, Northeast Reps.	603-673-1406
NY	Cazenovia, S.T. Woolard Co., Inc.	315-655-8145
NY	Plainview, Neptune Elctrns. Co.	516-349-1600
PA	Ft. Washington, SMC, Inc.	215-628-3394
TX	Austin, Gardin-Moore Sls.	512-794-2900
TX	Dallas, Gardin-Moore Sls.	214-985-1193
TX	Houston, Gardin-Moores Sls.	713-496-7651
TX	Plano, Gardin-Moore Sls.	214-985-1193
TX	Stafford, Gardin-Moore Sls.	713-240-6767
UT	Salt Lake City, Wescom Mktg. Inc.	801-269-0419

Local Distributors

CA	Sherman Oaks, DLDI	818-986-9455,800-624-2617

KATRONIC ELEKTRONIC GES.M.B.H., OrtenburgerstraBe 28, Austria, Tel: 04762-5340, FAX: 534075; Empl.: 74; *Sls. Mgr.:* Herbert Sandner

KAUT & BUX MANUFACTURING CO., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060, Tel: 708-949-8505, TELEX: 6871289 KBM UN/, FAX: 1-708-949-4250; *Sls. Mgr.:* Gene Larson

KAVLICO CORP., 14501 Los Angeles Ave., Moorpark, CA 93021, Tel: 805-523-2000, TELEX: 65-1481, FAX: 805-523-7125; Empl.: 500; *Dist. Mgr.:* Bill Fry

KAY ELEMETRICS CORP., 12 Maple Ave., P.O. Box 2025, Pine Brook, NJ 07058-2025, Tel: 201-227-2000, FAX: 201-227-7760; FSC No.: 80138; Empl.: 50; *Sls. Mgr.:* Stephen P. Crump .... **A•1846**

KAY-RAY/SENSALL, INC., 1400 Business Center Drive, Mt. Prospect, IL 60056, Tel: 708-803-5100; Empl.: 170

KB ELECTRONICS, 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, FAX: 718-257-4740; Empl.: 100; *Sls. Mgr.:* A Bueller

KCK

FAX: 708-577-0201

KCK AMERICA INC., Mitsubishi Materials Corporation, 4080 Winnetka Ave., Rolling Meadows, IL 60008, Tel: 708-577-0200; Empl.: 500; *Sls. Mgr.:* K. G. Such, V.P. .... **A•1091, 1647; B•1365**

Local Sales Offices & Reps

AL	Southern Elctrn. Reps.	205-461-8925
AZ	Inmark	602-830-9104
CA	Los Angeles, English/Damco Sls. Co., Inc.	213-772-7272
CA	Orange County, English/Damco Sls. Co., Inc.	714-753-1950
CA	San Diego, English/Damco Sls. Co., Inc.	619-271-0333
CO	Tech. Mktg. Co.	303-989-3611
FL	Kinetic Sls. Inc.	407-339-3855
GA	Atlanta, Advantage Comp. Sls.	404-458-3577
ID	Sierra Tech. Sls.	801-566-9719
IL	BNI Elctrns., Inc.	708-595-9210
IN	J & B Engry. Sls. Co., Inc.	219-483-2813
KS	Microtronics, Inc.	913-262-1444
MD	Karr Assocs.	410-280-2448
MA	JMG Inc.	617-762-5333
MI	DEM Sls., Inc.	313-583-1500
MN	E.I. Sls. Co.	507-345-5786
MS	Southern Elctrn. Reps.	205-461-8925
MO	Microtronics, Inc.	913-262-1444
MT	Sierra Tech. Sls.	801-566-9719
NJ	JMR Sls., Inc.	908-525-8000
NY	Metropolitan, JMR Sls., Inc.	908-525-8000
NY	Upstate, R Squared	315-457-3754
NC	Raleigh, Vantage Mktg. Inc.	919-870-7123
OH	Northern, J & B Engrg. Sls. Co., Inc.	216-766-5754
OH	Southern, J & B Engrg. Sls. Co., Inc.	513-848-2626
PA	Eastern, Check Assocs.	215-487-3007
PA	Western, J & B Engrg. Sls. Co., Inc.	216-766-5754
TN	Eastern, Electronic Comp. Mktg.	615-828-5741
TN	Western, Southern Elctrn. Reps.	205-461-8925
TX	Passive Comps. Assocs.	214-824-6162
UT	Sierra Tech Sls.	801-566-9719
WI	Larsen Assocs., Inc.	414-258-0529
WY	Eastern, Tech. Mktg. Co.	303-989-3611
WY	Western, Sierra Tech. Sls.	801-566-9719
Can	JRL Assocs.	416-754-3280

Local Distributors

AZ	Fountain Hills, RCD Inds., Inc.	602-837-9387
CA	Chatsworth, Passive Comps., Inc.	818-700-8838
CA	Huntington Beach, Surface Mount Distbn.	714-841-4556
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, California Capacitor	408-262-6000
CA	San Diego, Neumann Elctrns., Inc.	619-695-3005
CA	San Jose, Passive Comps.	408-441-1441
CA	San Jose, Surface Mount Distbn.	408-451-9200
CA	Santa Maria, Garrett Instrs.	805-922-0594
CO	Aurora, QPS Elctrns.	303-343-9260
FL	Ft. Lauderdale, Brothers Elctrns. of FL	305-561-6700
FL	Longwood, RM Elctrns Co., Inc.	407-767-8005
FL	Melbourne, Pridmore Corp.	407-727-2491
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
IL	Wheeling, Alpha Tek Elctrns.	800-798-2277
IN	Indianapolis, Custom Srvc. Elctrns., Inc.	317-879-9119
MI	Farmington Hills, Key Elctrns.	313-489-5455
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Grand Rapids, RM Elctrns. Co., Inc.	616-531-9300
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	Roseville, Parts 1	612-633-8079
NH	Derry, Brothers Elctrns.	603-437-8437
NH	Nashua, Brevan Elctrns.	603-429-1900
NJ	Bloomfield, Solid State, Inc.	201-429-8700
NJ	East Brunswick, Brothers Elctrns., Inc.	908-238-2200
NM	Albuquerque, Betatron Elctrns.	505-821-1122
NY	East Rochester, Rome Elctrns., Inc.	716-248-0160
NY	Rome, Rome Elctrns., Inc.	315-337-5400
NY	Syracuse, ADR Tech., Inc.	315-437-7087
NY	Williamsville, Rome Elctrns., Inc.	716-626-1602
NC	Raleigh, Century Elctrnic Comps., Inc.	919-782-2116
OH	Solon, Repco Elctrns.	800-544-1858
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Norristown, Century Elctrn. Comps., Inc.	215-631-5400
TX	Arlington, Bell Comps.	817-461-5303
TX	Austin, SMEC	800-336-7632
TX	Richardson, CTC	214-437-2211
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053
Can	Nepean, Ont., Carsten Elctrns.	613-726-9250
Can	Scarborough, Ont., Carsten Elctrns.	416-477-9898
Can	Scarborough, Ont., U-Tech Elctrns.	416-609-2900
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321

KD COMPONENTS, INC., 2151 Challenger Way, Carson City, NV 89706, Tel: 702-883-8003, FAX: 702-883-1150; FSC No.: 58421; Empl.: 44; *Sls. Mgr.:* John Horn

KDI/TRIANGLE ELECTRONICS, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700; FSC No.: 64537; Empl.: 385

KDS AMERICA, Daishinku Corp., 10901 Granada Ln., Overland Pk., KS 66211, Tel: 913-491-6825, FAX: 913-491-6812; Empl.: 12; *Sls. Mgr.:* Tom Lawrence-East. Reg.; *Dist. Mgr.:* Sara Peterson, Claudia Broome

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, FAX: 801-972-2756; Empl.: 100

KEITHLEY

FAX: 216-248-6168

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 800-552-1115; Empl.: 750; *Sls. Mgr.:* David Brock .... **D•1283-1288**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-830-9224
AZ	Tempe, Aztec Entprs.	602-431-8401
CA	Los Alamitos, Tritek Solutions	714-236-1190
CO	Denver, Aztec Entrprs.	303-779-5285
FL	Orlando, W. A. Brown Instrs.	407-648-9660
IL	Buffalo Grove, Torkelson	708-520-0710
IN	Indianapolis, Torkelson	317-244-7867
IA	Cedar Rapids, Torkelson	319-373-0200
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Lynnfield, Keithley	800-552-1115
MI	Detroit, EQS Sys.	313-455-7920
MN	Minneapolis, Torkelson	612-835-2414
NJ	Paramus, Keithley	800-552-1115
NM	Albuquerque, Aztec Entrprs.	505-262-1688
NY	Melville, Keithley	800-552-1115
NY	Syracuse, Labtronics	315-455-7314
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OR	Wilsonville, Syntek	503-682-2750
PA	Huntington Valley, Sci-Rep	215-322-6500
TX	Austin, Testech	512-338-9246
TX	Houston, Testech	713-893-9661
TX	Richardson, Testech	214-644-5010
VA	Fairfax, Sci-Rep	703-385-0600
WA	Bellevue, Syntek	206-462-7700
WI	Waukesha, Torkelson Assocs., Inc.	414-784-7736

KEITHLEY METRABYTE, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3000, TELEX: 503989, FAX: 508-880-0179; FSC No.: 1 FG 11; Empl.: 140; *Sls. Mgr.:* Gary Marraccini; *Dist. Mgr.:* Gary Marraccini

KEL AM, See Teltec, Inc.

KELLER-PSI, 503 No. 11 Vista Bella, Oceanside, CA 92056, Tel: 619-967-6066, FAX: 619-967-0563; Empl.: 8; *Sls. Mgr.:* Dick Grove; *Dist. Mgr.:* Dick Grove

KEL CONNECTORS, INC., KEL Corp., 1250 Oakmead Pkwy., No. 105, Sunnyvale, CA 94086, Tel: 408-720-9044, FAX: 408-720-1989; *Sls. Mgr.:* Jim Eilers

KELLY AMERICAN, INC., 640 Federal Rd., Brookfield, CT 06804, Tel: 203-775-2590, TELEX: 4750159ELECABUL, FAX: 203-775-9048; *Sls. Mgr.:* Robert Buckley

KELMET, INC., 569 W. Covina Blvd., San Dimas, CA 91773, Tel: 714-599-0954, FAX: 714-599-2835; Empl.: 6; *Sls. Mgr.:* Paul Hodge

KELTECH INC., 7508 Hitech Rd., Roanoke, VA 24019, Tel: 703-362-8466, FAX: 703-362-3957; Empl.: 35; *Sls. Mgr.:* William Sinclair

KELTRON CORPORATION

FAX: 617-899-9602

KELTRON CORP., High Voltage Power Supplies & Industrial Printers, 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700; Empl.: 170; *Sls. Mgr.:* T. Chadurjian, Power Supp., D. Raymond, Printers .... **D•1098, 1770-1771**

Local Sales Offices & Reps

IL	Park Ridge, Probe Elec.	312-696-2828
NY	Commack, R.C. Engrg.	516-543-3325
PA	Glenside, Koebert Assoc.	215-887-2310

KELTRON CORP., Miniprinter/Security Systems Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, FAX: 617-899-9602; FSC No.: 18662; Empl.: 250; *Sls. Mgr.:* Steven P. Sargent .... **D•1098**

Local Sales Offices & Reps

IL	Palatine, Key Entprs.	708-991-2144
MD	Baltimore, Advanced Tech. Sls., Inc.	301-323-3140
NY	Amsterdam, Traxonics	518-843-1445
PA	Oreland, Precision Mktg. Grp.	215-233-9233
WI	South Milwauke, Key Entprs.	414-762-2323

Local Distributors

AL	Decatur, Mgt. Security, Inc.	205-355-3030
CA	San Francisco, SF Fire & Burg.	415-861-0994
DC	District of Columbia, Ellenco Inc.	301-927-4370
FL	Miami, Glanz Technlg., Inc.	305-893-1269
GA	Albany, Tri-L Sys.	912-888-1266
IL	Chicago, Natl. Guardian Alarm	312-775-8600
MA	Georgetown, B & B Engrg.	508-352-6402
MI	Bloomfield Hills, W.E. Healy & Assocs.	313-335-9245
NC	Raleigh, National Security	919-821-1150
OK	Tulsa, Pendergraph, Inc.	918-835-8403
TX	Amarillo, Firehawk Safety Sys.	806-374-9613
WI	Brookfield, John Guetzke & Assocs., Inc.	414-784-5929

KELVIN INDUSTRIES, INC., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, Tel: 818-990-1192, FAX: 818-995-6460; FSC No.: 19587; Empl.: 180; *Sls. Mgr.:* R. A. Featherston

KEMET®

FAX: 803-963-6521

KEMET ELECTRONICS CORPORATION, Box 5928, Greenville, SC 29606, Tel: 803-963-6621, TELEX: 57-0496, TWX: 810-287-2536; FSC No.: 31433; Empl.: 6,200; *Sls. Mgr.:* Robert Taylor, VP-Domestic Sls.; *Dist. Mgr.:* Dan Manly .... **A•1092-1093**

Local Sales Offices & Reps

AL	Huntsville	205-830-1090
AZ	Tempe	602-831-2151
CA	Newport Beach	714-640-9320
CA	Santa Clara	408-986-0424
CO	Englewood	303-220-0759
FL	Orlando	407-855-8886
GA	Norcross	404-441-7701
IL	Schaumburg	708-517-1030
IN	Carmel	317-844-7756
MD	Columbia	410-992-5600
MA	Wakefield	617-245-4646
MI	Farmington Hills	313-489-5850
NY	Elmsford	914-347-4390
NC	Raleigh	919-872-2877
OH	Columbus	614-885-3330
PA	Exton	215-363-8310
SC	Greenville	803-242-5789
TX	Irving	214-556-0009
WA	Kirkland	206-828-4853
Can	Montreal	514-694-9525
Can	Ontario	416-542-7930

Local Distributors

CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Culver City, Hamilton/Avnet Elctrns.	213-558-2100
CA	Los Angeles, Bell Inds.	310-826-6778
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CO	Denver, Integrated Elctrns.	303-292-5537
GA	Duluth, Pioneer Technlgs.	404-623-1003
IL	Chicago, Newark Elctrns.	312-784-5100
MD	Columbia, TTI	301-955-1331
NJ	Old Bridge, Arm Bar Inds.	908-679-3377
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
NY	Central Islip, Semicap Elctrns.	516-582-4400
NY	Hauppauge, L.I., Jaco Elctrns.	516-273-5500
NY	Westbury, Hamilton-Avnet	516-997-6868
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer Elctrns.	216-587-3600
TX	Fort Worth, TTI Elctrns.	817-740-9000
Can	Vancouver, B.C., Deskin Sls.	604-324-8343

KEMLON PRODUCTS & DEVELOPMENT COMPANY, 6310 Sidney, Houston, TX 77021, Tel: 713-747-5020, FAX: 713-747-0049; Empl.: 165; *Sls. Mgr.:* Bob Horton

KEMTRON CIRCUITS & ELCTRNS. CORP., 110 S. Long Bch. Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

KENMAR/TSI, 3020 Barrow Drive, Raleigh, NC 27604, Tel: 919-876-6049, FAX: 919-876-6292; Empl.: 110

M.S. KENNEDY CORP., 8170 Thompson Rd., Cicero, NY 13039, Tel: 315-699-9201, FAX: 315-699-8023; FSC No.: 51651; Empl.: 60; *Sls. Mgr.:* Greg Overend

KENTRON, INC., P.O. Box 142, Cedarburg, WI 53012-0142, Tel: 414-377-3733; *Sls. Mgr.:* Kenneth L. Krolski

KEN-TRON MFG., INC., 610 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, TELEX: 20-4305, FAX: 502-684-0435; Empl.: 100; *Sls. Mgr.:* R. Thompson

KENWOOD

FAX: 310-537-8235

KENWOOD U.S.A., 2201 E. Dominguez St., Long Beach, CA 90810, Tel: 310-761-8295 .... **D•1406-1407, 1772-1775**

Local Sales Offices & Reps

CA	Belmont, Western Digital & Instrmn.	415-591-6535, FAX:415-591-9180
CA	Long Beach, Kenwood U.S.A.	310-761-8295, FAX:310-761-8246
CO	Lakewood, Tech. Mktg. Co.	303-989-3611, FAX:303-989-7225
CT	Killingworth, Paul Gallagher	203-663-2338, FAX:203-663-2338
GA	Marietta, Adams	404-973-0853, FAX:404-973-1903
IL	Mt. Prospect, Best Rep	708-632-0473, FAX:708-632-0475
IN	Carmel, New Era Sls.	317-844-4530, FAX:317-844-4534
IA	Cedar Rapids, KKB & Co.	319-373-1730, FAX:319-373-2019
MD	Hampstead, Technical Instr. Sls.	410-239-4452, FAX:410-239-4440
MA	Framingham, Paul Gallagher	508-626-2346, FAX:508-872-5677
MI	Warren, Burcaw	313-573-4605, FAX:313-573-6048
MI	Wyoming, Burcaw	616-532-2756, FAX:616-532-3847
MN	Apple Valley, Alliance Tech Prods.	612-432-2111, FAX:612-432-5060
MN	St. Paul, Alliance Tech Prods.	612-481-0518
MO	Blue Springs, KKB & Co.	816-229-0001, FAX:816-228-1466
MO	St. Louis, KKB & Co.	314-647-2400, FAX:314-647-3773
NY	Woodside, Greater Metro Sls.	718-424-1911, FAX:718-458-6791
NC	Greensboro, Adams	919-272-6838, FAX:919-273-6850
NC	Raleigh, Adams	919-972-0410, FAX:919-972-0410
OH	Cincinnati, Dietrich	513-984-8924, FAX:513-984-5351
OH	Cleveland, Dietrich	216-642-7965, FAX:216-642-3080
OK	Tulsa, Jim Wisdom & Assocs.	918-665-8899, FAX:918-665-9456
OR	Aloha, Cain Sweet	503-591-0647, FAX:503-591-0856
PA	Lansdale, Technical Instr. Sls.	215-361-7850, FAX:215-361-7803
PA	Pittsburgh, Dietrich	412-892-2992
TX	Richardson, Jim Wisdom & Assocs.	214-470-9093, FAX:214-470-9122
VA	Woodford, Technical Instr. Sls.	804-633-4586, FAX:804-633-4586
WA	Bellevue, Cain Sweet	206-462-2118, FAX:206-451-9418

Local Distributors

CA	Chatsworth, Testek Corp.	818-701-9911, FAX:818-701-6011
CA	El Monte, Marshall Inds.	818-307-6393, FAX:818-307-6299
CA	Los Alamitos, Power Specialists	310-594-9418
CA	Milpitas, R & D Elctrn. Parts	408-262-7144, FAX:408-262-7154
CO	Aurora, R & R Instrmn.	303-340-8228
FL	Orlando, Emsco	407-849-6362, FAX:407-843-0909
FL	Tampa, Sunex Elctrn. Supp., Inc.	813-885-4074, FAX:813-888-6487
IL	Niles, Joseph Elctrns.	708-297-4240, FAX:408-297-6923
IN	Indianapolis, Meunier Elctrns.	317-635-3511, FAX:317-631-4707
MD	Baltimore, Davis Instrs.	410-358-3900, FAX:410-358-0252
MD	Hunt Valley, E.I.L. Instrs., Inc.	410-584-7400, FAX:410-584-7561
MA	N. Andover, Contact East	508-682-2000, FAX:508-688-7829
MN	Minneapolis, Stark Elctrns., Inc.	612-332-1325, FAX:612-332-1783

MO	St. Louis, Scherrer Instrs.	314-644-5362, FAX:314-644-3530
NJ	Elizabeth, NEI	800-248-1634
NJ	Mickleton, Total Video Prods., Inc.	609-423-7400, FAX:609-423-4742
NY	Bayside, Technimart	718-479-1890
NY	Rochester, Transcat	800-828-1470, FAX:800-395-0543
PA	Philadelphia, Sunshine Instrs.	215-673-5600, FAX:215-673-5609
TN	Columbia, Randolph & Williams, Inc.	615-388-7566,FAX:615-381-7516
TX	Dallas, Inotek	214-243-2924,FAX:214-243-7814
TX	Dallas, M. Hutton & Co.	214-239-0580, FAX:214-239-5264
TX	Laredo, Franco Sls.	512-727-0003, FAX:512-727-0364
VA	Richmond, Avec Elctrns.	804-359-6071, FAX:804-359-5609
WA	Seattle, Radar Elec.	206-282-2511, FAX:206-282-1598
WI	Appleton, Appleton Elctrns.	414-734-5767, FAX:414-734-5172

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Local Sales Offices & Reps

AL	Huntsville, W. A. Brown, Inc.	205-830-9224
AZ	Mesa, Aztec Entprs.	602-649-9158
CA	Arcadia, Synertek Mktg.	818-357-0371
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	Sunnyvale, N-S Westronics	408-745-1102
CO	Denver, Aztec Entprs.	303-779-5285
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Waterbury, R. Perron Co.	203-756-9684
DC	Washington, Eastern Instrmn. Corp.	301-384-8500
FL	Melbourne, W. A. Brown Instrs., Inc.	407-723-0766
FL	Orlando, W. A. Brown Instrs., Inc.	407-648-9660
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
IL	Plainfield, Kepco, Inc.- Illinois	815-436-8808
LA	Metairie, Data Mktg. Assocs., Inc.	504-833-3655
MD	Baltimore, Eastern Instrmn. Corp.	301-792-7039
MA	Boston, R. Perron Co.	617-449-6162
MI	Plymouth, EQS	313-455-7920
MN	Plymouth, Kepco Inc.	612-559-1128
MO	St. Louis, Ramsey Assocs.	314-532-9388
NM	Albuquerque, Aztec Entrps.	505-262-1688
NY	Holbrook, Kepco Inc.-Long Island	516-472-5688
NY	Liverpool, NTS Assocs., Inc.	315-451-1091
NY	Port Chester, Radiation Elctrns., Inc.	914-937-2300
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Chesterland, EQS	216-729-2222
OH	Dayton, EQS	513-236-7676
OR	Beaverton, H. Levinson Co.	503-690-1312
PA	West Chester, Kepco,-Pennsylvania	215-594-0856
PA	Wexford, EQS	412-935-0455
TX	Austin, Data Mktg. Assocs., Inc.	512-338-4701
TX	Dallas, Data Mktg. Assocs., Inc.	214-661-0300
TX	Houston, Data Mktg. Assocs., Inc.	713-579-2995
TX	San Antonio, Data Mktg. Assocs., Inc.	210-342-3031
UT	Salt Lake City, Aztec Entprs., Inc.	801-467-4675
WA	Seattle, H. Levinson Co.	206-382-1300
WA	Seattle, KAM Elctrns.	206-382-1300
WI	Milwaukee, Star Engineering	414-645-3680
Can	Montreal, P.Q., Multitest Elctrns., Inc.	514-337-0723
Can	Ottawa, Multitest Elctrns., Inc.	613-727-0848
Can	Scarborough, Ont., Multitest Elctrns., Inc.	416-609-8396

KEPRO CIRCUIT SYSTEMS, 630 Axminister Dr., Fenton, MO 63026-2992, Tel: 314-343-1630, FAX: 314-343-0668; FSC No.: 5999; Empl.: 17; *Sls. Mgr.:* Jeff R. Keil; *Dist. Mgr.:* Jeff R. Keil

KESSLER-ELLIS PRODS., 120 1st Ave., Atlantic Highlands, NJ 07716, Tel: 908-291-0500, 800-631-2165, FAX: 908-291-8097; FSC No.: 28222; Empl.: 55

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave, Des Plaines, IL 60018, Tel: 708-297-1600, FAX: 708-390-9338; Empl.: 425; *Sls. Mgr.:* Nick Bohun; *Dist. Mgr.:* Carl Voelkel

KESTREL SYSTEMS CO., 948 N. Hwy 101 74, Leucadia, CA 92024, Tel: 619-944-2957, FAX: 619-944-6010; Empl.: 6; *Sls. Mgr.:* Mark J. Prager

KETEMA

FAX: 714-630-4131

KETEMA/RODAN DIVISION, 2900 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081; FSC No.: 15454;DESC-EQP-75-1387; Empl.: 100; *Sls. Mgr.:* Helen Hannah .... **B•1876-1878**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Alpine, Wes-K/Raltech	619-445-1126
CA	Chatsworth, Wes-K/Raltech	818-700-0933
CA	Los Altos, W.W. Posey Co.	415-969-7635
CO	Westminster, Straube Assocs.	303-426-0890
FL	Winter Springs, T-Squared Mktg.	407-699-9992
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Inverness, Heartland Tech. Mktg.	708-358-6622
IN	Ft. Wayne, Menze Sls. Co.	219-747-5616
IA	Cedar Rapids, M.I.N.K. Assocs. Inc.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs., Inc.	913-341-8309
MA	Framingham, Marathon Sls. Ltd.	508-875-3566
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	Bridgeton, M.I.N.K. Assocs., Inc.	314-291-5454
NJ	Moorestown, TAI Corp.	609-778-5353
NY	Islip, Cogent Technlg. Assoc.	516-277-7101
NY	Katonah, Cogent Technlg. Assocs.	914-232-2500
NY	Rochester, R.M. Scanlon & Assoc.	716-646-1349
NY	Syracuse, R.M.-Scanlon Assocs.	315-463-7682
NY	Webster, R.M. Scanlon Assocs.	716-671-6809
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OR	Beaverton, Blair-Hirsh Co.	503-641-1875
TX	Bedford, R-Squared/El-Tec	817-268-2896
TX	Dallas, R-Squared/El-Tec	214-702-8566
TX	Houston, R-Squared/El-Tec	713-820-3210
TX	Round Rock, R-Squared/El-Tec	512-255-4245
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Lynnwood, Blair-Hirsh Co.	206-774-8151
WI	Brookfield, Heartland Tech. Mktg.	414-789-6860
Can	Mississauga, Ont., Bestec Elctrns. Ltd.	416-671-1077

Local Distributors

CA	Chatsworth, Passive Comps.	818-700-8838
CA	Los Alamitos, Dexter Magnetic Matls.	714-952-2091
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Jose, Elctrn. Supp.	408-453-3770
CA	Sunnyvale, Dexter Magnetic Matls.	408-738-1080
CA	Torrance, TSC Elctrns. Ltd.	310-534-2739
GA	Norcross, Dexter Magnetic Matls.	404-448-4998
IL	Chicago, Leeds Elctrns., Inc.	312-625-3800
IL	Elk Grove Vl., Dexter Magnetic Matls.	708-956-1140
MA	Billerica, Dexter Magnetic Matls.	508-663-7500
MA	Wilmington, North Star Elctrns.	508-657-5155
MN	Chanhassen, Dexter Magnetic Matls.	612-934-4635
MN	Plymouth, Leeds Elctrns., Inc.	612-557-1277
NY	Hicksville, Dexter Magnetic Matls.	516-822-3311
NY	Rochester, North Star Elctrns.	716-244-9846
OH	Toledo, Dexter Magnetic Matls.	419-385-4621
TX	Carrollton, North Star Elctrns.	214-980-2999
TX	Richardson, Dexter Magnetic Matls.	214-699-1121
WI	Brookfield, Leeds Elctrns., Inc.	414-789-6995
Can	Mississauga, Ont., R-Theta, Inc.	416-890-0221

KEWAUNEE SCIENTIFIC CORP., Technical Workstation Div., 901 FM 20, P.O. Box 930, Lockhart, TX 78644, Tel: 512-398-5292, TELEX: 752706, FAX: 512-398-5104; Empl.: 165 (This Location) 800 (Company Wide); *Sls. Mgr.:* Frank Johnson, Dir. Sls./Mktg.

KEYMARC ELECTRONICS, INC., 2310 205th St., Ste. 101, Torrance, CA 90501, Tel: 310-212-7724, FAX: 310-212-6545; Empl.: 35; *Sls. Mgr.:* Robert Chan; *Dist. Mgr.:* James A. Sia .... **C•1598-1601**

Local Sales Offices & Reps

AL	Huntsville, L & D Sls.	205-837-1469
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Santa Clara, Cindel	408-988-8331
CT	Bloomfield, Zaslow Sls.	203-242-7781
DE	Denver, TechRep Sls.	303-758-7031
FL	Del Ray Bch., Phelps Assocs., Inc.	407-276-7591
GA	Dunwoody, L & D Sls.	404-395-7079
IL	Palatine, Vine Sls.	708-934-5476
MN	Minneapolis, Holmgren & Assocs.	612-574-9983
NY	Islip, Cogent Tech. Assoc.	516-277-7101
NC	Raleigh, L & D Sls.	919-879-5301
OR	Beaverton, Elctrn. Sources	503-627-0838
TX	Dallas, Rem Air Comps. Corp.	214-234-1069
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
Can	Vancouver, Fairwest Sls.	604-685-1473

Local Distributors

CA	Gardena, California Switch & Signal	310-538-9830
CO	Littleton, Display Plus	303-730-7333
NH	Atkinson, Astrum Elctrns.	603-898-3399
OR	Beaverton, Comp. Resources, Inc.	503-641-8488
TX	Tomball, Wofford Elctrns., Inc.	713-351-2255

KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591, FAX: 814-781-7648; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock .... **B•1879-1883**

Local Sales Offices & Reps

AZ	Tempe, Border States Tech.	602-839-1053
CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	San Jose, Westron Assoc.	408-264-4070
CA	Santee, ProSales	619-596-2190
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	Crystal Lake, David J. Brock	815-477-8966
IN	Fort Wayne, R.O. Whitesell & Assocs.	219-489-0588
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, Dave Marrone	612-566-6573
NM	Albuquerque, Border States Tech.	505-292-7400
NY	Rochester, Foster & Wager	716-385-7744
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
NC	Cary, J. E. Shea	919-481-2475
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Dallas, Benson Engrg.	214-342-0438
TX	Houston, Benson Engrg.	713-333-3112
Can	Birmingham, Mi, Gregory J. Lukas	313-642-9155

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Local Distributors

AL	Huntsville, Newark Elctrns.	205-837-9091
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Los Angeles, Newark Elctrns.	800-367-3573
CO	Denver, Newark Elctrns.	303-757-3351
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Plantation, Newark Elctrns.	305-424-4400
GA	Atlanta, Dexter Corp.	404-448-4998
IL	Newark Elctrns.	800-367-3573
IL	Elk Grove Vlg., Dexter Corp.	800-345-4082
IN	Indianapolis, Allied Elctrns.	317-875-0448
KY	Louisville, Allied Elctrns.	502-452-2293
MA	Billerica, Dexter Corp.	508-663-7500
MI	Farmington Hills, Newark Elctrns.	313-737-5150
MN	Digi-Key Corp.	800-344-4539
MN	Thief River Falls, Digi Key	800-344-4539
MO	St. Louis, Newark Elctrns.	314-291-7031
NY	Buffalo, Summit Distrs.	800-678-6648
OH	Toledo, Dexter Corp.	419-385-4621
PA	Summit Distrs.	800-678-6648
TX	Fort Worth, Allied Elctrns.	800-433-5700
EXP	Germany, Dexter Corp.	089-857-3071
Can	Summit Distrs.	800-678-6648
Can	Mississauga, Ont., Newark Elctrns.	416-670-7799

KEYSTONE ELECTRONICS CORP., 31-07 20th Rd., Astoria, NY 11105-2017, Tel: 718-956-8900, TELEX: 35-3700, FAX: 718-956-9040; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* Charles Gold

KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 508-658-0880, TELEX: 951389 KEYTEK BURL, FAX: 508-657-4803; *Sls. Mgr.:* Michael Hopkins

KEYTEK KEYBOARDS CANADA INC., 16 Mary St., Units 3 & 4, Aurora, Ontario, Canada L4G 3W8, Tel: 416-727-9491, FAX: 416-727-7118; Empl.: 20

KEYTRONICS, INC., 707 North St., Endicott, NY 13760, Tel: 607-754-5405, FAX: 607-754-9791; FSC No.: 51181; Empl.: 75; *Sls. Mgr.:* Judith M. Olson

KGS ELECTRONICS, INC., 418-A E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-574-1175, FAX: 818-574-0553; Empl.: 60 .... **D•1807, 2276**

Local Sales Offices & Reps

NJ	Wayne, BIZ Intl.	201-694-2417
TX	Hurst, McGarrah & Assocs.	817-268-3557

KIKUSUI
KIKUSUI INTERNATIONAL CORP.

FAX: 310-986-1624

KIKUSUI INTERNATIONAL CORP., 1980 Orizaba Ave., Signal Hill, CA 90804-1203, Tel: 310-986-1677, 800-545-8784; *Sls. Mgr.:* Joe Engler; *Dist. Mgr.:* Tom Haygarth .... **D•1289, 1409, 1808-1809**

Local Sales Offices & Reps

AZ	Chandler, Vic Myers Assocs.	602-345-6449
CA	Santa Clara, W-J Elctrns. Sls.	408-982-9222
CA	Torrance, Amasco South	213-781-9494
CO	Littleton, Vic Myers Assocs.	303-730-7313
FL	W. Melbourne, Trilogic Sunforce	407-722-1324
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
MD	Wheaton, KMA Sls.	301-460-8876
MA	Billerica, Eastronix	508-670-2400
MI	Bloomfield Hills, MacKellar Assoc. Inc.	313-335-4440
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
NJ	Ridgefield Park, Scientific Dvcs. East	201-440-1400
NM	Albuquerque, Vic Myers Assocs., Inc.	505-884-6878
NC	Raleigh, Trilogic Sunforce	919-233-0270
OH	Columbus, MacKellar Assoc. Inc.	614-848-3552
OR	Wilsonville, Syntek, Inc.	503-682-2750
PA	Horsham, PA Scientific Dvcs.	215-956-0700
UT	Salt Lake City, Vic Myers Assoc. Inc.	801-581-1760
WA	Bellevue, Syntek, Inc.	206-462-7700
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
PR	San Juan, David S. Ternent	809-762-2688
Can	Burnaby, BC, Interfax Sys., Inc.	604-430-1410
Can	Nepean, Ont., Interfax Sys., Inc.	613-726-8888
Can	Rexdale, Ont., Interfax Sys., Inc.	416-674-8970
Can	St. Laurent, Que., Interfax Sys., Inc.	514-336-0392

KILO INTERNATIONAL, 1952 Ironton Blvd., Provo, UT 84606, Tel: 801-377-5530, FAX: 801-377-5573; FSC No.: 05129; Empl.: 50; *Sls. Mgr.:* James T. Davis; *Dist. Mgr.:* James T. Davis

Kilovac® Corporation

FAX: 805-684-9679

KILOVAC CORP., Box 4422, Santa Barbara, CA 93140-4422, Tel: 805-684-4560, App. Hot Line 800-253-4560; FSC No.: 18741; Empl.: 107; *Sls. Mgr.:* Patrick McPherson, VP Sls. & Mktg. .... **B•1540-1545**

Local Sales Offices & Reps

CA	Chatsworth, Cygnus Sls. Engrg. Corp.	818-727-0312
CA	Morgan Hill, Power Connection	408-779-8888
CO	Englewood, Omega Limited	303-762-1921
FL	Orlando, Comp. Design Mktg.	407-240-3903
GA	Atlanta, Electro Tech	404-262-1522
GA	Norcross, Benchmark Technical	404-446-1711
IL	Elgin, Gassner & Clark, Inc.	708-695-9540
IA	Cedar Rapids, Seltec Sls. Corp.	319-364-7660
KS	Wichita, Baka Corp.	316-682-8411
MN	Bloomington, Jay Borman Sls.	612-830-1337
MO	St. Louis, Baka Corp.	314-569-1250
NH	Nashua, Bell Controls	603-882-6984
NY	Great Neck, Trionic Assocs.	516-466-2300
NC	Raleigh, Benchmark Tech.	919-850-0633
OH	Cleveland, Electronic Components, Inc.	216-331-5330
OH	Columbus, Electronic Comp., Inc.	614-231-2318
OH	Miamisburgh, Electronic Comps., Inc.	513-866-3340
OR	Beaverton, Components West, Inc.	503-642-9110
PA	Trevose, PSA North	215-245-0513
TX	Dallas, Caton Sls. Co.	214-350-1612
WA	Redmond, Components West, Inc.	206-885-5880
Can	Brit. Columbia, Macom Agencies, Ltd.	604-271-2661

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KINEMETRICS, INC., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, TELEX: 67-5402, FAX: 818-795-0868; Empl.: 75; *Sls. Mgr.:* Mel Lund

KINETICSYSTEMS CORP., 900 N. State St., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831, FAX: 815-838-4424; Empl.: 100; *Sls. Mgr.:* Norman R. Ellison, Dir. Domestic Sls.

Kingbright

FAX: 909-468-0505

KINGBRIGHT USA CORP., Kingbright Elec. Co., Ltd., 225 Brea Canyon Rd., City of Industry, CA 91789, Tel: 909-468-0500 .... **B•1169**

For all states not listed contact Mfr. at 909-468-0500

Local Sales Offices & Reps

AL	Madison, Contact Manufacturer	909-468-0500
AZ	Tempe, ACS of Arizona	602-731-9711
CO	Denver, Parker-Webster	303-841-4888
CO	Parker, Parker Wesbster Sls.	303-841-4888
FL	Ft. Lauderdale, Solutions	305-989-2931
IL	Buffalo Grove, Service Technlgs.	708-634-4995
IN	M/S Sls.	219-436-3023
IN	Greenwood, M/S Sls.	317-881-0110
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
MD	Gaithersburg, KSA of New England	508-443-5881
MA	Sudbury, KSA of New England	508-443-5881
MN	Oakdale, Complete Sls.	612-731-2923
MO	St. Louis, Rush & West Assocs.	314-965-3322
NJ	N. Brunswick, Unirep	908-940-1851
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	East Syracuse, Fountain, Young & Co.	315-437-7733
OH	Cleveland, RK Comps. Sls.	216-642-9312
PA	Pittsburgh, RK Comps. Sls.	412-775-0747
UT	Murray, Parker Webster Sls.	801-266-9939
WI	Colgate, Svc. Technlgs., Inc.	708-634-4995
Can	Churchill, Ont., Rystyn	705-456-3213

Local Distributors

AZ	Tempe, CDS/AZ	602-829-7981
AR	N. Little Rock, CDS/AR	501-851-3137
CA	Chatsworth, Passive Comps. Inc.	818-700-8838
CA	Costa Mesa, Orange Cnty. Comps.	909-979-3597
CA	Los Angeles, Electric Switches Inc.	213-660-1310
CA	Milpitas, Sierra West Elctrns.	408-945-1050
FL	Lauderdale, Lantern Elctrns.	305-979-3188
FL	W. Palm Bch., Atlantic Elctrns., Inc.	813-531-5900
IL	Morton Grove, Nedco Elctrns.	708-967-0500
IA	Des Moines, Mid-State Distbg. Co.	515-244-7231
MN	Eitzen, Capacitor Assoc.	507-495-3306
MO	St. Louis, Ric-Tronics, Inc.	314-997-4707
NJ	Bloomfield, Solid State, Inc.	201-429-8700
NY	East Syracuse, ADR Technlgs., Inc.	315-437-7087
NY	Melville, Kelvin Elec.	516-433-1700
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Salem, Light-Waves Elec.	503-585-4770
TX	Carrollton, LCD Elctrns., Inc.	214-245-0600
TX	Houston, CDS/Houston	713-868-4018
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
UT	Nephi, CDS/UT	801-623-2908
WA	Kent, Shannon Indl.	206-575-8600
EXP	City of Industry, Kingbright USA Corp.	909-468-0500
Can	Montreal, Megastar Electroniques, Inc.	514-329-0042

KINGS ELECTRONICS CO., INC., 40 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-5000, TELEX: 6818293, FAX: 914-793-5092; Empl.: 308; *Sls. Mgr.:* E. Lagarto; *Dist. Mgr.:* Joel Cohn

KIPP & ZONEN, Enraf-Nonius, 390 Central Ave., Bohemia, NY 11716, Tel: 516-589-2885, 800-645-1025, FAX: 516-589-2068; Empl.: 25; *Sls. Mgr.:* Joe Carlin; *Dist. Mgr.:* Joe Carlin

KIP TRANSFORMERS INC., P.O. Box 6162, 13 Town Line Rd., Wolcott, CT 06716, Tel: 203-758-7085, FAX: 203-596-8041

KIRKWOOD INDUSTRIES INC., 4855 West 130 St., Cleveland, OH 44135, Tel: 216-267-6200, TELEX: 980630, FAX: 216-362-3804; *Sls. Mgr.:* Tom Bauer

KISTLER INSTRUMENTS CORP., 75 John Glenn Dr., Amherst, NY 14228-2171, Tel: 716-691-5100, FAX: 716-691-5226; Empl.: 67; *Sls. Mgr.:* Mike Murphy

KISTLER-MORSE, P.O. Box 3009, Redmond, WA 98073, Tel: 206-881-8000, FAX: 206-883-4893; *Sls. Mgr.:* Stan Isenhath, Jack Smith

KIT MASTER, 11 South Broad St., Peekskill, NY 10566, Tel: 914-736-1010, FAX: 914-736-1899 .... **C•1541**

KLC/KARL LAMBRECHT CORP., 4204 N. Lincoln Ave., Chicago, IL 60618, Tel: 312-472-5442, FAX: 312-472-2724; Empl.: 29; *Sls. Mgr.:* Raymond Lambrecht

KLEIN TOOLS, INC., 7200 McCormick Blvd., P.O. Box 599033, Chicago, IL 60659-9033, Tel: 708-677-9500, TELEX: 72-4431; Empl.: 1000; *Sls. Mgr.:* Ron Bost

KLOCKNER MOELLER, 25 Forge Pkwy., Franklin, MA 02038, Tel: 508-520-7080, FAX: 508-520-7084; Empl.: 250; *Sls. Mgr.:* T. Thornton; *Dist. Mgr.:* P. Feruglio

KMC SYSTEMS, INC., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432, Tel: 201-447-0007, FAX: 201-447-0014; Empl.: 35; *Sls. Mgr.:* E. Verder

KMS ADVANCED PRODUCTS, INC., 700 KMS Place, P.O. Box 1868, Ann Arbor, MI 48106-1868, Tel: 313-769-1780, FAX: 313-769-8660; Empl.: 50; *Sls. Mgr.:* Bill McManus

KNIGHTFIRE TECHNOLOGY, 2139 University Dr., Ste.211, Coral Springs, FL 33071, Tel: 305-344-3682, FAX: 305-752-4353; FSC No.: FSC 6130; Empl.: 4; *Sls. Mgr.:* Sue Pantelakis

KNOWLEDGEWARE, INC., 3340 Peachtree Rd., N.E., Atlanta, GA 30326, Tel: 404-231-8575, TELEX: 544080; FSC No.: 7030-0003; Empl.: 780; *Sls. Mgr.:* Robert Chamberlain, Sr. V.P., Sls.

KNOWLES ELECTRONICS, INC., 1151 Maplewood Dr., Itasca, IL 60143, Tel: 708-250-5100, TELEX: 433-0330, FAX: 708-250-0575; *Sls. Mgr.:* W. Jeff Taylor

knürr

FAX: 805-584-8371

KNURR USA INC., Knurr A.G., 1890 N. Voyager Ave., Simi Valley, CA 93063, Tel: 805-526-7733; Empl.: 20; *Sls. Mgr.:* Georg Wolf (acting) .... **C•1050-1052**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer Inc.	205-883-4163
AZ	Phoenix, Facilutions	602-581-5253
CA	Daly City, Knurr USA	415-878-3300
CA	Laguna Hills, Knurr USA	714-581-8350
CA	Sherman Oaks, Knurr USA	818-986-3455
CA	Simi Valley, Knurr USA, Inc.	805-526-7733
CO	Englewood, Elctrn. Comp. Sys.	303-762-9576
FL	Longwood, Mathias Assocs. Inc.	407-682-1700
IL	Barrington, MCT Elctrns.	708-438-3200
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Ann Arbor, Lintott Assoc.	313-662-1611
MN	Brunsville, Schneiberg Co.	612-890-2416
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NJ	Fair Lawn, The Jette Grp.	201-794-9610

NY	Babylon, The Jette Grp.	516-669-6788
NY	Rochester, Tech. Comp. Sls.	716-342-2406
OH	Westlake, KRW Sls.	216-871-7521
PA	West Chester, Pantech Inc.	215-436-5440
SC	Columbia, Knurr USA East	803-871-6147
TX	Dallas, Kite	214-986-0321
VA	Springfield, Pantech Inc.	703-451-5700
WA	Seattle, Temper Tech. Mktg.	503-292-8201
Can	Oakville, Ont., Elctrn. Design Consulting	416-827-5398

Local Distributors

CO	Aurora, Ty Henkin	303-364-1000
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511

KOA

FAX: 814-362-8883

KOA SPEER ELECTRONICS, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, Tel: 814-362-5536; FSC No.: 09021; Empl.: 3000; *Sls. Mgr.:* L. G. Holzwarth; *Dist. Mgr.:* Fred L. Schenfield .... **A•1002, 1095, 1242-1243, 1858, 1958-1971**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
Can	Mississauga, Ont., Indigo Elctrns.	416-670-0284
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
CA	Santa Clara, Caltron Comps.	408-980-0181
CO	Boulder, R. G. Entprs.	303-447-9211
CT	Plainville, Northeast Representatives	203-747-2423
FL	Boca Raton, APM Assocs.	407-395-7308
FL	Tampa, APM Assocs.	813-886-2457
FL	Winter Park, APM Assocs.	407-678-2777
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Arlington Hgts., C. L. Greenslade Sls.	708-593-3450
IN	Fort Wayne, John F. Kilfoil	219-483-6208
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Pk., Spectrum Sls.	913-648-6811
LA	Covington, Cartwright & Bean	504-892-1780
MA	Hingham, Northeast Representatives	617-749-8700
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Edina, Grayden & Flemmer	612-941-1120
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Mont Vernon, Northeast Representatives	603-880-8199
NJ	Cherry Hill, Metz-Benham Assoc.	609-424-0404
NM	Albuquerque, SynTech	505-266-7951
NY	East Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, MOS Assocs.	516-487-3966
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, John F. Kilfoil	513-791-6150
OR	Tigard, Earl & Brown Co.	503-639-2100
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Lewisville, Jim Hughes	214-221-1536
WA	Redmond, Earl & Brown Co.	206-885-5064
PR	San German, Digit-Tech Sls.	809-892-4260
Can	Kanata, Ont., Indigo Elctrns.	613-591-1053
Can	Montreal, Que., Indigo Elctrns.	514-696-6104

Local Distributors

AL	Huntsville, Reptron	205-722-9500
AZ	Ftn. Hill, RCD Inds.	602-483-6412
AZ	Scottsdale, Shelley- Ragon	602-998-0399
AZ	Tempe, T.T.I.	602-431-1191
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Campbell, Lartronics	408-379-6454
CA	Chatsworth, MIL-Comm Distrs.	818-998-3111
CA	Chatsworth, Shelley-Ragon	818-998-3333
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Huntington Beach, SMD, Inc.	714-841-4556
CA	Irvine, KELEX	714-863-1230
CA	Milpitas, T.T.I.	408-946-5577
CA	Mission Hills, T.T.I.	818-891-8885
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Diego, T.T.I.	619-748-2025
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Jaco	408-432-9290
CA	San Jose, Shelley Ragon	408-432-0600
CA	San Jose, Surface Mount Distrs.	408-432-7274
CA	Santa Ana, TTI	714-641-9393
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Tustin, Capstone Elctrns.	714-730-0349
CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Westlake Village, Jaco	805-495-9998
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Boulder, R. G. Entprs.	303-447-9211
CO	Denver, T.T.I.	303-429-6806
CO	Englewood, Shelly-Ragon Elec. Parts	303-762-0670
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, T.T.I.	203-284-7474
CT	Wallingford, Utronics	203-265-2724
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Clearwater, Atlantic Elctrns.	813-531-5900
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Largo, Shelley-Ragon	813-545-0057
FL	Orlando, TTI	407-859-1000
FL	Tampa, Reptron	813-855-4656
FL	Tampa, Reptron Elec.	813-854-2351
FL	W. Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Norcross, Reptron	404-446-1300
GA	Norcross, T.T.I.	404-662-0911
IL	Bensenville, Goold Elctrns.	708-860-7171
IL	Glendale Heights, Shelley-Ragon	708-529-9977
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IL	Rosemont, Advent Elctrns.	708-298-4210
IL	Schaumburg, Reptron Elctrns.	708-882-1700
IL	Schaumburg, TTI	708-884-6500
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Baltimore, Radio Elec. Svc. Co.	301-931-8200
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MD	Columbia, Jaco Comps.	301-995-6620
MD	Columbia, T.T.I.	301-995-1331
MA	Billerica, Baldwin Comp. Ctr.	617-667-6710
MA	Chelmsford, Shelly-Ragon	508-250-9666
MA	Norwood, EMTEL Electronics	617-769-9500
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, North Star Elect.	508-657-5155
MA	Wilmington, T.T.I.	508-658-4700
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Farmington Hills, Key Elctrns.	313-489-5455
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
MN	Minnetonka, Reptron	612-938-0000
MN	Minnetonka, T.T.I.	612-933-8555
MN	St. Paul, Shelley-Ragon Elctrns.	612-642-2828
MO	Independence, Shelley-Ragon Elctrns.	816-254-3410
MO	St. Louis, Franklin Elctrns.	314-429-3111
NE	Lincoln, Scott Elctrns.	402-466-8221
NV	Las Vegas, Kiesub Corp.	702-733-3888
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Mount Laurel, TTI Inc.	609-234-6400
NJ	Mt. Laurel, Capstone Elctrns.	609-727-7800
NJ	Rockaway, Nasco	201-625-7777
NM	Albuquerque, Betatron	505-821-1122
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Bohemia, Prime Comps.	516-244-8190
NY	Buffalo, Summit Distrs.	716-887-2845
NY	Hauppauge, Jaco	516-273-5500
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Baldwin Comp. Ctr.	516-588-5700
NY	Ronkonkoma, T.T.I.	516-737-2000
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Jaco	919-876-7767
NC	Raleigh, Reptron	919-832-3117
NC	Raleigh, Resco-Raleigh	919-781-5700
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
OH	Dayton, T.T.I.	513-898-8330
OH	Independence, TTI	216-328-9755
OH	Solon, Reptron	216-349-1415
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Erie, Rem Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Philadelphia, Sager Electronics	215-464-4336
PA	Philadelphia, Shap	215-969-3300
RI	Pawtucket, Major Edwards	401-725-7400
TX	Addison, Jaco/QC Elctrns.	214-733-4300
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Fort Worth, Chaparral Elctrns.	817-232-2777
TX	Fort Worth, TTI	817-847-6666
TX	Ft. Worth, Carlton Bates	817-293-5558
TX	Ft. Worth, T.T.I.	817-740-9000
TX	Ft. Worth, T.T.I. Inc.	817-595-3100
TX	Houston, Altair Co.	713-462-3029
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, T.T.I.	206-882-0291
WI	Oconomowac, G W Elctrns.	414-567-9445
Can	Calgary, Alb., A. Deskin Sls.	403-270-4440
Can	Edmonton, Alb., A. Deskin Sls.	403-466-2106
Can	Markham, Ontario, Semad	416-475-8500
Can	Transcona, Manit., A. Deskin Sls.	204-224-1321
Can	Vancouver, B.C., A. Deskin Sls.	604-324-8343

KOBOLD INSTRUMENTS INC., 1810 Parkway View Dr., Pittsburgh, PA 15205, Tel: 412-788-2830, 800-998-1020, FAX: 412-788-4890; *Sls. Mgr.:* James M. Hall

KOEP PRECISION STANDARDS, INC., 500 B Great Bay Blvd., Tuckerton, NJ 08087, Tel: 609-296-9686, FAX: 609-296-9733; FSC No.: 57114; Empl.: 3; *Dist. Mgr.:* N/A

KOLIN INDS., INC., Box 300, Dept. EEM, Pound Ridge, NY 10576, Tel: 914-764-5775, FAX: 914-764-5785; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

KOLLMORGEN
Motion Technologies Group
Industrial and Commercial Products

FAX: 703-731-0847

KOLLMORGEN MOTION TECHNOLOGIES GROUP, 201 Rock Rd., Radford, VA 24141, Tel: 800-77-SERVO; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Pete Dougherty .... **B•1273-1277**

Local Sales Offices & Reps

AZ	Mesa, Western Automation Inc.	602-830-6315
AZ	Tempe, Thor Engrg.	602-438-8494
CA	Corona, Western Automation, Inc.	714-278-1900
CA	Hermosa Bch., Western Automation Inc.	310-798-8532
CA	La Jolla, KSA Inc.	619-453-5720
CA	Laguna Hills, Industrial Drives	714-581-3626
CA	Laguna Hills, Western Automation	714-859-6988
CA	Meadow Vista, O'Donnell Assocs. North	916-878-9087
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	San Jose, O'Donnell Assocs. North	408-456-2950
CA	San Marcos, Western Automation Inc.	619-727-8895
CA	Valencia, Western Automation, Inc.	805-254-7845
CO	Westminster, MJM Mktg. Inc.	303-428-9611
FL	Lakeland, Ludlum Assoc., Co. Inc.	813-683-0200, 800-525-1354
GA	Atlanta, Industrial Apparatus Co.	404-875-8086
IL	Skokie, Koepke & Assoc. Inc.	708-581-0000
MD	Annapolis, Homersmith, Inc.	301-269-6493
MA	Wellesley, Electro Kinetics	617-235-9415
MI	Sterling Hgts., Alliance Sls. Co.	313-726-8670
MN	New Brighton, The Mackubin Grp.	612-636-5533
NJ	Williamstown, Homersmith Inc.	609-567-7464
NY	Commack, Indl. Drives PMI Motion Technlgs.	516-864-1000
NY	E. Rochester, A&D Devices	716-385-2778
NY	Plainview, Motion Control Sls.	516-756-5656
NC	Charlotte, Motion Technlg. Inc.	704-525-9855, 800-438-1380
OH	Columbus, Exonic Sys.	614-337-8883
OH	Dayton, Exonic Sys.	513-434-4100
OH	Farmersville, The Kilroy Corp.	513-696-2277
OH	Medina, Cygnus	216-725-1663
OH	Toledo, Exonic Sys.	419-866-8600
OH	Twinsburg, Exonic Sys.	216-425-2100
OK	Broken Arrow, DJ Sls.	918-258-1445
PA	Downingtown, Homersmith, Inc.	215-269-3637
PA	Media, Homersmith, Inc.	215-543-2434
PA	Pittsburgh, Exonic Sys.	215-825-6797
TX	Austin, DJ Sls.	512-258-3002
TX	Dallas, DJ Sls.	214-783-8876
TX	Dallas, EC Sys. Inc.	214-960-1961
TX	Houston, DJ Sls.	713-690-2640
VA	Radford, The Hatfield Co.	703-639-5471
WA	Bellevue, Thorson Co. N.W.	206-455-9180
Can	Rexdale, Ont., Canadian Drives, Inc.	416-745-1137

Local Distributors

CA	Anaheim, Minarik Elec. Co.	714-994-2251
CA	S. San Francisco, Steven Engrg.	800-258-9200
CO	Denver, Tech Sls. Inc.	303-935-0109
CO	Denver, Warren Fluid Power	303-377-2736
DE	New Castle, J.C. Bennington Co.	302-322-3700
FL	Orlando, Ross Equip.	407-872-0874
IL	Chicago, Kelburn Engrg. Co.	312-775-8383
IN	Indianapolis, J. N. Fauver Co.	317-872-3060
KY	Louisville, J.N. Fauver Co.	502-267-7461
MI	Madison Heights, J. N. Fauver Co.	313-585-5252
NJ	Fairfield, Dodge Newark	201-575-7033
NY	Rochester, Magna Prods. Corp.	716-647-2280

NC	Jamestown, HSI-Piedmont Inc.	919-883-3999
OH	Twinsburg, Exonic Sys.	216-425-2100
PA	Pittsburgh, Exonic Sys.	215-825-6797
TX	Dallas, Cates Drives & Controls	214-960-1961
TX	Houston, Cates Control Sys.	713-644-3911
TX	Houston, Resch. Des. Inc.	713-995-8591
WA	Fall City, Pacific Motion Grp.	206-222-7387
WI	Elm Grove, Triphase Automation	414-821-5099
WI	Oneida, MCL Inds. Inc.	414-434-4100

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 800-223-7150, TWX: 510-687-8967

KONTRON ELEKTRONIK-US KONTRON ELEKTRONIK GMBH-SUB. BM, 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-6575, FAX: 508-927-6511; Empl.: 30

KOOLTRONIC, INC., P.O. Box 300, Hopewell, NJ 08525, Tel: 609-466-3400, FAX: 609-466-1114; Empl.: 200; *Sls. Mgr.:* John J. Drages

KOOLTRONIC, INC., 1700 Morse Avenue, Ventura, CA 93003, Tel: 805-642-8521, FAX: 805-658-2901; Empl.: 200

KRAFT DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, FAX: 715-268-8183; Empl.: 25; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

KRECKMAN, HERB, CO., 27 Spruce Cabin Road, Cresco, PA 18326, Tel: 717-595-2212, FAX: 717-595-2024; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 908-636-1900, FAX: 908-636-1982; FSC No.: 55259; Empl.: 15; *Sls. Mgr.:* Bob Fiordalisi **A•1648-1649**

Local Sales Offices & Reps

CA	Anaheim, Texel	714-998-2941
CA	San Diego, Texel	619-576-2162
CA	Seal Beach, Texel	310-596-9411
CA	Simi Valley, Texel	805-582-1223
CO	Englewood, Tech. Mktg. Co.	303-989-3611
FL	Longwood, J-Squared Mktg., Inc.	407-884-0810
IL	Chicago, Tech. Sls.	312-237-7210
KS	Kansas City, Abrams & Assocs.	913-432-2303
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Glen Gardner, F & M Tech. Sls.	908-537-7888
OH	Kettering, Frank Bold & Assocs.	513-298-6145
TX	Richardson, Carl Tinch Sls. Co.	214-231-1322

KRENZ INSTRUMENTS, INC., 7234 Via Mariposa, Bonsall, CA 92003, Tel: 619-630-3488, FAX: 619-630-4267; Empl.: 35; *Sls. Mgr.:* Michael Merget, G.M.

KRISTEL CORPORATION, 833 Industrial Dr., West Chicago, IL 60185, Tel: 708-293-0850, FAX: 708-293-1255; Empl.: 35; *Sls. Mgr.:* Kevin Michael

Bantry Components, Inc.

FAX: 603-624-0634

KRL/BANTRY COMPONENTS, INC., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210; FSC No.: 18235; Empl.: 100; *Sls. Mgr.:* Bert A. Spiller **A•1973-1979**

Local Sales Offices & Reps

CA	Copperopolis, Francisco & Assocs.	800-759-9607
FL	Boca Raton, Sls. Specialists	813-754-1329
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Aurora, EMA Inc.	216-562-6104
OH	Centerville, EMA Inc.	513-433-2800
OR	Beaverton, Olsen Tech. Sls. Corp.	503-643-9488
TX	Austin, Southwest Sys. Technlg.	512-467-2040
TX	Dallas, Southwest Sys. Technlg.	214-443-2688
WA	Bellevue, Olsen Tech. Sls. Corp.	206-883-7792

Local Distributors

FL	Boca Raton, NRC Elctrns.	407-241-8600
MA	Billerica, Baldwin Comps.	617-667-6710
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, FAX: 508-583-8989; Empl.: 35 **A•1650; D•1291**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-883-8455
AZ	Phoenix, Odyssey 1	505-345-9659
CA	Huntington Bch., Sci-Dev West	714-236-1190
CA	San Jose, Scientific Devs. West	408-554-0455
FL	Orlando, Gentry Elctrns., Inc.	407-859-4422
FL	Tampa, Gentry Elctrns., Inc.	813-888-9218
GA	Atlanta, Gentry Elctrns., Inc.	404-315-0092
IL	Chicago, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MD	Baltimore, Sci-Rep	703-385-0600
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-532-9386
NJ	Ridgefield Park, Scientific Dvcs. East	201-440-3430
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Syracuse, Labtronics	315-455-7314
OH	Chesterland, EQS Sys.	216-729-2222
OH	Columbus, EQS Sys.	614-228-3453
PA	Pittsburgh, EQS Sys.	216-729-2222
PA	Spring House, Scientific Devices East	215-643-3335
RI	Narragansett, Pat Assocs.	401-783-9598
SC	Columbia, Gentry Elctrns., Inc.	803-772-6786
TN	Knoxville, Gentry Elctrns., Inc.	615-584-0281
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Bellevue, Sci. Dvcs. N. W.	206-747-5169
WI	Milwaukee, Berndt Assocs.	414-545-8400

KRUEGER COMPANY, 1544 W. Mineral Rd., Tempe, AZ 85283, Tel: 800-245-2235,602-820-5330, FAX: 602-820-1707

KSI, See Kaiser Systems, Inc.

K-TRONICS, See U. S. Elco Inc. (Under Elco)

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OR	Beaverton, Quest Mktg.	503-641-7377
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TX	Houston, Weisler & Assocs.	713-849-3799
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MN	Roseville, Parts One	612-633-8079
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FL	Palm Harbor, Hughes Assocs., Inc.	813-785-6696
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IL	Northbrook, Raines & Assocs.	708-498-0890
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Burtonville, Component Technlg.	301-588-5366
MA	Lexington, Zieco	617-861-8300
MI	Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Edina Prairie, Hanna Lind	612-942-8554
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Englewood, Sprung & Rea, Inc.	201-569-5666
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Pittsford, R.M. Scanlon & Assoc.	716-359-0773
NY	Syracuse, R.M. Scanlon & Assoc.	315-463-7682
NY	Webster, R.M. Scanlon & Assoc.	716-671-6809
NC	Cary, Hughes Assocs., Inc.	919-467-7029
OH	Dayton, J.C. Hofstetter	513-296-1010
OH	Medina, J.C. Hofstetter	216-241-4880
OR	Tigard, Earl & Brown Co.	503-639-2100
PA	Hickory, J.C. Hofstetter	412-356-2305
PA	Horsham, Jacobsen Assocs.	215-674-2937
TX	Austin, Jim Hughes Co.	512-467-8896
TX	Lewisville, Jim Hughes Co.	214-221-1536
UT	N. Salt Lake City, Trembly Assocs.	801-295-4703
WA	Redmond, Earl & Brown Co.	206-885-5064

LEM U.S.A., INC.
PIONEERING POWER ELECTRONICS

FAX: 414-353-0733

LEM U.S.A., INC., 6643 W. Mill Road, Milwaukee, WI 53218, Tel: 414-353-0711; *Sls. Mgr.:* Eric Wentz .... **B•1964-1966; D•1294**

Local Sales Offices & Reps

CA	Arcadia, Van Gott Assocs., Inc.	818-445-9728
CA	San Jose, Shaw-Tech	408-866-6628
CT	Cheshire, Shain-Le Croix Assoc.	203-271-2448
ME	Bethel, Shain Assoc., Inc.	207-836-3200
MD	Annapolis, Rynone Engrg., Inc.	410-263-0794
MA	Norwell, Shain Assoc., Inc.	617-982-1474
MI	Livonia, Electro Sls. Assoc., Inc.	313-421-7500
NH	Nashua, Shain Assoc., Inc.	603-881-4881
NJ	Edison, R.E. Breuer Co. Inc.	908-561-6161
NY	Wantagh, R.E. Breuer Co. Inc.	516-783-7309
OH	Chesterland(Cleveland), Electro Sls. Assoc., Inc.	216-729-0190
OH	Dayton, Electo Sls. Assoc.	513-426-5551
OK	Tulsa, Delta Comps.	918-592-7711
PA	Pittsburgh, Electro Sls. Assoc., Inc.	412-322-9000
TX	Houston, Mitchel-Horter & Assocs.	713-496-9054
TX	Seagoville, Delta Comp., Inc.	214-287-6333
WI	New Berlin, Rekco, Inc.	414-784-3430

LENCO
ELECTRONICS, INC.

FAX: 815-344-2730

LENCO ELCTRNS., INC., 1330 Belden St., McHenry, IL 60050, Tel: 815-344-2900; Empl.: 100; *Sls. Mgr.:* Lenard J. Duncan .... **A•2374-2375**

Local Sales Offices & Reps

AZ	Phoenix, Mactronix	602-998-1848
CA	Northridge, Myco Sls.	818-886-7101
CA	Redwood City, TriRep	415-965-1822
CO	Longmont, Butler Tech. Sls.	303-651-7703
IL	Bartlett, Lemvig Assocs.	708-830-2241
IL	McHenry, Mesa Inc.	815-344-2820
KS	Shawnee, McAllister Assocs.	913-262-5500
MA	Framingham, Stone Comps.	617-875-3266
OH	Cleveland, Comp. Specialty	216-442-6200
PA	Bryn Mawr, J J Lyons Mktg.	215-687-2277
SC	Fripp Island, N.P.M. Assocs.	803-838-2691

LENOX-FUGLE ELECTRONICS, 100 Sylvania Pl., S. Plainfield, NJ 07080, Tel: 908-756-1164; Empl.: 25; *Sls. Mgr.:* Henry J. Lenox

LENTRONICS, Prism Systems Inc., 7025 Greenwood Street, Burnaby, B.C., Canada V5A 1X7, Tel: 604-421-8733, FAX: 604-421-8707; FSC No.: 5820; Empl.: 200; *Sls. Mgr.:* Sam Mouallem

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FAX: 510-651-2931

LEOCO (U.S.A.) CORPORATION, 41394 Christy St., Fremont, CA 94538, Tel: 510-651-4700; Empl.: 240; *Sls. Mgr.:* John Duffie; *Dist. Mgr.:* John Duffie .... **C•1382-1393**

Local Sales Offices & Reps

AL	Madison, Concord Comp. Rep	205-772-8883
CA	San Jose, Tri Par Assocs.	408-262-3190
FL	Davie, Dan-Tech Sls., Inc.	305-581-2884
GA	Norcross, Concord	404-416-9596
IL	Elk Grove Village, AL&W Sls.	708-437-6070
MA	Norwood, Comp. Mktg. Svcs.	617-762-4339
MI	Livonia, Leading Edge Sls.	313-478-6700
MN	Oakdale, Complete Sls.	612-731-2923
NC	Raleigh, Concord	919-783-8038
OH	Cincinnati, Leading Edge Sls.	513-742-2700
OR	Portland, Adapt Elecs.	503-297-2151
TX	Garland, Carey, McMahill & Assocs.	214-681-1414
VA	Lynchburg, TWC	804-525-0085
WA	Bellevue, Adapt Elecs.	206-450-0619

Local Distributors

CA	San Jose, Daine Prods.	408-265-7220, FAX:408-265-1038
FL	Pompano Bch., Tricore Connector	305-968-1026, FAX:305-968-1027
GA	Woodstock, D.G.E.	404-516-1196
IL	Palatine, Sentral Assemblies	708-202-1717, FAX:708-202-8126
MA	Norwood, Emtel	617-769-9500
MI	Farmington Hill, Key Elctrns.	313-489-5455, FAX:313-489-7185
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	New Brighton, Chris Elctrns.	612-631-2647, FAX:612-631-3071
TX	Austin, SSI The Shop	512-990-2233
VA	Lynchburg, TWC	804-525-0085, FAX:804-525-8641

LEONISCHE OF AMERICA, 301 Griffith Rd., Chicopee, MA 01022, Tel: 413-593-6618, FAX: 413-593-6639; Empl.: 25; *Sls. Mgr.:* Edward J. Bouffier

LEPCO/LEONARD ELEC. PRODS., 85 Industrial Dr., Brownsville, TX 78521, Tel: 210-546-1625, FAX: 210-546-4112; Empl.: 245; *Sls. Mgr.:* Norma A. Solis

LETCO INTERNATIONAL, 160 So. Guenther, New Braunfels, TX 78131-1200, Tel: 1-800-222-9676, FAX: 210-625-6993; Empl.: 35; *Sls. Mgr.:* Jim Carroll; *Dist. Mgr.:* Jim Carroll

LEVEL ONE COMMUNICATIONS, INC., 105 Lake Forest Way, Folsom, CA 95630, Tel: 916-985-3670, FAX: 916-985-3512

LEVEL PLUS, SENSORS DIVISION, MTS Sys. Corp., P.O. Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200; *Sls. Mgr.:* Mitch Wandzel

LEVITON TELCOM, Leviton Manufacturing, 2222 222nd St, S.E., Bothell, WA 98021-4416, Tel: 206-485-4288, 206-486-2222, FAX: 206-483-5270; Empl.: 40; *Sls. Mgr.:* Bill Minnis

LEXTEL, INC., P.O. Box 306, Wakefield, MA 01880, Tel: 617-245-5017, FAX: 617-245-6369

LEYBOLD INFICON INC., Two Technology Place, E. Syracuse, NY 13057-9714, Tel: 315-434-1100, TWX: 710-541-0594, FAX: 315-437-3803; Empl.: 200; *Sls. Mgr.:* Mark Wilson

LFE INSTRUMENTS, Mark IV Industries, Inc., 55 Green St, Clinton, MA 01510-3099, Tel: 508-365-3400, FAX: 508-365-3468; Empl.: 200; *Sls. Mgr.:* Dave Flanagan; *Dist. Mgr.:* Dave Snyder

LF ENGINEERING COMPANY INC., 17 Jeffry Road, East Haven, CT 06512, Tel: 203-467-3590

LG SYSTEMS CORP., Lockwood Greene Engineers, Inc., P.O. Box 491. 1500 International Drive, Spartanburg, SC 29304, Tel: 803-578-2143, TELEX: 805288, TWX: 809436, FAX: 803-599-0436; Empl.: 1720; *Sls. Mgr.:* Jim Anderson

LH RESEARCH, INC., 14402 Franklin Ave., Tustin, CA 92680, Tel: 1-800-547-2537, FAX: 714-669-2562; Empl.: 700; *Sls. Mgr.:* Vence Barnes

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LIBERTY CONTROLS, 500 Brookforest Ave., Shorewood, IL 60435, Tel: 815-725-2241; Empl.: 60; *Sls. Mgr.:* Gary Davies .... **B•1644-1645**

Local Sales Offices & Reps

CA	Arcadia, H.M.C. Inc.	818-447-0958
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Cheshire, The MacInnis Co.	203-272-3797
IL	Lisle, WG Controls, Inc.	708-963-5954
KS	Olathe, Advanced Tech. Sls.	913-782-8702
MA	Norwood, The MacInnis Co.	617-762-8090
MI	Detroit, R. P. Urban & Assocs.	313-535-2355
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	Englewood Cliffs, Mason-Esco Inc.	201-569-8868
NY	Hauppauge, Mason-Esco Inc.	516-273-3500
NY	Rochester, BRS Sls. Assocs.	716-586-1522
OH	Dayton, J. C. Hoffsteller Co.	513-296-1010
OH	Medina, J. C. Hoffstetter Co.	216-241-4880
OR	Portland, SPS Elctrns., Inc.	503-297-6919
TX	Dallas, Reese & Assocs.	214-351-0703
UT	Slat Lake City, Gemini Elctrns.	801-278-0201
WA	Redmond, SPS Elctrns., Inc.	206-323-4140

LIBERTY MIRROR CO., Pilkington Aerospace Inc., 851 Third Ave., Brackenridge, PA 15014, Tel: 412-224-1800, FAX: 412-224-8754; Empl.: 45; *Sls. Mgr.:* Steve Williams

LIBERTY POLYGLAS, INC., 1575 Lebanon School Rd., West Mifflin, PA 15122, Tel: 412-466-8611, FAX: 412-466-8640; FSC No.: 2E281; Empl.: 50; *Sls. Mgr.:* L.P. Connors

LIBRASCOPE CORP., Loral Corp., 833 Sonora Ave., Glendale, CA 91201, Tel: 818-244-6541, TELEX: 674912, FAX: 818-502-8145; Empl.: 1350

LIGHT CONTROL SYSTEMS INC., M/A COM Inc., 6 Wentworth Dr., Hudson, NH 03051, Tel: 603-883-8300, FAX: 603-883-8134; Empl.: 43; *Sls. Mgr.:* Karen A. Gentis

LIGHTNING PROTECTION CORP., Box 6086, Santa Barbara, CA 93160, Tel: 805-967-5089/4577, FAX: 805-967-4320; FSC No.: 56618; Empl.: 25; *Sls. Mgr.:* Chester J. Kawiecki

LIGHTWAVE COMMUNICATIONS, INC., 84 Research Drive, Milford, CT 06460, Tel: 203-878-9838, FAX: 203-874-0157; FSC No.: 6008,6020,6025,6026,6099; *Sls. Mgr.:* Peter Henderson; *Dist. Mgr.:* Philip Franceschini

Local Sales Offices & Reps

CA	San Jose, Lovoco Sls.	408-436-8770
MA	Reading, The Landmark Grp.	617-942-7829
TX	Dallas, Cain & Co.	214-247-3901

LILLY-RAM INDUSTRIES, 210 E. Alondra Blvd., Gardena, CA 90248, Tel: 213-321-0710; Empl.: 100; *Sls. Mgr.:* Jerome J. Pajor; *Dist. Mgr.:* Jerome J. Pajor

LINCOLN INSTRUMENTS, 2720 Kimball Ave., Pomona, CA 91767, Tel: 714-626-3399, FAX: 714-625-6654; Empl.: 13; *Sls. Mgr.:* Barbara J. Burchette

LINCOLN LASER CO., 234 East Mohave, Phoenix, AZ 85004, Tel: 602-257-0407, FAX: 602-257-0728; Empl.: 100; *Sls. Mgr.:* Robert S. Nehrbas, Jr.

LINDGREN RF ENCLOSURES, INC., 400 High Grove Blvd., Glendale Hgts., IL 60139, Tel: 708-307-7200, TELEX: 297296LIND UR, FAX: 708-307-7571; FSC No.: 18234; Empl.: 125; *Sls. Mgr.:* Michael Caruso

LINEAR INSTRUMENTS, Spectra Physics Analytical, 2325 Robb Dr., Reno, NV 89523, Tel: 702-746-2200, FAX: 702-746-2212; Empl.: 90

LINEAR INTEGRATED SYSTEMS, 310 S. Milpitas Blvd., Milpitas, CA 95035, Tel: 408-263-8401, FAX: 408-263-7280; FSC No.: 0MJ08; Empl.: 15

LINEAR LABORATORIES, SafetyTek Corp., 49050 Milmont Dr., Fremont, CA 94538, Tel: 510-226-0488, FAX: 510-226-1112; Empl.: 12

LINEAR MOTIONS CO., 17025 Dubesor St, Valinda, CA 91744, Tel: 818-918-7806, FAX: 818-918-7806; FSC No.: 5945; Empl.: 6; *Sls. Mgr.:* L. Wolby

LINEAR RESEARCH INC., 5231 Cushman Pl, Ste. 21, San Diego, CA 92110, Tel: 619-299-0719, TELEX: 6503322534 MCIUW, FAX: 619-299-0129; Empl.: 8

LINEAR TECHNOLOGY CORP., 1630 McCarthy Blvd., Milpitas, CA 95035-7487, Tel: 408-432-1900, TELEX: 499-3977, FAX: 408-434-0507; FSC No.: 64155; Empl.: 600; *Sls. Mgr.:* Tim Cox; *Dist. Mgr.:* Lou Di Nardo

LINE ELECTRIC PRODUCTS, 122 Naubuc Ave., Glastonbury, CT 06033, Tel: 203-659-3573, 1-800-331-1137, FAX: 203-659-3576; FSC No.: 07065; Empl.: 15; *Sls. Mgr.:* Bill Harris; *Dist. Mgr.:* Bill Harris

LINEMASTER SWITCH, 29 Plaine Hill Rd,P.O Box 238, Woodstock, CT 06281-0238, Tel: 203-974-1000, FAX: 203-974-0691; FSC No.: 979180; Empl.: 190

LINSEIS, INC., P.O. Box 666, Princeton Junction, NJ 08550, Tel: 609-799-6282, 800-RECORDER, FAX: 609-799-7739; *Sls. Mgr.:* Michael Bissell .... **D•1414**

LISK, G. W., CO., 2 South St, Clifton Springs, NY 14432, Tel: 315-462-2611, FAX: 315-462-7661; Empl.: 300; *Sls. Mgr.:* D.J. Riggs; *Dist. Mgr.:* D.J. Riggs

LITE-ON INC., 720 S. Hillview Dr., Milpitas, CA 95035, Tel: 408-946-4873, FAX: 408-942-1527; Empl.: 1100; *Sls. Mgr.:* Michael Barnes; *Dist. Mgr.:* Melinda Ericsson

LITTELFUSE, INC., 800 E. Northwest Hwy., Des Plaines, IL 60016, Tel: 708-824-1188, 708-824-0400, FAX: 708-824-3024; Empl.: 1700; *Sls. Mgr.:* David Hanley; *Dist. Mgr.:* Michael Budde .... **B•1366-1367**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Scottsdale, The Lindberg Co.	602-998-2944
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Burlingame, Wm. J. Purdy Co.	415-347-7701
CA	Irvine, Gravley & Assocs.	714-852-9994
CO	Denver, The Lindberg Co.	303-758-9033
CO	Englewood, Purdy Co. Assoc.	303-790-2211
CT	Branford, Coakley, Boyd & Abbett Inc.	203-481-2218
FL	Clearwater, Hawkins-Frederickson Assoc. Inc.	813-531-6520
FL	Ft. Lauderdale, Hawkins-Frederickson Assoc. Inc.	305-321-6702
FL	Maitland, Hawkins-Frederickson Assoc. Inc.	407-831-2474
FL	Valrico, Hawkins-Frederickson	813-651-1063
GA	Norcross, Cartwright & Bean Inc.	404-368-0160
IL	Mt. Prospect, The Dombrow Co.	708-253-3631
IN	Indianapolis, L. M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, T.L. Dowell Assoc.	319-393-7920
KS	Overland Park, T. L. Dowell Assocs.	913-722-4242
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MD	Silver Spring, Mid-Atlantic Sls. Co.	301-593-7749
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MA	W. Bridgewater, Coakley,Boyd & Abbott, Inc.	508-559-6700
MI	Farmington Hills, R. C. Merchant Co.	313-476-4600
MI	St. Joseph, R. C. Merchant	616-983-7378
MN	Edina, M. Foster Tech. Sls., Inc.	612-941-9790
MO	St. Louis, T. L. Dowell & Assocs.	314-849-4234
NJ	Englewood, MOS Mktg. Assoc.	201-569-2071
NM	Albuquerque, The Lindberg Co.	505-881-1006
NY	Batavia, R. W. Mitscher Co., Inc.	716-344-2035
NY	Binghamton, R.W. Mitscher Co., Inc.	607-724-6561
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	New York, MOS Mktg. Assoc.	516-487-3966
NY	Pittsford, R. W. Mitscher Co., Inc.	716-586-4012
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean,Inc.	919-876-4130
OH	Centerville, Bear Mktg., Inc.	513-436-2061
OH	Richfield, Bear Mktg., Inc.	216-659-3131
OR	Portland, J. V. Belusko Co.	503-222-4279
PA	Allison Pk., Bear Mktg., Inc.	412-492-1150
PA	Narberth, Bresson Assocs., Inc.	215-664-6460
PA	Stewartstown, Bresson Assocs.	717-993-6197
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, Elcom Mktg., Inc.	214-241-2166
TX	Dallas, Erickson Sls., Inc.	214-739-5833
TX	Houston, Elcom Mktg.	713-350-8064
VA	Charlottesville, Mid-Atlantic Sls. Co.	804-973-8099
Can	Calgary, Alb., A.C. Simmonds & Sons	403-256-1516
Can	Nova Scotia, A.C. Simmonds & Sons	902-865-1889
Can	Pickering, Ont., A. C. Simmonds	416-839-8041
Can	Richmond, B.C., A.C. Simmonds & Sons	604-438-5267
Can	Ville Lemoyne, Que., A.C. Simmonds & Sons	514-466-5250

LITTON ELECTRON DEVICES, 960 Industrial Rd., San Carlos, CA 94070, Tel: 415-591-8411, TWX: 910-376-4900, FAX: 415-591-5623; Empl.: 800

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Poly-Scientific

FAX: 703-953-1841

LITTON POLY-SCIENTIFIC, Div. of Litton Industries, 1213 N. Main St., Blacksburg, VA 24060-3100, Tel: 800-336-2112, 703-953-4751, TWX: 710-875-3694; Empl.: 550 .... **B•1218-1219, 1278-1292**

Local Sales Offices & Reps

AZ	Phoenix, Dick Palmer	602-242-0911
CA	Cupertino, Sal DeGrande	408-996-7507
CA	Huntington Bch., Mike Baggetta	714-968-0434
CA	Huntington Beach, Mike Baggetta	714-968-0434
CA	Woodland Hills, Bob Billington	818-982-9709
CT	Glastonbury, Larcon	203-633-6547

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FL	Fern Park, Blair Engrg.	407-834-1244
GA	Atlanta, Blair Engrg.	404-454-8979
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
MA	W. Newton, Larcom Inc.	617-244-2053
MI	Stockbridge, Erhart Engrg.	517-851-8770
MI	Stockbridge, Rettig Engrd. Prod.	517-851-8770
MN	Bloomington, EMT	612-888-1020
MN	Bloomington, EMT Engrg.	612-888-1020
MN	Eden Prairie, PWC, Inc.	612-934-1409
KS	Olathe, Technical Sls. Assoc.	913-829-2800
MO	St. Louis, Midtec Assoc. Inc.	314-275-8666
NY	Mineola, Kahn Assocs.	516-742-1900
OH	Fairborn, Clifton Precision	513-879-7100
OH	Medina, Stress Analysis Svcs.	216-725-7733
PA	Clifton Heights, Precision Dvcs.	215-284-9267
TX	Dallas, Blair Engrg.	214-241-5655
TX	Garland, Carey, McMahill & Associates	214-681-1414
TX	Garland, GMA	214-681-1414
WA	Bellevue, Thorsen Co.	206-455-9180

LIXI, INC., 1438 Brook Dr., Downers Grove, IL 60515, Tel: 708-620-4646, FAX: 708-620-7776; Empl.: 17; *Sls. Mgr.:* Andy Xydakis; *Dist. Mgr.:* Oscar Lijap

LJ TECHNICAL SYSTEMS, 19 Power Drive, Hauppauge, NY 11788, Tel: 516-234-2100, FAX: 516-234-2656; Empl.: 25; *Sls. Mgr.:* Christopher Rowe

LMB HEEGER, INC., 6400 Fleet St., Commerce, CA 90040, Tel: 213-728-5108, 213-728-4729, FAX: 213-728-4740; *Sls. Mgr.:* Robert Heeger

LMI CANADA, 5778 Thimens, St. Laurent, Que., Canada H4R 2K9, Tel: 514-333-7288, 800-565-2811, FAX: 514-333-2881 **C•1394-1399**

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LMI CONNECTORS INC., 1181 S. Rogers Cir. 11, Boca Raton, FL 33487-2710, Tel: 407-994-5896, 800-247-0564; *Sls. Mgr.:* David Asseraf; *Dist. Mgr.:* David Asseraf **C•1394-1399**

Local Sales Offices & Reps

AL	Huntsville, Pinnacle Mktg.	919-848-0404
CA	Canyon Country, Interconn Tech. Mktg.	805-298-3199
CA	Newbury Park, Interconn Tech. Mktg.	805-499-4024
CA	Trabuco Canyon, Interconn Tech. Mktg.	714-589-3793
CO	Boulder, Component Products Sls.	303-530-2800
CT	Madison, Focus Sls.	203-245-4314
GA	Alpharetta, Pinnacle Mktg.	404-410-9980
IL	Glenview, Prime Dvcs.	708-729-2550
KS	Overland Pk., Acorn Elctrns.	913-649-6402
MA	E. Taunton, Focus Sls.	508-824-3840
MA	W. Bridgewater, Focus Sls.	508-588-2367
MI	Warren, Burcaw Co.	313-573-4605
MN	Minneapolis, D.A. Case Assocs.	612-831-6777
MO	St. Louis, Acorn Elctrns.	314-421-1751
NH	Amherst, Focus Sls.	603-672-2010
NJ	Burlington, VDE Elctrn. Sls.	609-387-9331
NJ	Flanders, K & R Engrg. Sls.	201-584-5235
NC	Raleigh, Pinnacle Mktg.	919-848-0404
NC	Wilmington, Pinnacle Mktg.	919-686-4696
OH	Mentor, Sls. Plus	216-942-7811
OH	New Carlisle, Sls. Plus	513-845-9792
TX	Burleson, Bounty Elctrn. Sls.	817-447-9775
WA	Renton, K.R. Jensen Sls. Co.	206-277-2772
Can	Montreal, LMI Canada	514-333-1713

Local Distributors

AL	Huntsville, Comps. & Connections	205-534-2844
AL	Huntsville, CRI	205-533-2862
AL	Madison, Gateway Megatech	205-464-9300
AZ	Tempe, Control Design Supp.	602-829-7981
CA	Anaheim, Control Design Supp.	714-821-6173
CA	Fullerton, Interconnect Specs.	714-773-0411
CA	San Carlos, Control Design Supp.	415-592-4806
CA	San Diego, Control Design Supply	619-457-9822
CA	Santa Ana, BDS Elctrns.	714-662-1050
CO	Denver, Control Design Supp.	303-296-1922
CT	Wallingford, Control Design Supp.	203-269-9955
FL	Altamonte, Control Design Supp.	305-788-3220
FL	Pompano Beach, Control Design Supp.	305-782-1311
GA	Roswell, Gateway Megatech	404-642-8787
GA	Stone Mountain, Control Design Supp.	404-979-3500
IL	Chicago, Control Design Supp.	708-307-8944
IL	Chicago, Leeds	312-625-3800
IL	Elk Grove, Steiner Electric	708-228-0400
IL	Schaumburg, Control Design Supp.	708-307-8900
IN	Indianapolis, Control Design Supp.	317-788-4559
IN	Indianapolis, Gateway Megatech	317-298-0111
IA	Marion, Control Design Supp.	319-373-2923
KS	Kansas City, Control Design Supp.	913-362-4248
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Tewksbury, Armor Elctrns.	508-640-1499
MA	Westborough, Pierce Assocs.	508-366-0002
MA	Woburn, Control Design Supp.	617-932-9404
MI	Ann Arbor, Gateway Megatech	313-761-2980
MI	Kentwood, Gateway Megatech	616-245-3210
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	St. Louis, Control Design Supp.	314-426-3150
NJ	Union, Avanti	201-964-0333
NY	Canandaigua, Advacom	716-396-9050
NY	Henrietta, Control Design Supp.	716-334-1120
NY	Whitestone, Power Electro Supp.	718-767-1447
NC	Charlotte, Control Design Supp.	704-588-4410
OH	Columbus, Gateway Megatech	614-447-0222
OH	Kettering, Gateway Megatech	513-298-6342
OH	Willoughby, Gateway Megatech	216-953-0333
PA	Malvern, Control Design Supp.	215-296-0150
TN	Knoxville, Indl. Elctrns.	615-573-7135
TX	Arlington, Bell Comp. Sls.	817-461-5303
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Control Design Supp.	214-358-1441
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	Houston, Wofford Elctrns., Inc.	713-847-3583
UT	Nephi, Control Design Supp.	801-623-2977
VA	Richmond, Gateway Megatech	804-282-1360
WA	Kent, Control Design Supply	206-251-6323
WI	Menemonee Falls, Cablemaster	414-783-3000
WI	Menomonee Falls, Cablemaster	414-255-9033
WI	New Berlin, Control Design Supp.	414-784-1015
Can	Calgary, AB, Memco	403-258-3399
Can	Edmonton, AB, Wholesale Electronics	403-451-2180
Can	Montreal, Que., Ferrotronic Components	514-333-7288
Can	Surrey, B.C., Memco	604-590-1553

LNP ENGINEERING PLASTICS, 475 Creamery Way, Exton, PA 19341, Tel: 215-363-4500, TELEX: 4973041, TWX: 510-668-6728, FAX: 215-363-4749; *Sls. Mgr.:* William Shaker

LNR COMMUNICATIONS, INC., 180 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-7111, TELEX: 221620, TWX: 510-227-9871, FAX: 516-273-7119; FSC No.: 51049; Empl.: 200; *Sls. Mgr.:* F. Kelly, Dir. Mktg.

LOCKHEED SANDERS, INC., EMC Dept., 95 Canal St., Nashua, NH 03061-2004, Tel: 603-885-3602, TELEX: 94-3430, TWX: 710-228-1894, FAX: 603-885-2919; FSC No.: 94117; *Sls. Mgr.:* (EMC) R. Bossart

LOCTITE LUMINESCENT SYS., INC., LocTite Corp., Etna Rd., Lebanon, NH 03766, Tel: 603-448-3444, FAX: 603-448-3452; Empl.: 160; *Sls. Mgr.:* Michael R. Hartman **B•1172**

Local Sales Offices & Reps

AZ	Phoenix, Eltron	602-266-2164
CA	Irvine, Comp. Mktg. Assoc.	714-727-0688
NY	Rochester, H.C. Johnson	716-586-0777
WA	Bothell, Temco Northwest	206-481-6150

LOCUS, INC., Box 740, State College, PA 16804, Tel: 814-466-6275, FAX: 814-466-3341; *Sls. Mgr.:* Ellwood E. Brem

LOCUS, Kaman, PO Box 740, State College, PA 16804, Tel: 814-466-6275; *Sls. Mgr.:* Ellwood E. Brem

LOCUS, INC., 1842 Hoffman Street, Madison, WI 53704, Tel: 608-244-0500, FAX: 608-244-0528; Empl.: 18

LODAN ELECTRONICS, INC., 220 W. Campus Dr., Arlington Hgts., IL 60004-7805, Tel: 708-398-5311, 800-323-5207, FAX: 708-398-5340; Empl.: 130; *Sls. Mgr.:* Raymond A. Kedzior; *Dist. Mgr.:* Andrew D. Longhini

LODESTONE PACIFIC, 4065 E. La Palma Ave., Bldg. G, Anaheim, CA 92807, Tel: 714-630-1343; FSC No.: OJWU1; Empl.: 15; *Sls. Mgr.:* Mark Soukup **A•1244-1247**

Local Sales Offices & Reps

IL	Chicago, Charles Atwater Assoc.	708-668-2303
MA	Boston, Anchor Engrg. Corp.	508-898-2724
NY	Long Island, Kahgan Brody Assoc.	516-538-2300
PA	Easton, Kendon Co.	215-253-3100
VA	Roanoke, A.B. Kreger Co.	703-989-4738
Intl	Frankfurt, Germany, BFI	06074 4098-0
Intl	Hong Kong, P. Leo & Co. Ltd.	5-413655
Intl	London, England, Cirkit	0992-444111
Intl	Milano, Italy, BFI	2-33100535
Intl	Paris, France, BFI	145-330137
Intl	Roskilete, Denmark, BFI	488-8289900
Intl	Sollenton, Sweden, BFI	488 828 9900

LOGICAL DESIGN GROUP, INC., 6301 Chapel Hill Rd., Raleigh, NC 27607, Tel: 919-851-1101, FAX: 919-851-2844; Empl.: 22; *Sls. Mgr.:* Charles Pugh; *Dist. Mgr.:* Charles Pugh

LOGICAL DEVICES, INC., 1201 N.W. 65th Place, Fort Lauderdale 33309, Tel: 305-974-0967, FAX: 305-491-6956; *Sls. Mgr.:* Bob Sims

LOGICAL SYSTEMS CORPORATION, P.O. Box 6184, Syracuse, NY 13217-6184, Tel: 315-478-0722, FAX: 315-475-8460: *Sls. Mgr.:* Mitchell Burko

LOGIC BEACH INC., 8033 Pasadena Ave., La Mesa, CA 91941, Tel: 619-698-3300, FAX: 619-469-8604; Empl.: 15; *Sls. Mgr.:* David Parks; *Dist. Mgr.:* David Parks

LOGIC DEVICES INC., 628 E. Evelyn Ave., Sunnyvale, CA 94086, Tel: 408-737-3300, TELEX: 172-387, FAX: 408-733-7690

LOGICOMP ELCTRNS., INC., See Pres-Air-Trol Corp.

LOGIC TECHNOLOGY, INC., 1090-B L'Avenida, Mtn. View, CA 94043, Tel: 415-967-1007, FAX: 310-641-4691; FSC No.: 51019; *Sls. Mgr.:* Mel Morgan

LOGIMETRICS, 121-03 Dupont St., Plainview, NY 11803, Tel: 516-349-1700, TELEX: 7608152, FAX: 516-349-8552; FSC No.: 33013; Empl.: 75; *Sls. Mgr.:* Sol Abrams

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LOGITEK, INC., 101 Christopher St., Ronkonkoma, NY 11779, Tel: 516-467-4200; FSC No.: 15420; Empl.: 50; *Sls. Mgr.:* Joe Churchill **B•1556; D•1816-1817, 2130**

Local Sales Offices & Reps

CA	Campbell, Shur Sls., Inc.	408-374-5577
FL	St. Petersburg, Jack McGirr	813-345-4012
GA	Norcross, R.O. Whitesell & Assocs.	404-449-9190
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
KY	Versailles, R.O. Whitesell & Assocs.	606-873-1182
MI	Southfield, R.O. Whitesell & Assocs.	313-352-5454
MI	Southfield, R.O. Whitesell & Assocs.	313-559-5454
MN	Brooklyn Center, White Sls. Co.	612-566-8694
NH	Hampton, Primary Source	603-926-8044
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Ronkonkoma, Logitek	516-467-4200
NC	Greensboro, R.O. Whitesell & Assocs.	919-273-1945
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
PA	Glenside, Koebert Assocs.	215-887-2310
NY	Mendon, Tech Mark	716-624-3840
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Richardson, Scientific Sls.	214-231-6541
WA	Kirkland, Skye-Tek	206-828-2115
WI	White Sls. Co.	612-566-8694
Can	Montreal, Que, S.D. Electronique	514-735-9673

LONG ISLAND TRANSFORMER & INDUCTOR, 882 Wallace Ave., Baldwin, NY 11510, Tel: 516-379-1465, FAX: 516-379-0167; Empl.: 10

LORAIN PRODUCTS, Reliance Electric, 1122 F St., Lorain, OH 44052, Tel: 216-288-1122, TELEX: 98-0505, TWX: 196131; Empl.: 1200; *Sls. Mgr.:* T. F. McFadden

LORAL DATA SYSTEMS, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: 06141; Empl.: 900; *Sls. Mgr.:* F. V. Bud Hinkel

LORAL DATA SYSTEMS, Data Recorders, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Steve Hoff

LORAL FAIRCHILD, Imaging Sensors, 1801 McCarthy Blvd., Milpitas, CA 95035-7407, Tel: 408-433-2500, TWX: 910-373-2110, FAX: 408-433-2508; *Sls. Mgr.:* Jim Johnson; *Dist. Mgr.:* Jim Johnson

LORAL MICROWAVE-FSI, Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 508-256-4113/8101, TWX: 710-343-0404, FAX: 508-937-3748; FSC No.: 26629; Empl.: 90; *Sls. Mgr.:* D. Langan

LORAL MICROWAVE NARDA, 435 Moreland Rd., Hauppauge, NY 11788, Tel: 516-231-1700, TWX: 510-221-1867, FAX: 516-231-1711; FSC No.: 99899; Empl.: 400; *Sls. Mgr.:* Robert Nopper

LORAL MICROWAVE-NARDA WEST, 11040 White Rock Rd. 200, Rancho Cordova, CA 95670-6001, Tel: 916-638-5500, FAX: 916-638-8682; Empl.: 115; *Sls. Mgr.:* Leon Becker

LORAL MICROWAVE-WAVECOM, 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TELEX: 6502408147; FSC No.: 28979; Empl.: 109

LORAL TERRACOM, Sub. of Loral Corp., 9020 Balboa Ave., San Diego, CA 92123-1595, Tel: 619-278-4100, TELEX: TERRACOM A SDG 18-2774, FAX: 619-292-1140; Empl.: 130; *Sls. Mgr.:* Michael A. Lapadula

LORANGER INTL. CORP., 817 Fourth Ave., Warren, PA 16365, Tel: 814-723-2250, FAX: 814-723-5391; Empl.: 55; *Sls. Mgr.:* J. Albert Loranger

LORCH ELECTRONICS:DIV. OF VERNITRON CORP., 2801 - 72nd St., No., St. Petersburg, FL 33710, Tel: 813-347-2181, FAX: 813-347-3881; FSC No.: 29971; Empl.: 50; *Sls. Mgr.:* Carol McCoy

LORLIN TEST SYSTEMS, Axiam, Inc., 4 Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, FAX: 203-744-6185; Empl.: 30; *Sls. Mgr.:* John Seacord

LORTEC POWER SYSTEMS, INC., 145 Keep Court, Elyria, OH 44035-2214, Tel: 216-327-5050, FAX: 216-327-9628; Empl.: 45; *Sls. Mgr.:* Dale Lamirand

LOVE CONTROLS DIVISION, Dwyer Instruments, Inc., 1475 S. Wheeling Rd., Wheeling, IL 60090, Tel: 708-541-3232, TELEX: 297115, FAX: 708-541-7366; FSC No.: 81919; Empl.: 72; *Sls. Mgr.:* James Nolan; *Dist. Mgr.:* Jim Clark

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FAX: 508-281-6321

LOW KEY CORPORATION, Strong Group, 105 Maplewood Ave., P.O. Box 1195, Gloucester, MA 01930, Tel: 508-281-0448; Empl.: 25; *Sls. Mgr.:* Brian Hendricks .... **B•1842-1843**

Local Sales Offices & Reps

AL	Huntsville, MacKay Smith Assocs.	205-539-8005
CO	Englewood, Elctrn. Comp. Sls.	303-762-9576
CT	Plainville, Northeast Rep., Inc.	203-866-6030
FL	Orlando, MacKay Smith Assocs.	407-423-4353
GA	Tucker, MacKay Smith Assocs.	404-496-9913
IL	Skokie, Electro Tech Mktg.	312-676-3151
IN	Greenfield, France Entprs.	317-462-6098
MD	Baltimore, Hagy Assocs.	301-529-3995
MA	Hingham, Northeast Rep., Inc.	617-749-8700
NH	Mt. Vernon, Northeast Rep. Inc.	603-673-1406
NJ	Lebanon, F.F. Sylvester Assocs.	201-735-2488
NY	Coram, F.F. Sylvester Assocs.	516-473-2018
NC	Raleigh, MacKay Smith Assocs.	919-847-2277
PA	Newtown Sq., Hagy Assocs.	215-459-0504
UT	Salt Lake City, Elctrn. Comp. Sls.	
Can	St. Lazare, Que., Atkinson & Ross Assoc.	514-424-5679
Can	Witby, Ont., Atkinson & Ross Assoc.	416-666-8359

LSI COMPUTER SYSTEMS, INC., 1235 Walt Whitman Rd., Melville, NY 11747, Tel: 516-271-0400, FAX: 516-271-0405

LSI LOGIC CORP., 1551 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-8000, TELEX: 172153; *Dist. Mgr.:* John Mucciaro

LTI, INC., Autotech Technologies, LP, 363 St. Paul Blvd., Carol Stream, IL 60188, Tel: 708-668-8886, FAX: 708-668-9480; Empl.: 60; *Sls. Mgr.:* Ray Szydzik

LTX CORPORATION, LTX Pk. @ University Ave., Westwood, MA 02090, Tel: 617-461-1000, FAX: 617-461-0993; Empl.: 1,500; *Sls. Mgr.:* Roger Blethen, Sr. V.P. Sls.

LUCAS CONTROL SYSTEMS PRODUCTS, Lucas Industries PLC, 1000 Lucas Way, Hampton, VA 23666, Tel: 804-766-1500, FAX: 804-766-4258; Empl.: 375; *Sls. Mgr.:* Leroy Nopper, V.P. Sls.

LUCAS DEECO, Lucas Industries, 31047 Genstar Road, Hayward, CA 94544-7831, Tel: 510-471-4700, FAX: 510-489-3500; Empl.: 75; *Sls. Mgr.:* Bill Lepior, Natl; *Dist. Mgr.:* Harvey Goldman

LUCAS EPSCO, INC., 99 South St., Hopkinton, MA 01748-2204, Tel: 508-435-2400, TELEX: 95-1110, FAX: 508-435-2022; FSC No.: 15894; Empl.: 240; *Sls. Mgr.:* John M. Shalhoub

LUCAS LEDEX, Lucas Industries, P.O. Box 427, 801 Scholz Dr., Vandalia, OH 45377-0427, Tel: 513-898-3621, FAX: 513-898-8624; FSC No.: 54-0840753; Empl.: 200; *Sls. Mgr.:* Leroy Nopper ..... **B•1647-1651, 1766, 1967**

LUCAS NOVA SENSOR, Lucas Industries, 1055 Mission Court, Fremont, CA 94539, Tel: 510-490-9100, FAX: 510-770-0645; Empl.: 80; *Sls. Mgr.:* Bill Michaels

LUCAS SCHAEVITZ, INC., Lucas Industries PLC., 7905 N. Route 130, Pennsauken, NJ 08110-1489, Tel: 609-662-8000, FAX: 609-662-6281; FSC No.: 93190; Empl.: 175; *Sls. Mgr.:* Leroy Nopper

LUCAS WEINSCHEL, P.O. Box 6001, Gaithersburg, MD 20884-6001, Tel: 301-948-3434, FAX: 301-948-3625; FSC No.: 93459; *Sls. Mgr.:* Geoffrey D. Smith

LUCAS WESTERN INC., Electro Systems Division, 610 Neptune Ave., Brea, CA 92621, Tel: 714-671-4500, TWX: 910-240-3603, FAX: 714-671-4503; Empl.: 210; *Sls. Mgr.:* Jerry Neumayer

LUCAS ZETA, Lucas Aerospace, Inc., 2811 Orchard Parkway, San Jose, CA 95134, Tel: 408-434-3600, FAX: 408-433-0205; FSC No.: 31260; Empl.: 150; *Sls. Mgr.:* Joe Rock

LUFF RESEARCH, INC., 22 N. Tyson Ave., Floral Park, NY 11001, Tel: 516-358-2880, FAX: 516-358-2757

LUFT INSTRUMENTS, INC., Hillside Rd., P.O. Box 214, Lincoln, MA 01773, Tel: 617-259-9215, FAX: 617-259-9215; Empl.: 12

LUMBERG, INC., 11351 Business Ctr. Dr., Richmond, VA 23236, Tel: 804-379-2010, FAX: 804-379-3232; Empl.: 8; *Sls. Mgr.:* John R. Naudziunas

LUMEX OPTO/COMPONENTS, INC., 290 E. Hellen Rd., Palatine, IL 60067-6955, Tel: 708-359-2790, FAX: 708-359-8904; Empl.: 150; *Sls. Mgr.:* Hank Zabawski; *Dist. Mgr.:* Tanya Bons

LUMIDOR SAFTEY PRODUCTS, SafteyTek Corp., 11221 Interchange Circle South, Miramar, FL 33025, Tel: 305-433-7000, FAX: 305-433-7730; Empl.: 50; *Sls. Mgr.:* Bryan Bates; *Dist. Mgr.:* Bryan Bates

LUMINATOR AIRCRAFT PRODUCTS, 1200 E. Plano Parkway, Plano, TX 75074, Tel: 214-424-6511, FAX: 214-423-8515; FSC No.: 22973; Empl.: 70; *Sls. Mgr.:* Gordy Treichler

Local Sales Offices & Reps

CA	Long Beach, Luminator Aircraft	714-968-8748
KS	Wichita, Lee Prods.	316-264-2172

Local Distributors

GA	Smyrna, Electro Air	404-432-1900
NY	Purchase, Aerotech World Trade	716-428-3500

LUMINTECH

FAX: 201-374-2554

LUMINTECH INC., 171 Colt St., Irvington, NJ 07111, Tel: 201-374-1091; Empl.: 4; *Sls. Mgr.:* Subhash Goyal .... **A•2376**

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LUMITEX, INC., 8443 Dow Circle, Strongsville, OH 44136, Tel: 800-969-5483; *Sls. Mgr.:* Bruce Baunach ... **B•1173**

Local Sales Offices & Reps

AL	Guntersville, Tek-Rep Mktg.	205-582-7663
AZ	Phoenix, Van Dahl Engrg.	602-866-6988
CA	Misson Viejo, Champa Assocs.	714-581-3459
CA	Napa, Stewart-Fullerton Assoc.	707-258-1160
CA	Solana Bch., D2 Sls., Inc.	619-481-9310
CA	Tarzana, Tarco/Prime Source	818-708-8058
CO	Franktown, MRC	303-660-8750
FL	Margate, EPM	305-977-0331
FL	Orlando, EPM	407-425-6149
GA	Dunwoody, Tek-Rep Mktg.	404-963-1600
IL	Glen Ellyn, Lincoln Hodges	708-469-6750
IA	Cedar Rapids, J. R. Sls. Engrg.	319-393-2232
MA	Swansea, Poisson Assocs.	508-677-3655
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	St. Charles, Buckman & Assocs.	314-947-4727
NJ	E. Brunswick, Shepard Assocs.	908-254-5757
NJ	Totowa, Shepard Assocs.	201-256-1774
NY	Chester, Shepard Assocs.	914-469-2011
NY	Jericho, Shepard Assocs.	516-822-3700
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Columbus, The Bill Romine Co.	614-436-0565
PA	Dowingtown, Grasso Tech. Sls.	215-458-8967
TX	Austin, THT Sls.	512-835-2794
TX	Dallas, THT Sls.	214-783-1501
TX	Houston, THT Sls.	713-981-4277
VA	Herndon, Eastern Elctrns.	703-904-7272
WA	Redmond, VMI	206-882-2999
WI	Janesville, Antek Mktg. Corp.	608-754-4214
Can	Toronto, RepTech	416-863-9510
Can	W. Vancouver, Leister Blake Entpr.	604-926-6127

LUMITRON, PO Box 267, Summit, NJ 07902-0267, Tel: 908-273-8998, FAX: 908-273-0853; FSC No.: 51702; Empl.: 20; *Sls. Mgr.:* Gil Chassie

LUNAIRE ENVIRONMENTAL, INC., Lunaire Limited, 4 Quality St., Williamsport, PA 17701, Tel: 717-326-1770, FAX: 717-326-7304; Empl.: 130; *Sls. Mgr.:* Stu Lunick

LUNDAHL INSTRUMENTS, INC., Ezra C. Lundahl Inc., 429 South Main, Logan, UT 84321, Tel: 801-753-7300, FAX: 801-753-7490; Empl.: 17; *Sls. Mgr.:* Val Potter

LUTRON ELECTRONICS CO., 7200 Suter Rd., Coopersburg, PA 18036, Tel: 215-282-3800, TELEX: 847475, TWX: 510-651-3755; Empl.: 378; *Sls. Mgr.:* John McKiernan; *Dist. Mgr.:* Robert Van Horne

LUTZE, INC., 1911-A Associates Ln., Charlotte, NC 28217-9805, Tel: 704-357-8835, 800-447-2371, FAX: 704-357-8836; Empl.: 6

LUXO CORPORATION, P.O. Box 951, Port Chester, NY 10573, Tel: 914-937-4433, 800-222-5896, FAX: 914-937-7016; Empl.: 150; *Sls. Mgr.:* Robert H. Newton

LUXTRON INC., 15 Hale St., Haverhill, MA 01830-4803, Tel: 508-372-5211, FAX: 508-372-7051; *Sls. Mgr.:* Bruce F. Morse

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FAX: 216-786-8711

LXD, INC., 7650 First Place, Cleveland, OH 44146, Tel: 216-786-8700; FSC No.: 66706; Empl.: 100; *Sls. Mgr.:* Patrick Bowen; *Dist. Mgr.:* Patrick Bowen .... **B•1086-1087**

Local Sales Offices & Reps

AL	Huntsville, Tronex Grp.	205-859-5609
AZ	Phoenix, FP Sls.	602-894-5303
CA	Los Angeles, Universal Comps.	310-783-0220
CA	Milpitas, Telesis Sls.	408-946-7300
CA	San Diego, Universal Comps.	619-232-5163
CO	Denver, Tri Tec Sls.	303-440-7862
CT	New Haven, Sturdy Corp.	203-888-1480
CT	Newton, Sturdy Corp.	203-426-4403
FL	Plantation, Tronex Grp.	305-587-4797
GA	Alpharetta, Tronex Grp.	404-751-0794
ID	Coeur D'Alene, Matrex Mktg.	208-765-5810
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Fort Wayne, RL Bontempo Assoc.	219-478-1057
IN	Indianapolis, R. L. Bontempo Assocs.	317-843-2142
IA	Cedar Rapids, KKB & Co.	319-373-1730
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Minneapolis, George Russell & Assocs.	612-854-1166
MO	Kansas City, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NH	Derry, Sturdy Corp.	603-434-8440

NJ	Haddon Field, Sunday O'Brein	609-429-4013
NJ	Tenafly, November Sls.	201-894-8964
NY	Rochester, J.G. Welch Assoc.	716-244-1100
NC	Raleigh, EEI Corp.	919-876-7591
NC	Raleigh, Tronex Grp.	919-859-2117
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Midwest Mktg.	513-433-2511
OR	Tigard, Matrex Mktg. & Sls.	503-245-8080
TX	Austin, THT Sls.	512-835-2796
TX	Dallas, THT Sls.	214-783-1501
TX	Houston, THT Sls.	713-981-4277
WA	Bellevue, Matrex Mktg. & Sls.	206-643-0363
Can	Concord, Ont., ITT Multicomponents	416-736-1144

Local Distributors

NC	Charlotte, EMC Inc.	704-394-6195
OH	Columbus, EMC Inc.	614-299-4161
OK	Tulsa, Merlin Elctrns.	918-251-2084
TX	Austin, Omnipro Elctrns.	512-794-9200
TX	Dallas, Omnipro Elctrns.	214-233-0500
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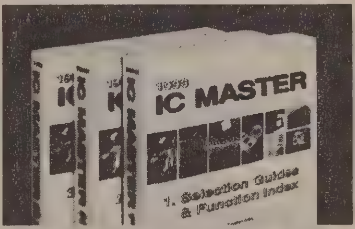

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NJ	Upper Montclair, McCarron Entprs.	201-783-3112
NM	Albuquerque, IMEC	505-294-1124
TX	Dallas, S & B Sls.	214-369-5936

MALCO, DIV. OF MICRODOT, INC., See Microdot, Interconnect Sys. Div.

MALLORY BATTERY, See Duracell Intl.

MALLORY CONTROLS, Emerson Electric Canada, P.O. Box 210, 1079 Parkinson Rd., Woodstock, Ont., Canada N4S 7W8, Tel: 519-539-4891, TELEX: 23 MOY 001, FAX: 519-539-6684; FSC No.: 37942;76055; *Sls. Mgr.:* Joe Labonte; *Dist. Mgr.:* Joe Labonte .... **A•1099, 2092-2093**

Local Sales Offices & Reps

IL	Chicago, M & S Sls.	708-934-1200, FAX:708-934-9169
MN	St. Paul, Johnson Co.	612-641-1878, FAX:612-641-0146
NY	New York, Hebert Rude Assoc., Inc.	212-721-1001, FAX:212-721-1004
OH	Cleveland, ESI	216-831-9555,FAX:216-831-8647
TX	Dallas, Eltec Sls.	817-268-2896,FAX:817-282-3010

MALLORY CONTROLS, Emerson Electric, 2831 Waterfront Pkwy-E. Drive, Indianapolis, IN 46214, Tel: 317-328-4010, FAX: 317-328-4244; Empl.: 2,000; *Sls. Mgr.:* Lewis Jones .... **A•1099, 2092-2093**

MALLORY

NORTH AMERICAN CAPACITOR CO., See North American Capacitor Co.

MANAGE, INC., Fibre Optics Elctrns. Sys. Grp., P.O. Box 158, 40 Nichols Rd., Chicopee, MA 01014, Tel: 413-592-9123, FAX: 413-594-4891; Empl.: 33; *Sls. Mgr.:* David Menard

MANGER ELECTRIC COMPANY, INC., W. Henry St., Stamford, CT 06902, Tel: 203-348-7761, FAX: 203-324-5447; FSC No.: 20262; Empl.: 100; *Sls. Mgr.:* George Hubbard

Manhattan®
ELECTRIC CABLE CORPORATION

FAX: 914-967-1616

MANHATTAN ELECTRIC CABLE CORPORATION, Station Plaza, Rye, NY 10580, Tel: 914-967-8000, TELEX: 137-387; Empl.: 50; *Sls. Mgr.:* Allan P. Marconi, VP Sls. & Mktg. .... **C•1763**

Local Sales Offices & Reps

CA	Los Angeles, Manhattan Elec. Cable Corp.	800-423-4040
IN	Indianapolis, Roth-Mooney Elctrl. Agcy.	800-289-7684
MA	Westboro, Manhattan Elec. Cable Corp.	800-831-1429
MN	Maple grove, North Central Sls.	800-829-2885
NJ	Bridgeton, Manhattan Elec. Cable Corp.	800-843-4454
TX	Houston, Manhattan Elec. Cable Corp.	800-392-4928
WA	Redmond, Elctrn. Mktg. Grp., Inc.	206-882-0962

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	El Monte, Marshall Elctrns.	818-442-7204
CA	El Toro, Sourcery Wire & Cable	714-380-0466
CA	Long Bch., John B. Rudy Co.	213-636-6934
CA	Oakland, Brill Elctrns.	415-834-5888
CA	San Jose, Compass Comps.	408-432-7575
CA	Santa Clara, Trinity Elctrns.	408-980-9011
CO	Denver, CSID	303-292-9594
CT	Greenwich, Wise Comps.	203-531-4880
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Pensacola, Elctrn. Supp. Co.	904-432-6916
FL	Tamarac, Pacer Elctrns.	305-749-1910
FL	Tampa, Dow Elctrns.	813-626-5195
LA	Harahan, MG Elctrns.	504-733-0070
MD	Owings Mill, Cameo Elctrns.	800-227-7077
MA	Burlington, QPL	617-229-2424
MA	Hudson, Metro Wire & Cable	508-562-6288
MA	Woburn, Pacer	617-935-8330
MI	Madison Hgts., Quad Elctrns.	800-969-9220
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Long Island City, H.L. Dalis	718-361-1100
NY	Mt. Vernon, QAR/All American	914-699-2224
NY	Rochester, Simcona Elctrns.	800-274-6266
NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Cincinnati, Hughes Peters	800-543-4483
OH	Columbus, Hughes Peters	800-282-1262
OH	Strongsville, Calvert Wire & Cable	800-321-1203
OH	Yellow Springs, Electroshield	800-662-1054
PA	Allentown, P.A. Peters	800-322-9583
PA	Harrisburg, Cumberland Elctrns.	800-692-7425
PA	Montgomeryville, Pytronic Inds.	800-562-5780
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Austin, Wholesale Elctrn. Supp.	512-478-9568
TX	Houston, Houston Wholesale Elctrns.	713-644-8320
TX	Houston, Kent Elctrns.	713-780-7770
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VT	Bethel, Clifford of Vermont	802-234-9921
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Woodinville, Northwest Wire & Cable	206-486-8342

MANIX MFG. INC., 50 Ash Circle, Warminster, PA 18974, Tel: 215-957-6565, FAX: 215-957-6599; Empl.: 20; *Sls. Mgr.:* Ira Schafer

MANNCORP, Box 8, Huntingdon Valley, PA 19006, Tel: 215-364-6100, FAX: 215-364-6110; Empl.: 15; *Dist. Mgr.:* Mickey Hoffer

MANSFIELD & GREEN DIVISION, A Subsidiary of Ametek Inc., 8600 Somerset Dr., Largo, FL 34643, Tel: 813-536-7831, FAX: 813-539-6882; Empl.: 120; *Sls. Mgr.:* Gary Queensberry

MANTEX CORP., 1800 Metamora Rd., P.O. Box 15, Oxford, MI 48371, Tel: 313-628-8210, FAX: 313-628-1520; Empl.: 100; *Sls. Mgr.:* Dave Wm. Rice

MANU-TRONICS, INC., 8701-100th St., Lakeview Corporate Pk., Kenosha, WI 53142-7799, Tel: 414-947-7700, FAX: 414-947-7729; Empl.: 250; *Sls. Mgr.:* Frank Montabana

MARATHON POWER TECHNOLOGIES, P.O. Box 8233, Waco, TX 76714-8233, Tel: 817-776-0650, TWX: 910-894-5203 MARATHON WAC

MARATHON SPECIAL PRODS., Marathon Electric, 13300 Van Camp Rd., Bowling Green, OH 43402, Tel: 419-352-8441, FAX: 419-352-0875; FSC No.: 26405; Empl.: 150; *Sls. Mgr.:* J. Campisi

MARC ENTERPRISES, 27762 Forbes Rd., # 17, Laguna Niguel, CA 92677, Tel: 714-249-0302, FAX: 714-249-0302; Empl.: 10; *Sls. Mgr.:* Brian Maravich

MARCO MANUFACTURING CO., INC., 2021-43 So. 29th St., Philadelphia, PA 19145, Tel: 215-463-2332, FAX: 215-334-4990; Empl.: 35-40

MARCON AMERICA CORP., 998 Forest Edge Dr., Vernon Hills, IL 60061, Tel: 708-913-9980, FAX: 708-913-1150; Empl.: 14; *Sls. Mgr.:* Tony Olita; *Dist. Mgr.:* Mary Lou Just

MARCONI INSTRUMENTS, 3 Pearl Court, Allendale, NJ 07401, Tel: 201-934-9050, FAX: 201-934-9229; *Sls. Mgr.:* Carl Pepple, Gen. Mgr. .... **D•1297**

Local Sales Offices & Reps

AZ	Mesa, Scientific Dvcs.West	602-730-9774
CA	Santa Fe Springs, Wallace & Wallace	213-945-2908
CA	Shingle Springs, LK Allen Comms.	916-676-2533
CO	Scientific Dvcs. West	303-665-8089
CO	Broomfield, Scientific Dvcs. West	303-469-5145
CO	Littleton, K. C. Marketers, Inc.	303-972-8411
FL	Clearwater, Beacon Microwave	813-796-2378
GA	Alpharetta, Panterra Sls.	404-772-9944
GA	Marietta, Comm. Mktg. S.E.	404-424-9097
IL	Schaumburg, K.W. Meyers	708-882-4808
IN	Colombus, Tom Rittenhouse	812-378-0866
KS	Pomona, Comms. Equip. Specs.	913-566-8387
MD	Laurel, Elctrn. Mktg. Assocs.	301-953-7800
MA	Westford, ICS Assocs.	508-765-5131
MI	Houghton Lake, W.E.Price & Co.	517-366-8702
MN	Minneapolis, Baltz Assocs.	612-546-8520
MO	Maryland Hgts., Comms. Equip. Specialties	314-291-7841
NJ	Allendale, Allan Mowat	201-934-9050
NM	Albuquerque, Scientific Dvcs.	505-883-3668
OH	St. Mary's, Thomas Shelby & Co.	419-394-3377
OR	Oregon City, Proctor Sls. & Mktg.	503-657-7583
TX	Richardson, Engrg. Equip. Sls.	214-578-1146
TX	Richardson, EES	214-644-8881

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MARINE ELECTRIC SYSTEMS, 2 Bridewell St, Clifton, NJ 07014-1135, Tel: 201-471-6800; FSC No.: 00062; Empl.: 65; *Sls. Mgr.:* G. V. Mandell; *Dist. Mgr.:* G. V. Mandell .... **D•1015**

Local Sales Offices & Reps

PA	Sewickley, Teplitz-Byrne Assoc.	412-741-3628
WA	Bothell, D. Bartholomew	206-483-8617
WI	Green Bay, Winn Agency	414-336-7476
Can	Montreal, Metrone	514-483-2323

WILD OATS

FAX: 803-249-5191

MARKAT DIV., Wild Oats Corp., 1432 Fox Hollow Way, N. Myrtle Bch., SC 29582-2514, Tel: 803-249-5191; Empl.: 211; *Sls. Mgr.:* K. L. Campbell; *Dist. Mgr.:* W. B. Heather

Markel
CORPORATION

FAX: 215-270-3138

MARKEL CORP., P.O. Box 752, Norristown, PA 19404, Tel: 215-272-8960; FSC No.: 03890; Empl.: 228; *Sls. Mgr.:* Allan R. Soldwisch; *Dist. Mgr.:* L. J. Clemente ... **C•1666**

Local Sales Offices & Reps

AL	Montgomery, MYA, Inc.	205-284-1948
AZ	Scottsdale, Mid/West Co.	602-991-0427
CA	Montrose, Signal Enterprises	818-957-0640
CA	Santa Cruz, WestCal Sls.	408-423-9344
CO	Evergreen, Mid/West Co.	303-374-4829
FL	Ft. Lauderdale, Hawkins Frederickson	305-321-6702
FL	Maitland, Hawkins Frederickson	407-831-2474
IL	Schiller Pk, Wm. R. Bolles	312-678-7888
MD	Glen Burnie, C.W. Boss Co.	301-744-4611
MA	Hopedale, D.M.A. Mktg.	508-473-9994
MI	Northville, L. George & Assoc.	313-380-6300
MN	Brooklyn Park, Technical Comps. Grp.	612-561-5556
MO	Florissant, Mid/West Co.	314-837-3361
NJ	Colonia, Heft & Ficarra	201-381-5193
NY	Lynbrook, Heft & Ficarra	516-599-3351
NY	Rochester, Ontec	716-464-8636
OH	Chagrin Falls, Electrolock	216-543-6626
OR	Hillsboro, Temco NW	503-645-2030
PA	Flourtown, CGM Inc.	215-233-0333
SC	Greenville, Electrolock Inc.	803-297-9830
TN	Murfreesboro, Alpha Mktg.	615-896-6102
WA	Bothell, Temco NW	206-481-6150
WI	Mequon, Wm. R. Bolles	414-241-3320
EXP	Plymouth Meeting, PA, Ballagh & Thrall	215-825-5710
Can	Rexdale,Ont, True North Technology	416-744-2233

Local Distributors

CA	Los Angeles, Natl. Wire & Cable	213-225-5611
CA	Santa Clara, Amax Wire & Cable	408-727-3234
CO	Denver, Brownell Elctrns.	303-333-3541
CT	Hartford, Wes-Garde	203-527-7705
FL	Davie, Arco Distrs.	305-473-2550
FL	Lakeland, Switch Controls	800-282-7619
GA	Atlanta, Accu-Tech Cable	404-455-6422
IL	Chicago, Fay Electric Wire	708-267-9222
IL	West Chicago, J.J. Glenn	708-293-7800
IN	Indianapolis, Marian Rubber	317-638-6525
KS	Wichita, Midwest Aircraft Supp.	316-267-3318
LA	New Orleans, Radio Parts	504-581-5959
MD	Rockville, Read Plastics	301-881-7900
MI	St. Clair Shores, Spemco	313-771-2700
MN	Bloomington, K.L. Tannenill	612-881-6700
MO	St. Louis, Midwest Switch	314-567-7164
NY	Rochester, Simcona Elctrns.	716-328-3230
OH	Chagrin Falls, Electrolock	216-543-6626
OR	Wilsonville, O.T.S. Wire	503-682-7050
SC	Greenville, Electrolock, Inc.	803-297-9830
AR	Little Rock, Hisco	501-568-3105
CT	Manchester, IMS Inc.	203-288-7005
VA	Roanoke, Control Distbn.	703-774-4586
Can	Mississauga, Ont., Marflex-Barrett Ltd.	416-828-0220

MARKEM CORP., 150 Congress St., Keene, NH 03431, Tel: 603-352-1130, TELEX: 710-366-1800, FAX: 603-357-5871; FSC No.: 38360; Empl.: 1400; *Sls. Mgr.:* Rich Howsen

MARKETECH, INC., 11061 173rd Ave., N.W., Elk River, MN 55330-7034, Tel: 612-441-8664, FAX: 612-441-8692; FSC No.: 1505; Empl.: 13; *Sls. Mgr.:* Richard Duggan

MARK EYELET INC., AMP, Inc., 63 Wakelee Rd., Wolcott, CT 06716, Tel: 203-756-8847, TELEX: 69-6191, FAX: 203-755-9410; Empl.: 90; *Dist. Mgr.:* Andrew Babiak

MARKING METHODS, INC., 301 South Raymond Ave., Alhambra, CA 91803-1531, Tel: 818-282-8823, FAX: 818-576-7564; Empl.: 37; *Sls. Mgr.:* Ralph Gallella

MARKS POLARIZED CORP., 275-D Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-8900, FAX: 516-273-1190; FSC No.: 1240,1270,5895; Empl.: 10; *Sls. Mgr.:* Ronald M. Miller

MARKTECH INTERNATIONAL CORP., 5 Hemlock St., Latham, NY 12110, Tel: 518-786-6591, FAX: 518-786-6599; Empl.: 42

MARLEE SWITCH CO., 933-D N. Central Ave., Upland, CA 91786, Tel: 714-982-8988, FAX: 714-982-8989; Empl.: 10; *Sls. Mgr.:* LeRoy Tichy

marlow industries, inc.

FAX: 214-341-5212

MARLOW INDUSTRIES, INC., 10451 Vista Park Rd., Dallas, TX 75238-1645, Tel: 214-340-4900; FSC No.: 55686; Empl.: 160; *Sls. Mgr.:* John Nelson; *Dist. Mgr.:* David Marlow .... **C•1602-1605**

MARQUARDT SWITCHES INC., 2711 Rte. 20 East, Cazenovia, NY 13035, Tel: 315-655-8050, TELEX: 703-287-UD, FAX: 315-655-8042; *Sls. Mgr.:* R. A. Philipchik, V.P. Mktg.; *Dist. Mgr.:* P. D'Addario

MARSH-MCBIRNEY, INC., 4539 Metropolitan Court, Frederick, MD 21701, Tel: 800-368-2723, 301-874-5599, TWX: 710-828-0083, FAX: 301-874-2172; Empl.: 105; *Sls. Mgr.:* Fred McKinney; *Dist. Mgr.:* Jan L. Pillar

MARSH PRODUCTS, INC., Spectrum Companies, Intl., 336 McKee St., Batavia, IL 60510, Tel: 708-879-8008, FAX: 708-879-8072

MARTEL ELECTRONICS, 90 Indian Rock Rd., Windham, NH 03087, Tel: 603-893-0886, FAX: 603-898-6820; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS. INC., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286, FAX: 216-442-7713; Empl.: 4; *Sls. Mgr.:* Christopher Martin; *Dist. Mgr.:* Christopher Martin

MARWAY
PRODUCTS INC.

FAX: 714-973-2931

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 60955; Empl.: 28; *Sls. Mgr.:* Jose Molina .... **D•2278-2281**

Local Sales Offices & Reps

AZ	Glendale, Sunbird Inds, Inc.	602-439-0134
CA	Milpitas, Ward Elctrn. Packaging Sls.	408-945-0420
CA	Santa Ana, Marway Prods., Inc.	714-973-1800
CO	Monument, Sunbird Inds., Inc.	719-481-2900
CT	Meriden, PCS-Power Conversion Sys.	203-235-4886
FL	Land O' Lakes, AJ's Power Source, Inc.	813-996-2583
MD	Landover, Sel-Tronics, Inc.	301-341-2700
NH	Londonderry, PCS- Power Conversion Sys.	603-434-2371
OR	Portland, Underwood Assocs.	503-224-0583
TX	Richardson, BP Sls.	214-234-8438
WA	Seattle, Underwood Assocs.	206-870-7475
WA	Vancouver, Underwood Assocs.	206-695-2311

MASTECH, INC., Lorlin Test Systems, Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, FAX: 203-744-6185; Empl.: 42; *Sls. Mgr.:* John M. Seacord

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, TELEX: 269-505; FSC No.: 83284; Empl.: 54; *Sls. Mgr.:* Don Royer, Natl. Sls. Mgr.; *Dist. Mgr.:* Scott Radwill, Intl. Sls. Mgr.

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MASTER CIRCUITS INC., 424 Apperson Way North, Kokomo, IN 46901, Tel: 317-457-6605, FAX: 317-452-3584; Empl.: 20; *Sls. Mgr.:* Felicia Abdon

MASTER DISTRIBUTORS, P.O. Box 25662, Los Angeles, CA 90025, Tel: 213-452-1229 .... **A•1250, 2424; B•1375, 1382, 1406, 1416, 1488, 1508, 1512, 1521, 1557, 1686, 1757; C•1439, 1626, 1642**

MASTER ELECTRONIC CONTROLS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 310-452-1336, TELEX: 182041 MASTER SNM, FAX: 310-399-8600; Empl.: 74; *Sls. Mgr.:* Jamil Nizam; *Dist. Mgr.:* Belinda Valle .... **B•1558-1561**

Local Sales Offices & Reps

CA	Los Angeles, Master Distrs.	310-829-4656
CA	Santa Monica, Master Distrs.	310-452-1229

Local Distributors

AZ	Phoenix, Master Distrs.	602-267-1111
CA	Los Angeles, Brill Elctrns.	310-452-8002
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Oakland, Master Distrs.	510-835-1500
CA	Santa Monica, Master Distrs.	310-452-1336

MASTER MAGNETICS INC., The Magnet Source, 607 S. Gilbert St., Castle Rock, CO 80104, Tel: 800-525-3536, FAX: 303-688-5303; FSC No.: 5999; Empl.: 47; *Sls. Mgr.:* Jennifer Brown; *Dist. Mgr.:* Ed J. Hocks ... **A•1319**

Local Sales Offices & Reps

CA	Placentia, A-L-L Magnetics	714-632-1754
CO	Castle Rock, The Magnet Source	303-688-3966
FL	Miami, Miami Magnet Co., Inc.	305-823-1603

MATEC INSTRUMENTS, INC., 75 South St., Hopkinton, MA 01748, Tel: 508-435-9039, FAX: 508-435-5311; Empl.: 55; *Sls. Mgr.:* Ken Bishop

MATERIALS RESEARCH CORPORATION, 560 Rte. 303, Orangeburg, NY 10962, Tel: 914-359-4200, FAX: 914-359-3454; Empl.: 780; *Sls. Mgr.:* Edward Erny

Local Sales Offices & Reps

CA	Santa Clara	408-748-0902
NY	Orangeburg, Materials Rsch. Corp.	914-359-4200
TX	Dallas	214-235-9008

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MATHEMATICAL SYSTEMS DESIGN, INC., 11835 W. Olympic Blvd, Suite 745, Los Angeles, CA 90064, Tel: 310-479-7180, FAX: 310-479-0942; *Sls. Mgr.:* Lorr Kramer

THE MATHWORKS, INC., Cochituate Pl., 24 Prime Park Way, Natick, MA 01760, Tel: 508-653-1415, FAX: 508-653-2997

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036, FAX: 317-248-8369; Empl.: 10 .... **D•1195**

MATRIX CORP., 1203 New Hope Rd., Raleigh, NC 27610, Tel: 919-231-8000, FAX: 919-231-8001; Empl.: 65; *Sls. Mgr.:* Sheldon Shapiro

MATRIX SYSTEMS CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 818-222-2301, FAX: 818-222-2304; FSC No.: 33281; Empl.: 47; *Sls. Mgr.:* Randy Sue Rabideau .... **B•1562-1565**

Local Sales Offices & Reps

AL	Huntsville, Reynolds Assoc., Inc.	800-255-1965
AZ	Scottsdale, Faser Techn. Sls.	602-948-4404
CA	Los Alamitos, Tritek Solutions, Inc.	714-236-1190
CA	San Diego, Tritek Solutions, Inc.	619-455-1911
CA	San Jose, Tritek Solutions, Inc.	408-554-0455
CO	Louisville, Mountain States Reps.	303-665-8089
CT	Meriden, Polytek Assocs.	800-358-7348
FL	Melbourne, Reynolds Assocs., Inc.	800-251-1965
FL	Newport Richey, Reynolds Assocs.	800-255-1965
GA	Duluth, Reynolds Assoc., Inc.	800-255-1965
IL	Arlington Hgts., Comtel Midwest	708-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
ME	Polytek Assocs.	800-358-7348
MA	Ashland, Polytek Assocs.	800-358-7348
MA	Falmouth Hgts., RJC Assocs.	508-540-8832
MI	Southfield, Comtel Instr.	313-358-2505
MN	Wayzata, Comtel Midwest	612-476-1551
MO	Manchester, Comtel Midwest	314-227-7220
MT	Westcon, Inc.	800-547-4515
NH	Polytek Assocs.	800-358-7348
NY	Polytek Assocs.	800-358-7348
NC	Raleigh, Polytek Assocs.	800-255-1965
OH	Cleveland, Comtel Instr.	216-442-8080
OH	Columbus, Comtel Instr.	614-876-8305
OH	Dayton, Comtel Instr.	513-426-5310
OR	Portland, Westcon, Inc.	800-547-4515
PA	Polytek Assocs.	800-358-7348
PA	Pittsburgh, Comtel Instr.	412-922-5720
SC	Reynolds & Assocs.	800-255-1965
TN	Reynolds Assocs., Inc.	800-255-1965
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Mountain States Reps.	303-665-8089
VT	Polytek Assocs.	800-358-7348
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Kent, Westcon, Inc.	800-547-4515
WI	New Berlin, Comtel Midwest	414-544-6042
Can	St. Laurent, Que., Electrodesign Ltd.	514-331-3202

MATROX ELECTRONIC SYSTEMS, LTD., 1055 St. Regis Blvd., Dorval, Que., Canada H9P 2T4, Tel: 514-685-2630, TELEX: 05-822798, FAX: 514-685-2853; Empl.: 400; *Sls. Mgr.:* Ed Dwyer, VP Sls.

FAX: 714-960-6492

MATSUO ELECTRONICS, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, Tel: 714-969-2491; Empl.: 654; *Sls. Mgr.:* Ted Wiltse/John Carpenter .... **A•1100-1105**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
CA	Los Altos, Recht Assocs.	415-964-6231
CA	Mission Viejo, Angle Assocs.	714-582-8858
FL	Plantation, Gallagher	305-473-2101
GA	Lilburn, South Tech. Sls.	404-381-2088
IL	Des Plaines, ESCO Assocs.	708-298-5310
IN	Crawfordsville, Ed Mar Rep Assocs.	317-364-1871
MD	Randallstown, Chesapeake Mktg.	301-922-5997
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Madison Hgts., D.E.M. Sls.	313-583-1500
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NM	Albuquerque, FP Sls.	505-345-5553
NY	Plainview, Neptune Elctrns.	516-349-1600
NC	Raleigh, South Tech. Sls.	919-573-1313
OH	Columbus, Ed Mar Rep Assocs.	614-431-5151
OR	Beaverton, Elctrn. Sources, Inc.	503-627-0838
TX	Plano, RAM Elctrns.	214-578-5400
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
Can	Scarborough, Ont., Bach-Simpson	416-288-9932

Local Distributors

CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, National Elctrns.	714-892-7749
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Maria, Garrett Instrs.	805-922-0594
CA	W. Covina, CSI	818-960-4761
CA	Yorba Linda, Corona Elctrns.	714-283-8185
FL	Boca Raton, NRC Elctrns.	407-241-8600
GA	Norcross, NRC-Jaro	404-729-0411
GA	Norcross, Spectrum Elctrns.	404-448-1516
IL	Arlington Heights, Mar/Lyn	312-364-0444
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Billerica, Baldwin Comps.	617-667-6710
MA	Wilmington, Aved Elctrns.	617-657-6310
MI	Farmington Hills, Key Elctrns.	313-489-5455
MN	New Brighton, Parts 1	612-633-8079
NJ	Fairfield, C.H.P.S., Inc.	201-882-0997
NJ	Kenilworth, Ventronics	201-272-9262
NY	Buffalo, Summit	716-887-2800
NY	Ronkonkoma, Baldwin Comps.	516-588-5700
OH	Cleveland, Repco	216-248-8900
PA	McKean, Advacom	814-476-7774
PA	Norristown; Century Elctrn. Comps.	215-631-5400
TN	Knoxville, Venture Elctrns. Sls.	615-544-0723
TX	Dallas, Omni-Pro	214-233-0500
VA	Charlottesville, Virginia Elctrns.	804-296-4184
Can	Willowdale, Ont., Electro Sonic	416-494-1666

MAUELL CORP., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019-0339, Tel: 717-432-8686, FAX: 717-432-8688; Empl.: 25; *Sls. Mgr.:* Frank A. Ulrich; *Dist. Mgr.:* Frank A. Ulrich

MAUREY INSTRUMENT CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, FAX: 312-581-2576; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski .... **A•2095-2103**

Local Sales Offices & Reps

CT	Killingworth, Gallagher Assocs.	203-663-2338
MA	Framingham, Gallagher Assocs.	617-626-2346
TX	Dallas, THT Sls. Co.	214-783-1501

Local Distributors

CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
FL	Margate, Allied Elctrns.	305-973-3070
LA	Lafayette, Ralphs Elctrns. Supply	800-825-4507
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Grand Rapids, SF Elctrn. Supp.	616-459-0216
MI	Westland, Allied Elctrns.	313-595-6565
MO	St. Louis, Allied Elctrns.	314-878-1229
NJ	Montville, Servo Sys. Co.	800-922-1103
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-821-0415
OH	Akron, Stotts-Friedman	216-253-7000
OH	Cincinnati, Stotts-Friedman	513-574-7701
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-267-6940
TN	Knoxville, Shields Elctrns.	615-588-2421
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-932-7321
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Appleton, Appleton Elctrns.	414-734-5767

MAURY MICROWAVE CORP., 2900 Inland Empire Blvd., Ontario, CA 91764, Tel: 909-987-4715, FAX: 909-987-1112; FSC No.: 13047; Empl.: 75; *Sls. Mgr.:* M. A. Maury, Jr.

MAXELL CORP. OF AMERICA, 22-08 Rte. 208 S., Fair Lawn, NJ 07410, Tel: 201-794-5900, FAX: 201-796-8790; *Sls. Mgr.:* Ian D. Irving

MAXIM INTEGRATED PRODUCTS, 120 San Gabriel Dr., Sunnyvale, CA 94086, Tel: 408-737-7600, FAX: 408-737-7194

MAX LEVY AUTOGRAPH, INC., 220 West Roberts Ave., Philadelphia, PA 19144-4298, Tel: 215-842-3675, FAX: 215-842-3637; FSC No.: 35885; Empl.: 20; *Sls. Mgr.:* Gary Cohen

MAXMAR CONTROLS INC., 99 Castleton St., Pleasantville, NY 10570, Tel: 914-747-3540, FAX: 914-747-3567; *Sls. Mgr.:* Max Birrer; *Dist. Mgr.:* Max Birrer

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Sam Robinson

MAXUS ELECTRONIC CORP., 2760 29th St., Boulder, CO 80301, Tel: 303-447-1226, FAX: 303-447-1446; Empl.: 6; *Sls. Mgr.:* Cory J. Gates

MAXWELL LABORATORIES, INC., 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, FAX: 619-279-1554; Empl.: 600; *Sls. Mgr.:* Michael M. Plum, V.P. Mktg.

MBD INTERNATIONAL, P.O. Box 870577, Dallas, TX 75287-0577, Tel: 214-788-5277, FAX: 214-404-0471; Empl.: 5; *Sls. Mgr.:* Robert McLeod; *Dist. Mgr.:* Robert McLeod

MB DYNAMICS INC., 25865 Richmond Rd., Cleveland, OH 44146-1483, Tel: 216-292-5850, TELEX: 510-601, FAX: 216-292-5614; Empl.: 45; *Sls. Mgr.:* Ed Peterson

MCCOY/OVENAIRE/SPECTRUM, A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548, FAX: 717-486-5920; FSC No.: 00136; Empl.: 450 .... **A•1412-1417**

Local Sales Offices & Reps

AL	Madison, Arthur, Harris, Assocs.	205-461-9896, FAX:205-461-9897
AZ	Mesa, Sedco Sls.	602-461-9069, FAX:602-461-1695
CA	Chatsworth, Wes-K/Raltech, Inc.	818-700-0933, FAX:818-709-9832
CA	Goleta, Thorson Co.	805-964-8751, FAX:805-964-8753
CA	San Diego, Thorson Co.	619-292-8525, FAX:619-292-9052
CA	San Mateo, Melvin Sls.	415-349-7445, FAX:415-349-6340
CA	Signal Hill, Thorson Co.	310-595-0361, FAX:310-595-1389
CO	Grand Function, Krebill Comp. Sls.	303-243-8220, FAX:303-243-7939
CO	Littleton, Advanced Tech Mktg.	303-798-4200
FL	Longwood, Septer & Assocs., Inc.	407-774-3161, FAX:407-774-2585
FL	Oviedo, Conley & Assocs.	407-365-3283, FAX:407-365-3727
GA	Marietta, Arthur, Harris, Assocs.	404-565-5506, FAX:404-971-9778
IL	Glendale Heights, Beta Technlg. Sls., Inc.	312-790-9886
IL	Northfield, Feller Assoc.	708-446-8065
IN	Ft. Wayne, Skyline Sls. & Assocs., Inc.	219-489-4992,FAX:219-489-6194
IN	Kokomo, Skyline Sls. & Assocs., Inc.	317-452-6500, FAX:317-452-6006
IA	Cedar Rapids, Jack L. Tucker & Assoc.	319-395-7616,FAX:319-395-7873
KY	Lexington, Skyline Sls. & Assocs., Inc.	606-276-5061,FAX:606-276-5142
MD	Towson, Dickison Sls.	410-823-0923, FAX:410-321-9664
MA	Norwood, Naton Assoc.	617-762-3224, FAX:617-769-4849
MN	Minneapolis, Dunlop Conslts.	612-557-1076
NM	Albuquerque, Sunwest Mktg.	505-898-6471
NY	East Amherst, Foster & Wager, Inc.	716-688-7864
NY	Endicott, Foster & Wager, Inc.	607-748-5963, FAX:607-748-5965
NY	Liverpool, Foster & Wager, Inc.	315-457-7954, FAX:315-457-7076
NY	New Rochelle, Ascor Elctrns.	914-235-8838, FAX:914-235-2690
NY	Rochester, Foster & Wager, Inc.	716-385-7744, FAX:716-586-1359
NC	Greensboro, Arthur, Harris, Assocs.	919-275-3030, FAX:919-275-3877
NC	Matthews, Arthur, Harris, Assocs.	704-845-1085, FAX:704-845-1086
OR	Tigard, Eltech Incorp.	503-684-3458, FAX:503-684-6043
PA	Ft. Washington, Beta Sls.	215-643-6650, FAX:215-643-6651
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447, FAX:214-231-8314
VA	Charlottesville, PDQ Sls.	804-979-7085, FAX:804-979-2155
WA	Bellevue, Eltech. Incorp.	206-643-4330, FAX:206-643-0525
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200
EXP	Oradell, NJ, Sylvan Ginsbury	201-261-3200, FAX:201-261-2729
Can	Brampton, Ont., Elctrns. Sls. Prof. (ESP)	416-458-1103,FAX:416-458-4469
Can	Chateauguay, Que., Elctrns. Sls. Prof. (ESP)	514-227-2639,FAX:514-227-1518
Can	Ottawa, Ont., Elctrns. Sls. Prof. (ESP)	613-567-8547,FAX:613-567-8548
Can	Scarborough, Ont., Elctrns. Sls. Prof. (ESP)	416-321-9693,FAX:416-321-9794

MCE SEMICONDUCTOR, INC., 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 407-845-2837, TELEX: 44105 (MCE UI), FAX: 407-863-8275; Empl.: 58; *Sls. Mgr.:* Thomas Munn

MCFADDEN SYSTEMS, INC., 11835 E. Smith Ave., Santa Fe Springs, CA 90670, Tel: 310-948-4414, FAX: 310-948-1291; FSC No.: 25750; Empl.: 30

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, FAX: 516-586-5120; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Don Worden .... **B•1368**

Local Sales Offices & Reps

CA	Jamul, Power Partners	619-669-0354
CA	Los Angeles, Power Partners	310-215-0800
CA	San Bruno, Gateway Elctrl. Sls.	415-875-1600
CA	Ventura, Power Partners	805-659-5356
CO	Denver, Computer Power & Air	303-534-4235
FL	Vero Bch., E.J. Ruth Assoc.	407-234-5460
IL	Crystal Lake, Carzoli Engr. Sls.	815-459-4397
IN	Fort Wayne, Progressive Controls	219-482-1409
LA	New Orleans, Indcom Sys.	504-486-4455
MA	Woburn, EMS	617-229-6686
MN	St. Louis Pk., Electro Midwest	612-922-7017
NJ	Oakland, Midlantic Mktg.	201-848-1144
OK	Oklahoma City, Circa Inc.	405-236-2606
OK	Tulsa, Allan & Assoc.	918-451-2962
TN	Ramona, Powerforce Sys.	615-681-6255
TX	Houston, Koenig & Assoc.	713-453-8844
TX	Richardson, Devices, Inc.	214-250-2093
UT	Salt Lake City, S&T Mktg.	801-268-8183
WV	Huntington, Seco, Inc.	304-522-9732

McGILL®

FAX: 219-465-2456

MCGILL ELECTRICAL PRODUCT GROUP, 1002 North Campbell Street, Valparaiso, IN 46383, Tel: 219-465-2200; Empl.: 295 .... **B•1767-1769**

Local Sales Offices & Reps

AL	Huntsville, James E. Heusser Agy.	205-836-3896
CA	Cotati, Joseph Foster	707-792-4392
CA	Downey, Sierra Indl. Eng. Co.	310-803-6330
CO	Northglenn, Dan Ryall	303-452-8185
CT	Bristol, Eric Peterson	203-297-7464
IN	Bremen, Jan Richard Stahly	219-282-3592
IA	Des Moines, Jerry Bunch Electrical Sls.	515-287-7057
MI	Chelsea, Rick Mayday	313-995-2965
MN	Eagan, Stan Lock	612-890-9347
MS	Brandon, Service Electrical Sls.	601-992-9122
MO	St. Peters, Neil Klocke	314-947-2259
NJ	Plainfield, Don MacGillivray	908-753-4890
NM	Albuquerque, Paul Atkinson	505-292-1222
NY	Rochester, Integra Sls., Inc.	716-328-2110
OH	Euclid, Joe Ciulla	216-574-7164
PA	Coatesville, Emmett Ferra	215-380-8289
SC	Columbia, Harold Heaton	803-733-0941
TN	Nashville, Richard Hardy	615-748-1150
TX	Dallas, Raley Sls. Co.	214-368-1683
UT	Salt Lake City, Kev Paul	801-484-9941
VA	Richmond, Wynn Meredith	804-275-7970
WI	Kenosha, Wally Coats	312-299-2354
Can	Mississauga, Ont., Marr Elec. Ltd.	416-277-9481

Local Distributors

AL	Birmingham, Control Comps., Inc.	205-942-3760
AZ	Tempe, Lcomp	602-730-1633
CA	Gardena, California Switch & Signal	213-770-2330
CA	Tustin, Western Switches	714-259-8144
CT	Wallingford, Cronin Elctrns.	203-624-3134
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141
FL	Tampa, Raybro Elec. Supplies, Inc.	813-228-8571
IL	Wheeling, Hawk Elctrns.	708-459-4050
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Livonia, RS Elctrns.	313-525-1155
MI	St. Clair Shores, SPEMCO	313-771-2700
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Maryland Heights, Olive Elctrns.	314-997-7709
NJ	Oakland, Relay Specialties Inc.	201-337-1000
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Woodside, Switches Unltd., Inc.	718-478-5000
NC	Charlotte, Southeastern Elctrns.	704-523-1122
OH	Maumee, RS Elctrns.	419-893-0721
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Erie, Seaway Elec. Supp.	814-455-1304
WA	Renton, Dunn Elctrns.	206-271-6213
WI	Milwaukee, Marsh Elctrns.	414-475-6000

MCGUIRK ELECTRONICS CO. INC., 212 So. Main St., P. O. Box 853, Middleton, MA 01949, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* R. O'Neill

mci

FAX: 516-587-0624

MCI TRANSFORMER CORPORATION, 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510; Empl.: 50; *Sls. Mgr.:* Timothy J. Williams .... **A•2392-2403**

Local Sales Offices & Reps

MA	Orange, MCI Transformer	508-544-8272
NH	Nashua, Key Sls. of New England, Inc.	603-888-8742

McKENZIE

TECHNOLOGY

FAX: 510-651-1020

MCKENZIE TECHNOLOGY, 910 Page Ave., Fremont, CA 94538, Tel: 510-651-2700; FSC No.: 5938; Empl.: 175; *Sls. Mgr.:* Kari Trautman; *Dist. Mgr.:* Vicky Wodopianov .... **C•1415**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Scottsdale, Thom Luke Sls.	602-451-5400
CA	Pleasanton (N), Moulthrop Sls.	510-463-0450
CA	San Marcos, Falcon	619-591-0504
CO	Aurora, Interconnect Sls.	303-751-8777
CT	Waterbury, Compak, Inc.	203-753-6431
FL	Apopka, Cartwright & Bean, Inc.	407-889-9100
FL	Deerfield, Cartwright & Bean, Inc.	305-429-3400
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Woodbridge, Golten Assocs., Inc.	708-985-5100
IN	Fishers, Connect 21	317-578-2121
MD	Ellicott City, Tech. Sls.	410-461-2400
MA	Hudson, Compak Inc.	508-568-0331
MI	Brighton, Elctrn. Sources	313-227-3598
MN	Edina, GP Sls. Inc.	612-831-2362
NJ	Medford, The McCoy Grp.	609-953-0770

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NY	Bellmore, Compar New York, Inc.	516-227-7300
NY	Manlius, Lamtec	315-682-4780
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Loveland, Centruy Tech. Sls.	513-677-5088
OR	Beaverton, Westmark Elctrns.	503-641-8780
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, JYSCO.	214-349-1650
WA	Bellevue, Westmark Elctrns.	206-454-1944
Can	Ontario, Cana Rep Grp.	613-692-4682

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, D.C. Elctrns.	602-438-1234
AZ	Tempe, TTI	602-431-1191
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fountain Valley, Comps Ctr., Inc.	714-979-0433
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	Milpitas, R&D Elctrn. Parts	408-262-7144
CA	Milpitas, TTI	408-946-5577
CA	Mission Hills, TTI	818-891-8885
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Kent Elctrns.	619-453-7133
CA	San Diego, TTI	619-748-2025
CA	San Jose, D.C. Elctrns.	408-453-2400
CA	Santa Ana, TTI	714-641-9393
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CA	Torrence, Kent Elctrns.	714-773-0781
CA	Tustin, D.C. Elctrns.	714-259-9066
CO	Denver, Alliance Elctrns.	303-433-1648
CO	Englewood, Kent Elctrns.	303-762-0670
CT	South Bay, Heilind Elctrns.	203-262-1700
CT	Wallingford, TTI	203-284-7474
FL	Largo, Electronic Precepts of FL, Inc.	813-544-3636
FL	Largo, Kent Elctrns.	813-545-0057
FL	Longwood, RM Elctrns.	407-767-8005
FL	Orlando, TTI	407-859-1000
GA	Norcross, TTI	404-662-0911
IL	Elk Grove Vlg., Kent Elctrns.	708-529-9977
IL	Schaumburg, TTI	708-884-6500
IN	Indianapolis, RM Elctrns.	317-843-9403
IA	Cedar Rapids, Kent Elctrns.	319-373-0525
MD	Columbia, Kent Elctrns.	301-720-6000
MD	Columbia, TTI	410-995-1331
MA	Chelmsford, Kent Elctrns.	508-250-9666
MA	Tewksbury, TTI	508-857-2000
MA	Wilmington, Heilind Elctrns.	800-800-1666
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Duluth, Parts 1	218-624-0651
MN	Minnetonka, TTI	612-933-8555
MN	Roseville, Parts 1	612-633-8079
MN	St. Paul, Kent Elctrns.	612-642-2828
MN	Stillwater, Elctrn. Depot Supp. Co.	612-439-9409
MO	Hazelwood, Kent Elctrns.	314-895-1515
MO	Independence, Kent Elctrns.	816-254-3410
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Mt. Laurel, TTI	609-234-6400
NY	Rochester, Cam RPC Elctrns.	800-827-2650
NY	Ronkonkoma, TTI	516-737-2000
NC	Raleigh, Century Elctrns.	919-596-2220
OH	Dayton, TTI	513-898-8330
OH	Independence, TTI	216-328-9755
OR	Beaverton, Comp. Resources, Inc.	503-641-8488
OR	Beaverton, Kent Elctrns.	503-626-8300
PA	Pittsburgh, CAM RPC Elctrns.	412-782-3770
TX	Austin, Kent Elctrns.	512-834-1900
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, TTI	817-834-2202
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, TTI	713-879-5800
TX	Richardson, Kent	214-669-2600
WA	Redmond, TTI	206-882-0291
WA	Kent, Comp. Resources, Inc.	206-340-1646

MCL, INC., 501 S. Woodcreek Rd., Bolingbrook, IL 60440-4999, Tel: 708-759-9500, TWX: 910-683-1899, FAX: 708-759-5018· FSC No.: 16469; Empl.: 127; *Sls. Mgr.:* Ron Adamson

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MCLEAN ENGINEERING, Zero Corporation, 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543; FSC No.: 03522; Empl.: 118; *Sls. Mgr.:* Craig A. Reed; *Dist. Mgr.:* Craig A. Reed .... **C•1606-1607**

Local Sales Offices & Reps

AL	Huntsville, Raycom	205-895-9264
AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	San Mateo, Halbar Assocs.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Boulder, Comps. Prods. Sls.	303-530-2800
FL	Orlando, Raycom	407-859-5504
IL	Elmhurst, Scott Assocs.	708-279-5681
MD	Rockville, Marktron	301-251-8990
MA	Chelmsford, JEBCO	508-256-5800
MI	Farmington, Marlow Assocs.	313-478-2240
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Lebanon, Sylvester Sls. Assocs.	201-735-2488
NM	Albuquerque, S & S Technlgs.	505-298-7177
NY	Rochester, Talty Assocs.	716-323-1210
NC	Raleigh, Raycom	919-266-9827
OH	Cleveland, Marlow Assoc.	216-831-8232
OH	Dayton, Marlow Assoc.	513-274-9666
OR	Tigard, Halbar-RTS	503-624-5741
PA	Allison Park, Marlow Assoc.	412-487-0664
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
TX	Dallas, REM-AIR	214-234-1069
WA	Redmond, Halbar-RTS	206-882-0990
Can	Guelph, Ont., Hammond Mfg. Co.	519-822-2960

Local Distributors

FL	Ft. Lauderdale, Component Distrs.	305-971-4950
GA	Norcross, Component Distrs.	404-441-3320
MI	Ann Arbor, Wedemeyer Elctrn. Supp. Co.	313-665-8611
NC	Raleigh, Component Distrs.	919-834-9465
TX	Dallas, Component Distrs.	214-644-0373
Can	Guelph, Ontario, Hammond Mfg. Co.	519-822-2960

McLEAN MIDWEST
SUBSIDIARY OF ZERO CORPORATION

FAX: 612-569-0533

MCLEAN MIDWEST, Sub. of Zero Corporation, 4000 83rd Ave. N., Brooklyn Pk., MN 55443, Tel: 612-561-9400; *Sls. Mgr.:* J. Buyse; *Dist. Mgr.:* D. Walker, Distr. Sls. Dir. .... **C•1608-1609**

Local Sales Offices & Reps

AZ	Tempe, Border States Tech. Assocs. Inc.	602-839-0248
CA	Laguna Hills, Western Automation	714-859-6988
CA	Oakland, Powermatic Assocs.	510-635-6825
CO	Boulder, Comp. Prod. Sls. Co.	303-530-2800
FL	Winter Pk., Southland Comps. Inc.	407-629-5550
GA	Norcross, F & J Squared Assocs.	404-368-9191
IL	Elmhurst, Scott Assocs., Inc.	708-279-5681
MD	Rockville, Marktron, Inc.	301-251-8990
MA	Chelmsford, John E. Boeing Co.	508-256-5800
MI	Sterling Hgts., Alliance Sls. Co.	313-726-8670
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Totowa, R.O.I. Sls. Co.	201-812-9606
NY	Endwell, Reagan/Compar, Inc.	607-754-2171
NC	Charlotte, F & J Squared Assocs.	803-548-2133
OH	Cleveland, Marlow Assocs.	216-831-8232
PA	Huntingdon Valley, Inacker Sls. Inc.	215-947-5660
PA	Pittsburgh, Marlow Assocs., Inc.	412-487-0664
TX	Dallas, The Power Connection	214-401-3490
WA	Redmond, HALBAR-RTS, Inc.	206-882-0990

MCSI, 2598-G Fortune Way, Vista, CA 92083, Tel: 619-598-2177, FAX: 619-598-2450; Empl.: 25; *Sls. Mgr.:* Jim Edwards

Local Sales Offices & Reps

CA	Laguna Hills, Computech Assocs.	714-837-8421
CA	Sunnyvale, Qualtech Assocs.	408-732-4800
CT	Orange, Isdale Assocs.	203-387-2704
GA	Duluth, Dixie Tech. Mktg.	404-381-5592
IL	Arlington Heights, Coombs Assocs., Inc.	708-439-9892

3M AUDIO AND VIDEO MARKETS DIVISION, 223-5N-01, St. Paul, MN 55144-1000, Tel: 612-733-7644, FAX: 612-737-5583; Empl.: 38,351

In any city, 1-800-752-0732 In area code 703, Call 1-800-831-8726

3M DYNATEL SYSTEMS DIVISION, See 3M Telecom Markets Division

3M

FAX: 512-984-2211

3M ELECTRICAL SPECIALITIES DIVISION, 6801 River Place Blvd., Bldg. 130-3N-56, Austin, TX 78726-9000, Tel: 800-328-1368; *Sls. Mgr.:* Mike Martin ...... **C•1667; D•2311**

Local Sales Offices & Reps

CA	Los Angeles	213-726-6563
GA	Atlanta	404-447-7000
MN	St. Paul	612-736-3269
PA	Philadelphia	215-638-6300

3M PHOTODYNE PRODUCTS, See 3M Telecom Markets Divison

3M-ELECTRONIC PRODUCTS DIVISION, 6801 River Place Blvd., Austin, TX 78726, Tel: 1-800-225-5373 Sls. & Prod. Info., TELEX: 29-7023, FAX: 512-984-6972; *Sls. Mgr.:* Joe Bruzzone .... **C•1667; D•2311**

Local Sales Offices & Reps

CA	Campbell, Olsheski & Assoc.	408-378-6003
CA	Danville, Olsheski & Assoc.	415-820-9144
CA	Valencia, Cessing Assocs.	805-295-0225
CO	Wheatridge, Cluff & Assoc.	303-425-6604
CT	Chesire, The Macinnis Co.	203-372-3797
FL	Apopka, Cartwright & Bean, Inc.	407-889-2168
FL	Deerfield Beach, Cartwright & Bean, Inc.	305-429-3400
GA	Atlanta, Wallace Elctrn. Sls.	800-334-3518
IL	Lombard, RMP/McBride Corp.	312-932-9090
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Cedar Rapids, T. Dowell & Assoc.	319-364-3880
KS	Overland Park, T. Dowell & Assoc.	913-599-1100
LA	Slidell, Wallace Elctrn. Sls.	504-643-4751
MD	Lisbon, S.K. MacDonald, Inc.	301-442-1590
MA	Norwood, The Macinnis Co.	617-762-8090
MI	Warren, Burcaw Co.	313-573-6048
MI	Wyoming, Burcaw Co.	313-573-4605
MN	Edina, Restronics, Inc.	612-941-9135
MO	St. Louis, T. Dowell & Assoc.	314-849-4334
NJ	Cherry Hill, S.K. MacDonald, Inc.	609-482-2666
NY	Hauppauge, Aurora-Schmitt Assoc.	516-434-1572
NY	Syracuse, T-Squared Elctrns., Co.	315-463-8592
NY	Victor, T-Squared Elctrns. Co.	716-924-9101
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Beachwood, Elctrns. Salemasters	216-831-9555
OR	Beaverton, Pacific Mktg. Specialists	503-641-9373
PA	Monroeville, S.K. MacDonald, Inc.	412-373-1723
TN	Tullahoma, Wallace Elctrn. Sls.	800-334-3518
TX	Dallas, Elcom Mktg.	214-241-2166
TX	Houston, Elcom Mktg.	713-350-8064
WA	Redmond, Pacific Mktg. Specialists	206-882-3144
Can	London, Ont., David Allen	

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Acacia/Deanco, Inc.	602-894-2874, 602-882-9054
AZ	Tempe, Shelley-Ragon, Inc.	602-894-2058
CA	Chatsworth, Hall-Mark	818-773-4500
CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	Fremont, Acacia/Deanco, Inc.	415-623-7500
CA	Garden Grove, Richey/Impact Elctrns.	714-895-0060
CA	Irvine, Acacia/Deanco, Inc.	714-660-0834, 213-971-2428
CA	Rocklin, Hall-Mark	916-624-9718
CA	San Diego, Acacia/Deanco, Inc.	619-565-4365
CA	San Diego, Hall-Mark	619-268-1201
CA	San Diego, Richey/Impact Elctrns., Inc.	619-271-4511
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Jose, Hall-Mark	408-432-0900
CA	San Jose, Powell Elctrns., Inc.	408-943-9020
CA	San Jose, Richey/Impact Elctrns., Inc.	408-432-7100
CA	San Jose, Shelley/Ragon	408-432-0600
CA	Santa Clara, DC Elctrn. Supp.	408-980-1199
CA	Torrance, Kent Elctrns.	213-320-2700
CA	Tustin, DC Elctrns.	714-259-9066
CA	Tustin, Hall-Mark	714-669-4700
CO	Denver, CSID/Integrated Fastn. Inc.	303-292-9594
CO	Englewood, Hall-Mark	303-790-1662,303-790-4991
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
CO	Englewood, Shelley/Ragon	303-762-0670

CT	Cheshire, Hall-Mark	203-271-1704
CT	East Haven, JV Elctrns.	203-469-2321
CT	Yalesville, Schaal Assocs., Inc.	203-269-3779
FL	Casselberry, Hall-Mark	407-830-5855
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Largo, Hall-Mark	813-541-7440
FL	Pompano Beach, Hall-Mark	305-971-9280
FL	Tampa, Shelley-Ragon, Inc.	813-623-6560
FL	Winter Park, Deanco	305-671-5100
GA	Marietta, Deanco	404-429-0126
GA	Norcross, Hall-Mark	404-447-8000
IL	Bensenville, Magnuson Elctrns.	312-595-7575
IL	Wood Dale, Hall-Mark	312-860-3800,312-860-0239
IL	Wood Dale, NEP Elctrns., Inc.	312-595-8500
IN	Ft. Wayne, Bell Inds., Inc.	219-423-3422
IN	Indianapolis, Bell Inds., Inc.	317-875-8200, 800-622-4814,
IN	Indianapolis, Hall-Mark	317-872-8875
IN	Indianapolis, Magnuson Elctrns., Inc.	317-247-5108
IA	Cedar Rapids, Shelley-Ragon, Inc.	319-373-0525
KS	Lenexa, Hall-Mark	913-888-4747
MD	Annapolis Jct., Powell Elctrns., Inc.	301-880-3255, 301-953-3435
MD	Columbia, Aztech Elctrns.	301-995-6800, 800-777-5977
MD	Columbia, Hall-Mark	301-998-9800
MD	Gaithersburg, Deanco	301-948-5444
MA	Billerica, Hall-Mark	508-667-0902
MA	Burlington, Schaal Assocs./Deanco	617-272-1506
MA	Canton, Richey/Impact Elctrns.	617-821-1500
MA	Westboro, Powell Elctrns.	508-366-6100
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, Hall-Mark	313-462-1205
MI	Southfield, Michigan Lectrols	313-353-1350
MN	Eden Prairie, Hall-Mark	612-941-2600
MN	St. Paul, Shelley/Ragon Elctrns.	612-642-2828
MO	Earth City, Hall-Mark	314-291-5350
MO	Hazelwood, Shelley-Ragon, Inc.	314-895-1515
MO	Independence, Shelley/Ragon Inc.	816-254-3410
MO	St. Charles, Lectronix, Inc.	314-946-6424, 800-325-3348
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Fairfield, Deanco	201-575-7960
NJ	Parsippany, Hall-Mark	201-515-4475
NJ	Teterboro, EAC	201-772-6400,201-288-4477
NJ	Mt. Laurel, Hall-Mark	609-235-1900
NY	Fairport, Hall-Mark	716-425-3300
NY	Farmingdale, Addem Distrs.	516-752-9303
NY	Hauppauge, Schaal Assocs., Inc.	516-434-7100
NY	Ithaca, Deanco	607-257-4444
NY	Medford, Shelley-Ragon, Inc.	516-447-2000
NY	Ronkonkoma, Hall-Mark	516-737-0600
NC	Cary, Powell Elctrns.	919-467-1212
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Raleigh, Deanco, Inc.	919-851-2065
NC	Raleigh, Hall-Mark	919-872-0712
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Elctrns. Mktg. Corp.	513-439-4711
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Highland Heights, Elctrns. Mktg. Corp.	216-442-3441
OH	Solon, Hall-Mark	216-349-4632
OH	Worthington, Hall-Mark	614-888-3313
OK	Tulsa, Hall-Mark	918-254-6110
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Beaverton, Acacia/Deanco, Inc.	503-646-3377
OR	Beaverton, Shelley/Ragon	503-641-1691
OR	Tualatin, Moore Elctrns., Inc.	503-692-5333
TX	Houston, Hall-Mark	713-781-6100
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Richardson, Kent Electrns.	214-699-2600
TX	Austin, Hall-Mark	512-258-8848
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Norvell Elctrns., Inc.	512-837-5555
TX	Dallas, Hall-Mark	214-553-4300
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	El Paso, ERA Elctrns.	915-855-3600
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Plano, Tactic Elctrns.	214-422-0777
UT	W. Valley City, Hall-Mark	801-972-1008
WA	Redmond, Acacia/Deanco, Inc.	206-881-5566
WA	Redmond, Shelley/Ragon Elctrns.	206-883-2220
WA	Seattle, Hall-Mark	206-547-0415
WA	Tukwila, Carlyle Inc.	206-251-0700
WI	Milwaukee, Elctrn. Expeditors, Inc.	414-228-8100
WI	New Berlin, Hall-Mark	414-797-7844

3M PRIVATE NETWORK PRODUCTS, 3M, 6801 River Place Blvd., Austin, TX 78726, Tel: 512-984-3400, 800-426-8626, FAX: 512-984-6628; Empl.: 50; *Sls. Mgr.:* R.C. Ware

3M TELECOM MARKETS DIVISION, 6801 River Place, Austin, TX 78726, Tel: 512-984-3400, 800-426-8626, FAX: 512-984-3408; *Sls. Mgr.:* W.E. Metzler

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, TELEX: 499-8051, FAX: 203-744-2704; FSC No.: 60628

MDM, INC., 9601 Irondale Ave., Chatsworth, CA 91311, Tel: 818-700-8400, FAX: 818-700-1938; FSC No.: 60994; Empl.: 150; *Sls. Mgr.:* Steven J. LaLonde

MDS CALIBRATION LAB. INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789; *Sls. Mgr.:* Gerry Doiron

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, TELEX: 62919594, FAX: 919-365-3945

MEASUREMENT SYSTEMS, INC., 777 Commerce Dr., Fairfield, CT 06430, Tel: 203-336-4590, FAX: 203-336-5945; Empl.: 97; *Sls. Mgr.:* Gerard M. Lacrocque, Nat'l. Sls. Mgr. .... **D•1163**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Anaheim, Gabriel & Assoc.	714-531-7674
IA	Cedar Rapids, S & O Sls.	319-393-7331
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Hudson, Data Rep	508-481-0333
MN	Edina, Elctrn. Sls., Inc.	612-933-9070
MO	St. Louis, J. S. DeWeese Co.	314-469-7350
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Richmond, Robert Elctrn. Sls.	804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 011-45-44973366, FAX: 011-4544681514; Empl.: 50

Local Sales Offices & Reps

CA	San Rafael, Wright Assocs.	415-457-9940
AZ	Scottsdale, Advent Comps. Corp.	602-481-0044
CA	Tustin, Schoenbachler-Dobson	715-544-1888
FL	Tampa, Florida Comps. Sls.	813-873-3622
IL	Schiller Park, W.R.B. Inc.	708-678-7888
IN	Ft. Wayne, Menze Sale	219-747-5616
KS	Overland Park, M.I.N.K. Assocs., Inc.	913-341-8309
MD	Gaithersburg, Naudian Assoc. Southern	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	Minneapolis, Tech. Comps. Grp.	612-536-9512
MO	Bridgeton, M.I.N.K. Assocs., Inc.	314-291-5454
NY	Great Neck, Pacent Engrg.	516-482-4678
NJ	Union, Pacent Engrg.	201-687-7197
NJ	Burlington, VDE Elctrns.	609-387-9331
NC	Silver City, Crossroads Elctrns.	919-742-2372
TX	Richardson, R.F. Kimball Co.	214-231-3447
WI	Mequon, W M Bolles Assoc. Inc.	414-241-3320

Local Distributors

CA	Gardena, California Switch & Signal	310-538-9830
CA	Los Angeles, Electric Switch	213-660-1310
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Van Nuys, Wes-Garde Comp. Grp.	213-873-4802
CT	Hartford, Wes-Garde Comp. Grp.	203-527-7705
FL	Lakeland, Switch Controls, Inc.	813-644-7564
IL	Carol Stream, Wes-Garde Comps.	708-653-1460
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Canton, Xenell	617-828-2948
MI	St. Clair Shores, Spemco Inc.	313-771-2700
MN	Minneapolis, Carl Bergquist Co.	612-835-2322
MO	St. Louis, Wes-Garde Comp.	314-567-7776
NH	Nashua, Wes-Garde Comp.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
TX	Dallas, Wes-Garde Comps.	214-357-1768
WI	Milwaukee, Progressive Image	414-321-4722

MP

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Dave Olson .... **B•1369-1374**

Local Sales Offices & Reps

AL	Decatur, Tenn Tech.	205-350-0630
AZ	Scottsdale, Advent Comps. Corp.	602-481-0044
CA	Los Angeles, Universal Components Co.	213-641-4255
CA	Sunnyvale, Pass Associates	408-735-9040
CO	Denver, Advent Comps. Corp.	303-455-1985
FL	Tampa, Florida Comp. Sls., Inc.	813-873-3622
GA	Marietta, Tenn Tech.	404-971-1419
IL	Barrington, Perhats Assocs.	708-381-6360
IN	Indianapolis, Rockford Controls Ohio	317-251-2866
KS	Prairie Village, C. Logsdon & Assoc.	913-381-3833
MD	Pikesville, Muncy Sls.	301-484-6376
MA	Danvers, Global Technical Sales	508-774-0111
MN	St. Paul, Mackubin Grp.	612-636-5686
MO	St.Louis, C. Logsdon & Assoc.	314-849-5125
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Port Washington, Ashtec, Inc.	516-267-0981
NC	Garner, Tenn Tech.	919-779-3309
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
OK	Barrington, Global Technical Sales	603-664-5780
OR	Hillsboro, Doran Sales Assoc.	503-640-4500
RI	Lincoln, Global Technical Sales	401-334-3830
TX	Dallas, Control Comps. Corp.	214-458-8877
WA	Redmond, Doran Sales Assoc.	206-448-1200
Can	Downsview, Ont., Har Tech	416-665-7773
Can	Pointe Claire, Que., Har Tech	514-694-6110

Local Distributors

CA	Gardena, Cal Switch	213-770-2330/213-538-9830
CA	San Carlos, Campbell & George Co.	415-594-1994
CO	Denver, Consolidated Parts	800-748-2963
FL	Ft. Lauderdale, Zelcon, Inc.	305-565-2555/6
FL	Lakeland, Wes-Garde Comps. Grp.	800-282-7619
IL	Carol Stream, Wes-Garde Comps. Grp.	800-323-9431
IL	Chicago, Nep Elctrns.	708-625-8400
MA	Danvers, RCI	617-777-4441
MI	St. Clair Shore, Spemco Switch, Inc.	313-771-2700
MN	Minneapolis, Berquist	612-835-2322
NY	Bohemia, Genelco	800-645-9802
NY	Plainview, Linrose Elctrns.	516-293-2520
NY	Woodside, Switches Unlimited	800-221-0487
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
TX	Arlington, Bell Components Sls., Inc.	817-461-5303
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-9999
Can	St. Laurent, Que., Tara Inds. Corp.	514-331-6550

MECHANIZED ELCTRN. ASSEMBLEY DIV., UNIVERSAL INSTRS. CORP., See Dover Electronics Manufacturing

MECHATRONICS INC., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-232-4800, FAX: 206-236-5480; Empl.: 40; *Sls. Mgr.:* Jim Innes .... **C•1610-1611**

Local Sales Offices & Reps

WA	Mercer Island, Mechatronics Inc.	206-232-4800

MECH-TRONICS, 100 Campus Dr., RR 30, Mount Holly, NJ 08060, Tel: 609-267-0680, FAX: 609-267-7621; *Sls. Mgr.:* Peter Reed

MECO PRECISION/INDS. INC., 955 Connecticut Ave., Bridgeport, CT 06607, Tel: 203-333-4900, FAX: 203-333-4519; FSC No.: OSBC1; Empl.: 10

MEDA, INC., Macintyre Electronics Design Assocs., 485 Spring Pk. Pl., Ste 350, Herndon, VA 22070, Tel: 703-471-1445, FAX: 703-471-9130; Empl.: 6; *Sls. Mgr.:* Barbara Vayda

Local Distributors

CA	Carlsbad, ASC Scientific	619-431-2655
MA	Worcester, Walker Scientific Inc.	508-852-3674
PA	Media, Phase Two Technlgs., Inc.	215-340-0313

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
MEC MASTER ELECTRONIC CONTROLS
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

MEDIA RECOVERY INC., Box 1407, Graham, TX 76450, Tel: 800-527-9497, 817-549-5462 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEDICAM TECHNOLOGIES INC., 35 Sagamore Park Dr., Hudson, NH 03051, Tel: 603-886-9460, FAX: 603-886-0372; Empl.: 4; *Sls. Mgr.:* Robert C. Rush

MEGA CIRCUIT, INC., 1040 S. Westgate, Addison, IL 60101, Tel: 708-629-1800, FAX: 708-629-1800; Empl.: 45; *Sls. Mgr.:* Jim Malavia

MEGADATA CORP., 35 Orville Dr., Bohemia, NY 11716, Tel: 516-589-6800, FAX: 516-589-6858; FSC No.: 53436; Empl.: 40; *Sls. Mgr.:* Steve Sloan

MEGA SYSTEMS & CHEMICALS, 4828 S. 40th St., Phoenix, AZ 85040, Tel: 602-437-9105, FAX: 602-437-2613; Empl.: 15

Local Sales Offices & Reps

OR	Portland, Mega Sys. & Chemicals	503-228-4773
EXP	Milano, Italy, High Purity Tech.	02-26821604
EXP	Swindon, England, Wessex Semicon	602-437-9105

(MEI) MARPET ENTERPRISES, INC., 107 Audubon Rd., Wakefield, MA 01880, Tel: 617-246-2040, FAX: 617-246-0603; Empl.: 30; *Sls. Mgr.:* John A. Pope

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

MEKTRONIX TECHNOLOGY, INC., 507 N. Milwaukee Ave., Libertyville, IL 60048-2000, Tel: 708-680-3300, FAX: 708-680-1868; Empl.: 5; *Sls. Mgr.:* Gregory Mayworm

MELCHER

Tel: 800-828-9712

MELCHER, INC., Melcher AG, 187 Billerica Rd., Chelmsford, MA 01824, FAX: 508-256-4642 ; Empl.: 280; *Sls. Mgr.:* Rob Sinclair .... **D•2131-2135**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
AZ	Scottsdale, Power Up Elctrns.	602-955-1105
CA	Cupertino, PEI Assocs.	408-253-1960
CA	La Habra, West Coast Reps.	213-690-9960
CO	Parker, TMA	303-841-3435
FL	Orlando, Currie, Peak & Frazier	407-855-0843
GA	Duluth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Coombs Assocs., Inc.	708-439-9810
IA	Cedar Rapids, Tech. Sls. Assoc.	319-373-0686
KS	Olathe, Tech. Sls. Assocs.	913-829-2800
MA	Chelmsford, Melcher, Inc.	800-828-9712
MA	Whitinsville, Power Factor Assoc.	508-234-6415
MI	Troy, CB Jensen & Assocs.	313-643-0506
MN	Wayzata, Cardinal Sls.	612-475-0042
MO	St. Louis, Tech. Sls. Assocs.	314-521-2044
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Centerville, EMA, Inc.	513-433-2800
PA	Nottingham, Excel Tech	717-529-6059
TX	Richardson, Jim D. Gray & Assocs., Inc.	214-699-9976
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Spokane, APC	509-922-7959
WI	Brookfield, McMahon Inc.	414-782-3335
Can	Ontario, Melcher Corp.	416-727-9341

MeLCOR

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 1040 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178; FSC No.: 32333; Empl.: 275; *Sls. Mgr.:* M.A. Levine .... **C•1613-1616**

Local Sales Offices & Reps

CA	San Jose, Shaw Tech, Inc.	408-866-6628
CO	Fort Collins, Rep Sls., Inc.	303-226-1504
NY	W. Henrietta, Exogray Tech. Sls.	716-334-1340

PERIPHERAL RESOURCES, 9911 W. Pico Blvd., Ste. B-215, Los Angeles, CA 90035, Tel: 310-552-3888, 800-533-2297, FAX: 310-552-2806; Empl.: 11; *Sls. Mgr.:* Bil Dwyer

MELFESS FIVE INC., See Peripheral Resources

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527, FAX: 616-657-2528; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEMCOR-TRUOHM INC.

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool .... **A•1984, 2105**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
CA	American Canyon, Jacobson & Assoc.	707-552-4412
CA	Huntington Bch., Mil-Com Sls.	714-840-2424
FL	Indialantic, Raycom	305-727-8860
GA	Atlanta, Murcota	404-875-2525
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Ft. Wayne, Menze Sls.	219-747-5616
MI	St. Clair Shores, J.M. Thorpe	313-779-6363
MO	St. Charles, Hayes Elec. Sls. Co.	314-946-6677
NH	Atkinson, Mark Rep Assoc.	603-382-9563
NJ	Englewood Cliffs, Masin Esco	201-569-8868
NY	Hauppauge, Masin Esco	516-273-3500
NY	Marcellus, Mullahy Sls. Inc.	315-685-6280
NC	Burlington, Murcota	919-585-1577
NC	Winston-Salem, Murcota	919-723-1001
OH	Cleveland, Glover Sls.	216-842-4520
PA	Newtown Square, G.M. Conneen	215-353-2241
TX	Dallas, SW Elctrn. Ind.	214-233-9816
TX	Houston, SW Elctrn. Ind.	713-729-1670

MEMODYNE, 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-6556 (in MA), 800-255-1510, FAX: 617-964-2444; Empl.: 40; *Sls. Mgr.:* Leonard Sacon

MEMORY PROTECTION DEVICES, INC., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-293-5891, FAX: 516-752-1971; *Sls. Mgr.:* Thomas Blaha .... **D•1455**

Local Sales Offices & Reps

CA	Irvine, English/Damco Sls. Co., Inc.	714-753-1950
CA	Mountain View, Griffith, Nunley & Assocs.	415-961-6740
FL	Tampa, SRT Mktg.	813-884-4805
IL	Downers Grove, Momak Sls.	708-963-6400
MD	Lisbon, S.K. MacDonald, Inc.	301-982-1088
MI	Brighton, A.P Assocs., Inc.	313-229-6550
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
NH	Hampton, Primary Source	603-926-8044
NJ	Cherry Hill, S.K. MacDonald, Inc.	609-482-2666
NJ	New Brunswick, Synergy Sls.	908-828-5090
OR	Beaverton, Advanced Power Prods., Inc.	503-646-0994
OR	Monroeville, S.K. MacDonald, Inc,	412-373-1723
WI	Fontana, Momak Sls.	414-363-7744

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AL	Huntsville, Powell Elctrns.	205-837-5300
AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Phoenix, Lynntronics	602-841-3900
CA	Costa Mesa, Battery Specialties	800-854-5759
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Huntington Beach, House of Batteries	714-642-8222
CA	Irvine, Powell Elctrns.	714-263-9363
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Powell Elctrns.	408-943-6438
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Van Nuys, Nesco Battery Sys.	818-781-0505
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Englewood, AVT, Inc.	303-779-8056
CO	Englewood, Cypress Elctrns.	303-792-5829
FL	Fort Lauderdale, Powell Elctrns.	305-484-8377
FL	St. Petersberg, Engrd. Assemblies & Comps. Corp.	813-328-1970
GA	Norcross, Applied Power	404-263-0421
GA	Norcross, Engrd. Assemplies & Comps. Corp.	404-446-3135
IL	Morton Grove, Power Pak	312-966-6000
MD	Annapolis Junction, Powell Elctrns.	301-880-3255
MA	Methuen, Generation Elctrns.	508-683-1177
MA	Sutton, Engrd. Assembilies and Comp. Corp.	508-865-0722
MA	Westborough, Powell Elctrns.	508-366-6100
MI	Brighton, Applied Power	313-227-3604
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Thief River Falls, Digi Key Corp.	218-681-6674
NJ	Little Falls, Powell Elctrns.	201-890-0010
NJ	Mountainside, Mars Elctrns.	908-233-0044
NJ	Teterboro, Engrd. Assembilies & Comp. Corp.	201-288-4477
NY	Buffalo, Summit Distrs.	716-887-2800
NC	Cary, Powell Elctrns.	919-467-1212
NC	Raleigh, Engrd. Assembilies & Comps. Corp.	919-790-9700
OH	Columbus, Promark Elctrns.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Dallas, Cypress Elctrns.	214-255-0065
TX	Ft. Worth, Tandy Natl. Parts	817-870-5600
TX	Irving, Powell Elctrns.	214-550-0457
UT	W. Valley City, Denver Beta Wintronics	801-966-0378
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Seattle, Powell Elctrns.	206-439-8550
WI	Milwaukee, Taylor Elctrns.	414-241-4321
Can	Calgary, Alberta, Electro Sonic, Inc.	403-255-9550
Can	Ottawa, Ont., Electro Sonic, Inc.	613-728-8333
Can	Richmond, B.C., Electro Sonic, Inc.	604-273-2911
Can	Willow Dale, Ont., Electro Sonic Inc.	416-494-1666
Can	Winnipeg, Man., ELectro Sonic, Inc.	204-783-3105

MEMTEC CORP., 19-B Keewaydin Dr., Salem, NH 03079, Tel: 603-893-8080, FAX: 603-893-8699; Empl.: 35

MEMTRON®

FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 530 N.Franklin, Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 130; *Sls. Mgr.:* Daniel T. Ortner .... **B•1845**

Local Sales Offices & Reps

AZ	Tucson, Multi-Innovations	602-326-8997
CA	San Diego, Champa Assocs.	714-581-3459
CA	Saratoga, Edward King & Assocs.	408-741-0434
CO	Westminister, Glennmar	303-423-1572
FL	Mount Dora, Hedrick, Walker	904-735-2600
GA	Lawrenceville, Tek-Rep Mktg., Inc.	404-804-0358
IL	Wheaton, CS Tech. Sls.	312-653-8126
IN	Noblesville, Phoenix Mktg.	317-776-1871
MA	Framingham, Stone Comp. Sls. Corp.	508-875-3266
MN	Oakdale, Complete Sls.	612-731-2923
MO	Saint Charles, Buckman & Assocs.	314-946-6201
NY	Islip, Cogent Tech.	516-277-7101
NY	Liverpool, Alfred Lee Sls.	315-451-0968
NY	Victor, Net Sls.	716-924-1844
OH	Delaware, Bill Romine Co.	614-363-1600
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Richardson, Zonk & Assocs.	214-238-7651, 512-346-7651
WA	Renton, K. R. Jensen Sls.	206-277-2772
EXP	Corpus Christi, TX, Radesa Co.	512-993-4528
Can	Toronto, Ont., Reptech	416-863-9510

MENSOR CORPORATION, 2230 IH-35 South, San Marcos, TX 78666, Tel: 512-396-4200, FAX: 512-396-1820

MEPCO/CENTRALAB CORP., See Philips Components Discrete Products Division

MEP CONTROLS, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 25

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11525 Sorrento Valley Rd., San Diego, CA 92121-1307, Tel: 619-481-0210; Empl.: 160 .... **A•2106-2107; B•1770-1771**

Potentiometers (Cermet, Carbon) Industrial & Military

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Irvine, Harper & Strong	714-261-7233
CA	Sacramento, TSI	916-451-9068
CA	San Diego, Harper & Strong	619-549-5360
CA	Santa Clara, Technlg. Sls.	408-727-7200
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Over & Over	407-339-5073
FL	Ft. Lauderdale, Over & Over	305-485-0115
GA	Norcross, Over & Over Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
KS	Overland Pk, Lorenz Sls. Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6010
MN	Minneapolis, Elec. Comps. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls. Inc.	314-997-4558
NE	Lincoln, Lorenz Sls. Inc.	402-475-4660
NJ	Englewood Cliff, Ed Glass Assoc.	201-592-0200
NY	E. Rochester, Empire Tech. Assocs.	716-381-8500
NY	Endwell, Empire Tech. Assoc., Inc.	607-754-8756
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Charlotte, Over & Over Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6096
TX	Austin, Philips Comps.	512-832-9819
TX	Houston, Philips Comps.	713-272-8086
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	New Berlin, Philips Comps.	414-785-6509
Can	Alberta, Philips Comps.	403-239-7075
Can	Scarborough, Ont., Philips Comps.	416-292-5161

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CO	Englewood, Kent, Shelley-Ragon	303-762-0670
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, TTI, Inc.	404-662-0911
IL	Chicago, Nep Elctrns.	708-595-8500
IN	Indianapolis, Marshall Inds.	317-297-0483
MD	Columbia, TTI, Inc.	301-995-1331
MA	Peabody, Hamilton/Avnet	508-532-3701
MI	Livonia, Marshall Inds.	313-525-5850
MN	St. Paul, Kent, Shelley-Ragon	612-642-2828
NE	Omaha, Scott Elctrns.	402-734-6750
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NC	Raleigh, Hall-Mark	919-872-0712
OH	Independence, TTI, Inc.	216-328-9755
OK	Tulsa, Hamilton/Avnet	918-252-7297
OR	Beaverton, Kent, Shelley-Ragon	503-641-1691
PA	Mars, Hamilton/Avnet	412-772-1881
TX	Ft. Worth, TTI, Inc.	817-595-3100
WA	Redmond, Hamilton/Avnet	206-881-6697
WI	New Berlin, Nep Electronics	414-785-9131
Can	Nepean, Ont., Hamilton/Avnet	613-226-1700

MERCOTAC INC., 6195 Corte del Cedro E, Carlsbad, CA 92009, Tel: 619-431-7723, FAX: 619-431-0905; Empl.: 19; *Sls. Mgr.:* Bruce Enigenburg; *Dist. Mgr.:* Bruce Enigenburg

MERCURY COMPUTER SYSTEMS, INC., 199 Riverneck Rd., Chelmsford, MA 01824, Tel: 508-256-1300, FAX: 508-256-3599; Empl.: 160; *Sls. Mgr.:* Ed Hennessy

MERCURY PLASTICS, A UNIT OF ZERO CORP., See Zero Plastics, A Unit of Zero Corp.

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St., West Warwick, RI 02893, Tel: 401-822-9300, FAX: 401-822-9311; Empl.: 25; *Sls. Mgr.:* John E. Powell, Jr.

MERET OPTICAL COMMUNICATIONS, INC., An Amoco Co., 1800 Stewart St., Santa Monica, CA 90404-4998, Tel: 310-828-7496, FAX: 310-828-7567; FSC No.: 53071; Empl.: 85

For all states not listed call Meret MN. Ofc. 310-828-7496

MERIAM INSTRUMENT, Scott Fetzer, 10920 Madison Ave., Cleveland, OH 44102, Tel: 216-281-1100, FAX: 216-281-0228; Empl.: 85; *Sls. Mgr.:* Russ Arslanian; *Dist. Mgr.:* Russ Arslanian

MERITEC, Associated Enterprises, 1359 W. Jackson St., P.O. Box 8003, Painesville, OH 44077, Tel: 216-354-3148, FAX: 216-354-0509; Empl.: 200; *Sls. Mgr.:* Richard Wilkinson; *Dist. Mgr.:* Craig Fosnaught

MERIX CHEMICAL CO., 2234 East 75th St., Chicago, IL 60649, Tel: 312-221-8242, FAX: 312-221-3047; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, INC., P.O. Box 2751, Bonita Springs, FL 33959, Tel: 813-591-1626, FAX: 813-947-1821; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl., West Caldwell, NJ 07006, Tel: 201-575-1300, FAX: 201-575-0531; FSC No.: 12457; Empl.: 150; *Sls. Mgr.:* Tom Cox

J. R. MERRITT CONTROLS, INC., 320 Martin Luther King Dr., Norwalk, CT 06854, Tel: 203-855-9100, 800-333-5762, FAX: 203-855-1038; *Sls. Mgr.:* Douglas Holzwarth

MESA POWER SYSTEMS, 2350 Meyers Ave., Escondido, CA 92029, Tel: 619-489-8162, FAX: 619-489-5718; FSC No.: 46937; Empl.: 20

MESA TECHNOLOGY, Peak Technologies, 8990 Old Annapolis Road, Columbia, MD 21045, Tel: 410-992-0516, 410-992-0517, FAX: 410-290-9171; Empl.: 364; *Sls. Mgr.:* Howard Parker

MES INDUSTRIES CO., LTD., Fl. No. 93 Lo-Li Rd., Taipei, Tel: 886-2-2180302, FAX: 886-2-2181480; Empl.: 25

MESUR-MATIC ELCTRNS., 309 Lowell St., Peabody, MA 01960, Tel: 508-745-7000; Empl.: 18; *Sls. Mgr.:* Kosma L. Evangelidis

METALINK CORPORATION, P.O. Box 1329, Chandler, AZ 85244, Tel: 602-926-0797, TELEX: 4998050, FAX: 602-926-1198

METCAL, INC., 1530 O'Brien Dr., Menlo Park, CA 94025, Tel: 800-776-1778, FAX: 415-325-5932; Empl.: 100; *Sls. Mgr.:* Bob Simpson; *Dist. Mgr.:* Bob Simpson

METERMASTER, 2507 W. Erie Dr., Tempe, AZ 85282, Tel: 602-431-0015, FAX: 602-431-1836; *Sls. Mgr.:* Steve Alexander

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-9600, FAX: 708-867-9130; Empl.: 2000; *Sls. Mgr.:* S. Landeene; *Dist. Mgr.:* Suzi Landeene

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 708-392-3500, FAX: 708-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Suzi Landeene

METRA CORPORATION, 1874 Lundy Ave., San Jose, CA 95131, Tel: 408-432-1110, FAX: 408-432-9644; Empl.: 24

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099; Empl.: 105; *Sls. Mgr.:* Charles Weaver

METRICOR, INC., 18800 - 142nd Ave. NE, Woodinville, WA 98072, Tel: 206-483-5577, FAX: 206-485-2592; Empl.: 42

METRIC SYSTEMS, 645 Anchors St., Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, FAX: 904-863-6371; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 60; *Sls. Mgr.:* W. B. Brown

METRO CIRCUITS, PJC Technologies, Inc., 205 LaGrange Ave., Rochester, NY 14613, Tel: 716-254-2980, FAX: 716-254-4614; Empl.: 36; *Sls. Mgr.:* Burhan Capar

METROLAB INSTRUMENTS SA, 110,Chemin du Pont-du-Centenaire, Geneva, Switzerland CH-1228, Tel: ò41(22)7941121, FAX: ò41(22)7941120

METRO-MARK INC., 11574 Encore Circle, Minnetonka, MN 55343, Tel: 612-935-8844, FAX: 612-935-5718 .... **B•1846**

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 10

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John Tarsia

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Ginsberg; *Dist. Mgr.:* R. Brauch

METRUM, P.O. Box 5227, Denver, CO 80217-5227, Tel: 303-773-4700, FAX: 303-773-4762; Empl.: 350; *Sls. Mgr.:* J. Smith

FAX: 908-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 908-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter .... **A•1106-1114, 1651-1653; C•1416-1419, 1617**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Prods.	205-880-1156
CA	Pleasanton, CFMC	510-417-0450
MD	Rockville, C.E. Tech. Elctrns.	301-666-0315
MD	Rockville, Metuchen Capacitors	301-590-0094
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
PA	Saegertown, Multi-Phase Comps.	814-763-3640

MEXITRONIX (WOMAN OWNED), 2651 Airway Ave., Ste. A, Kingman, AZ 86401, Tel: 602-757-9798, FAX: 602-757-8741; Empl.: 5

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, FAX: 203-281-9648; Empl.: 25; *Sls. Mgr.:* Brian Meyer

MEYLAN CORPORATION, 543 Valley Rd., Upper Montclair, NJ 07043-1844, Tel: 201-744-6400, FAX: 201-744-1011; Empl.: 8; *Sls. Mgr.:* Stanley Mills

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CALIFORNIA SWITCH AND SIGNAL, INC.
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[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

MFE INSTRUMENTS, Stocker & Yale, Inc., 133 Brimbal Ave., PO Box 490, Beverly, MA 01915-0490, Tel: 508-921-9104, 800-472-4633, ESYLNK: 953145, FAX: 508-921-9110; FSC No.: 6640,6685,6625,6660; *Sls. Mgr.:* John Lepore; *Dist. Mgr.:* John Lepore

Local Distributors

CA	Los Angeles, E.I.L. Instrs.	213-685-7020
MD	Baltimore, E.I.L. Instrs.	410-584-7400

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, FAX: 914-576-6570; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Zaw Nawaday .... **A•1419**

Local Sales Offices & Reps

CA	Carlsbad, Mkt. Resource Network	619-721-6717
CA	San Jose, Mac Tron	408-446-8224
AL	Madison, Benchmark Tech. Sls.	205-464-0033
CT	Southington, Orion Group	203-621-8371
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
MA	Peabody, The Orion Group	508-532-6266
MD	Annapolis, Rynone Assocs.	301-263-0794
NY	Smithtown, T & K Sls.	516-724-3456
MN	Minneapolis, Ferrian Sls. & Assocs.	612-721-8915
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OR	Beaverton, Core II Mktg.	503-649-0877
OR	Portland, Core II	503-649-0871
PA	Prospect Park, Elf Sls. Co.	215-534-3340
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
UT	Salt Lake City, R 2 Mktg. Inc.	801-595-0631

Local Distributors

CA	Burbank, Atwater Elctrns.	818-841-9050
CA	San Jose, Turbo Elctrns.	408-441-6616
CA	Sunnyvale, PSC Elctrns.	408-737-1333
NJ	Bellmawr, Mid Atlantic	609-931-5303
NY	Bohemia, RBD Elec.	516-589-7717
NY	Mt. Vernon, Janesway Elec.	914-699-6710

MFG, Parabam Div., 1130 Watsoncenter Rd., Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 310-447-6633, 800-533-2297, FAX: 310-820-6958

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An Affiliate of UNITRODE Corporation

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CA	San Jose, Motion Control-North	408-997-0544

MG ELECTRONICS

FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey .... **D•1051**

MGR INDUSTRIES INC., 450B Industrial Dr., Ft. Collins, CO 80524, Tel: 303-221-2201, FAX: 303-484-4078; Empl.: 2; *Sls. Mgr.:* R. Vangermeersch

MHOTRONICS., INC., 960 Corporate Woods Pkwy., Vernon Hills, IL 60061, Tel: 708-913-9566, FAX: 708-913-9587; Empl.: 45; *Sls. Mgr.:* David McFadden

MIAMI MAGNET CO., INC., The Magnet Source, 6073 Bldg. C 26 N.W. 167th St., Miami, FL 33015, Tel: 800-222-7846, FAX: 305-823-1603; FSC No.: 5999; Empl.: 38; *Sls. Mgr.:* Gale Peregrin; *Dist. Mgr.:* C. Peregrin .... **A•1319**

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CA	Placentia, A-L-L Magnetics Inc.	714-632-1754
CO	Castle Rock, Master Magnetics	303-688-3966
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MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590, FAX: 517-726-0078; Empl.: 50; *Sls. Mgr.:* Tom Krul

MICREL SEMICONDUCTOR, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-944-0800, FAX: 408-944-0970; FSC No.: 60496; Empl.: 135; *Sls. Mgr.:* Mike O'Neal; *Dist. Mgr.:* Mike O'Neal

MICRO ALLIANCE, INC., 1384-A Poinsettia Dr., Vista, CA 92083, Tel: 619-598-1900; Empl.: 10; *Sls. Mgr.:* Ed Larson

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904, FAX: 714-957-1614; Empl.: 15; *Sls. Mgr.:* B. H. Corzine

MICROBAR SYSTEMS, INC., 3350 Scott Blvd. 3902, Santa Clara, CA 95054-3119, Tel: 408-748-2920, FAX: 408-748-2924

MICRO-CERAMX TECHNOLOGY, A MicroSemi Company, 501 South Andreasen Dr., Escondido, CA 92029, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

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MICRO-COAX, Box 993, Collegeville, PA 19426, Tel: 215-489-3700, FAX: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Bruce Ash

MICROCOMPATIBLES INC., 301 Prelude Drive, Silver Springs, MD 20901, Tel: 301-593-0683, FAX: 301-593-5151; Empl.: 4; *Sls. Mgr.:* Linda Esterling

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IN	Greenwood, M/S Sls. and Assocs., Inc.	317-881-0110
MD	Kensington, Koebert Assocs., Inc.	301-493-8924
MN	Afton, Real Elctrns. Sls. Assocs.	612-436-1950
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PA	Glenside, Koebert Assocs.	215-887-2310
TX	Fort Worth, Merlin Elctrns.	817-429-4420
TX	Grapevine, Merlin Elctrns.	817-329-8922

MICRO DATA SYSTEMS, P.O. Box 3278, Thomasville, GA 31799, Tel: 912-226-1709, TELEX: 6503406939 MCI CW; Empl.: 5; *Sls. Mgr.:* Sid Davis; *Dist. Mgr.:* Sid Davis

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MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller

MICRODRY, INC., 7450 Hwy. 329, Crestwood, Kentucky 40014, Tel: 502-241-8933, FAX: 502-241-8648; Empl.: 16; *Sls. Mgr.:* Mark Arsenault, Tech. Sls. Engr.

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MICROFLECT CO., INC., 3575 25th St. S.E., P.O. Box 12985, Salem, OR 97309-0985, Tel: 503-363-9267, TWX: 510-599-0107, FAX: 503-363-4613; Empl.: 160; *Sls. Mgr.:* John J. Kranitz

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MA	Bedford, Vector Assoc.	617-271-0000
MN	Maple Grove, Elctrn. Prods. For Ind.	612-784-5554
TN	Nashville, Strategic Mktg. Inc.	615-883-7882

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CA	San Diego, Shelley-Ragon	619-453-7133
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NY	Oceanside, Tritech	516-678-6222
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Industrial Elect.	817-731-7321
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UT	Salt Lake City, Kimball Elctrns.	801-328-2075
EXP	Basle, Switzerland, Siabalco W. Siegrist & Co. AG	845-962851
EXP	Huntingdale, Australia, Stewart Elctrn. Comps. Pty.	790-AA36908

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OH	Dayton, Q-Mark	513-438-1129
PA	Clenside, Wyncote Instrmn.	215-572-6500
VA	Fairfax, CSDS	703-385-0139

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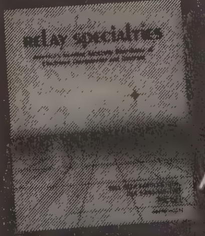

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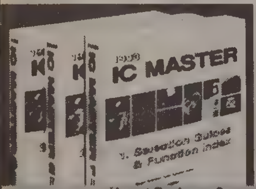

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MA	Wellesley, Logan Sls.	617-235-6868
MN	Minnneapolis, RK Sales	612-571-1001
MO	St. Louis, AEM, Inc.	314-298-9900
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NY	Marcellus, Mullahy-Welch Sls.	315-673-3891
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Cary, Arthur, Harris & Assoc.	919-460-8660
OH	Cleveland, J.O. Olsen Co.	216-838-0510
OH	Goshen, J.O. Olsen Co.	513-722-3320
PA	Pittsburgh, J.O. Olsen Co.	412-381-4254
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
Can	Brampton, Ont., Reemco Inc.	416-624-2730

Local Distributors

AL	Birmingham, MG Elctrns. & Equip.	205-328-4525
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	Oakland, Brill Elctrns.	510-834-5888
CA	San Diego, Kent Electronics	619-471-9561
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Santa Monica, Master Distrs.	310-452-1229
CA	Torrance, Kent Elctrns.	310-320-2700
CO	Englewood, Kent/Shelley-Ragon	303-762-0670
FL	Largo, Elctrn. Precepts of Florida	813-544-3636
FL	Pompano Beach, Peerless Radio Corp.	800-327-4993
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Sager	410-995-4900
MA	Hingham, Sager Elec. Supp.	617-749-6700
MN	Minneapolis, Bergquist	612-835-2322
MN	Thief River Falls, Digi-Key Corp.	800-344-4539
NJ	Oakland, Relay Specialties	800-526-5376
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Sager	516-348-1300
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Summit Distrs.	716-334-8110
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Dayton, J.A. Becker Co.	513-226-1341
PA	Philadelphia, Shap Elctrns.	215-969-3300
PA	Pittsburgh, Sager	412-772-2233
TX	Houston, Kent Elctrns.	713-780-7770

TX	Houston, Lenert Co.	713-225-1465
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	New Berlin, Classic Comp.	414-786-5300

MICROVISION CORP., 180 Knowles Dr., Ste. 100, Los Gatos, CA 95008, Tel: 408-374-3158, FAX: 408-374-9394; Empl.: 15; *Sls. Mgr.:* Stan Buckstad

MICROWAVE APPLICATIONS GROUP, 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: 910-351-5808, FAX: 805-925-5903; FSC No.: 26357; Empl.: 51; *Sls. Mgr.:* T. Janzen

MICROWAVE COMMUNICATIONS CORP., 26007 Huntington Lane, Bldg. 11, Valencia, CA 91355, Tel: 805-257-1948, FAX: 805-257-0557; FSC No.: 57757; Empl.: 10; *Sls. Mgr.:* Michael Claggett

MICROWAVE DESIGN SVCS., INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789

MICROWAVE DEVELOPMENT LABORATORIES, 10 Michigan Dr., Natick, MA 01760, Tel: 508-655-0060, FAX: 508-655-6972; Empl.: 180; *Sls. Mgr.:* R. Tucker

MICROWAVE DEVICE TECH., 4 Liberty Way, Westford, MA 01886, Tel: 508-692-7800, FAX: 508-688-6220; FSC No.: ODRE6; Empl.: 11; *Sls. Mgr.:* Murthy S. Ayyagari

MFC
MICROWAVE FILTER COMPANY

FAX: 315-463-1467

MICROWAVE FILTER INC., 6743 Kinne St., East Syracuse, NY 13057-0486, Tel: 315-437-3953, 800-448-1666, TELEX: 249-613; FSC No.: 27834; Empl.: 98; *Sls. Mgr.:* Dave Headley .... **A•1655-1659**

Local Sales Offices & Reps

CA	Oceanside, The House of Reps.	619-967-2712
MA	Randolph, Bengal Assocs.	617-961-3120
OH	Bellbrook, Tom Herman & Assocs.	513-372-5707
VA	Fairfax, Schibley Assocs., Inc.	703-591-3008

Local Distributors

AZ	Mesa, Antenna Techlg. Corp.	602-898-7667
CA	Campbell, Signal Sources	408-866-0600
CA	Downey, Montero Intl., Inc.	310-862-0116
CA	Sacramento, Audiolab Elctrns.	800-624-1903
CA	Torrance, Western CATV	213-539-8030
CO	Englewood, Midwest CATV	303-799-4343
FL	Boca Raton, Passive Dvcs., Inc.	407-998-0600
FL	Hialeah, Hero Comm.	305-887-3203
FL	Miami, Centennial So.	800-468-5465
FL	Miami, Gendra Intl.	305-372-8845
FL	Mt. Dora, FM Technlg. Assoc., Inc.	904-383-3682
FL	Ocala, Broadcasters Gen. Store	904-622-9058
FL	Panama City, Bay Elctrns. Supp.	904-785-7258
GA	Lawrenceville, John Weeks Entprs.	404-963-7870
IL	Rolling Meadows, Antec Comm.	708-677-2600
IN	Richmond, Allied Broadcast Equip.	317-962-8596
LA	Mamou, Satellite Earth Stas.	318-468-2203
MI	Bloomfield Hills, Nat. Satellite Corp.	313-644-4052
MS	Raymond, Broadcast Equip. Engrg. Sls.	601-857-8578
NE	Dakota City, ATV Research, Inc.	402-987-3771
NH	Bow, Earth Terminal, Inc.	603-224-5166
NJ	Union, Avanti Elctrns.	201-964-0333
NY	New York, Universal Elctrns. Tech. Corp.	212-262-7200
NC	Pineville, S.C.M.S., Inc.	704-889-4508
OR	Beaver Creek, Northwest Comms.	503-266-7266
PA	Horsham, Toner Cable	215-675-2053
PA	Willow Grove, NCS Inds.	215-657-4690
TX	Bedford, Spectrum Megahertz	817-267-2288
TX	Houston, Elctrn. Comps. Dist.	713-529-8806
UT	Salt Lake City, RIA Corp.	801-486-8822
VA	Charlottesville, Hall Elctrncs.	804-974-6466
WA	Edmonds, Glade Comms.	206-771-6891
WA	Seattle, RF Specialties of Wash.	206-546-6546
WV	Dunbar, Seneca Comm., Inc.	304-766-8740
WI	Plymouth, Hi-Tech.	414-892-6210
Can	Boucherville, Que., Planon Telexpertise	514-449-6481
Can	Calgary, Alberta, AVR Comms. Ltd.	403-251-0707
Can	Lavel, Que., Incospec Elctrns.	514-686-0033
Can	Markham, Ont., Cabletel Comms.	416-475-1030
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Montreal, Que., Comega Technlgs.	514-355-3105
Can	Oshawa, Ont., Comlink Sys.	416-436-1075
Can	St. Leonard, Que., Trispec Comms.	514-328-2025

MICROWAVE SOLUTIONS, INC., 3200 Highland Ave., Ste 3A, National City, CA 91950, Tel: 800-967-4267, FAX: 619-474-7003; FSC No.: 65151; Empl.: 12; *Sls. Mgr.:* Edward M. Teyssier

MICROWAVE TECHNOLOGY DIV., JHP Industrial, 405 West Taylor St., Syracuse, NY 13202-3442, Tel: 315-422-0050, FAX: 315-422-3331; FSC No.: 0G5J9; Empl.: 8; *Sls. Mgr.:* Emanuel Henderson, Jr.

MICROWAY INC. RESEARCH PARK, Research Park, P.O. Box 79, Kingston, MA 02364, Tel: 508-746-7341, FAX: 508-746-4678; Empl.: 35; *Sls. Mgr.:* Maryann Strassel; *Dist. Mgr.:* Maryann Strassel

MIDAMERICA DESIGN SERVICE, Spirit of America Corp., 10206 Lima Rd., Fort Wayne, IN 46818, Tel: 219-489-2511, FAX: 219-489-2295; Empl.: 350; *Sls. Mgr.:* Bob Croup

MIDCOM, INC., 121 Airport Dr., Watertown, SD 57201, Tel: 605-886-4385, FAX: 605-886-4486; FSC No.: 0GP22; Empl.: 300; *Sls. Mgr.:* Dean Ward .... **A•2425-2431**

Local Sales Offices & Reps

CA	Huntington Beach, Solutech	714-374-0130
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
FL	Pompano Bch., Richmar Elctrns. Corp.	305-783-9214
FL	Valrico, Richmar Elctrns. Corp.	813-654-8032
IL	Downers Grove, Richmar Elctrns. Corp.	708-968-0118
IN	Indianapolis, Richmar Elctrns. Corp. ...	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
MN	N. Mankato, E.I. Sls.	507-345-5786
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp. ..	512-255-2551
VA	Powhatan, Eagle Sls. Corp.	804-492-9027
WI	Butler, Richmar Elctrns. Corp.	414-781-1730

MID-EASTERN INDUSTRIES, Technology Dynamics Inc., 100 School Street, Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 06179; Empl.: 15; *Sls. Mgr.:* Daniel Ellenback .... **D•1832-1835**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
FL	Clearwater, Tech-Rep Assocs.	813-872-9900
GA	Lawrenceville, BCI	404-962-6826
IL	Arlington Hgts., Greenslade Sls. Inc. ...	708-593-3450
MD	Columbia, Delta III Assocs.	410-730-4700
MA	Topsfield, Whitehead Assocs., Inc.	508-887-8050
MN	Minneapolis, Tecteam Sls. Inc.	612-854-6616
NM	Albuquerque, IMEC	505-275-0936
NY	Elmont, Crane & Egert	516-872-0800
OH	Chagrin, J.J. Bair & Co.	216-543-8617
TX	Dallas, Tesco Elctrn. Sls. Co.	214-553-1200
UT	Midvale, Christec	801-566-3694
WI	Wauwatosa, Greenslade Sls. Inc.	414-258-2727

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06851, Tel: 203-866-2342, FAX: 203-847-7147; Empl.: 10; *Sls. Mgr.:* Helen Monroe; *Dist. Mgr.:* Helen Monroe

MIDLAND-ROSS CORP., NEL UNIT, See NEL Frequency Controls, Inc.

MIDORI

FAX: 714-449-0139

MIDORI AMERICA CORP., 2555 E. Chapman Ave., Ste. 400, Fullerton, CA 92631, Tel: 714-449-0997; Empl.: 3 .... **A•2109**

MIDSTATES MARKETING, INC., 1122 E. Washington St., Ste 100, Indianapolis, IN 46202, Tel: 317-639-9999; Empl.: 3

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, FAX: 915-772-1116; Empl.: 275, *Sls. Mgr.:* Craig Law; *Dist. Mgr.:* Bob Walasiak

MIDWEST COMPONENTS,INC., See Therm-O-Disc, Div. Midwest Component Product Group

MIDWEST CONTAINER SYSTEMS, 5604 Intl. Pkwy., Minneapolis, MN 55428, Tel: 612-533-4532, FAX: 612-533-9260; Empl.: 3; *Sls. Mgr.:* John Poyer

MIDWEST MICROWAVE, 6564 South State Rd., Saline, MI 48176-9569, Tel: 313-429-4773, 800-521-4410, FAX: 313-429-1415; FSC No.: 34078; Empl.: 120; *Sls. Mgr.:* William H. Lavery

MIKRON INSTRUMENT COMPANY, INC., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, FAX: 201-891-1205; Empl.: 50; *Sls. Mgr.:* John Merchant

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. # C, Chatsworth, CA 91311, Tel: 818-998-3111

MIL ELECTRONICS, INC., One Chestnut St., Nashua, NH 03060, Tel: 603-882-3200, FAX: 603-881-8661; FSC No.: 07862; Empl.: 40

MILES PLATTS INC., 901 Touhy Ave., Elk Grove Village, IL 60007, Tel: 1-708-364-0363, FAX: 708-364-0614; Empl.: 7; *Sls. Mgr.:* J. L. Packwood

JAMES MILLEN ELCTRNS., Caywood Elec. Inc., 87 Belmont St., No. Andover, MA 01845, Tel: 508-975-2711, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* R. Jannini

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, FAX: 818-443-3267; FSC No.: 91345; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611, FAX: 213-264-3203; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415, FAX: 207-864-3344; Empl.: 8

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-0950, Tel: 203-743-4447; *Sls. Mgr.:* Mrs. Fran Bounar

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 510-791-5188, TELEX: 466465, FAX: 510-791-5237; FSC No.: 52426; Empl.: 42; *Sls. Mgr.:* Philip Hamad; *Dist. Mgr.:* Philip Hamad

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300, FAX: 518-356-5161; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* Jan B. Metzger .... **D•1299**

Local Sales Offices & Reps

CA	San Diego, Advanced Prods. Sls.	619-530-0200
CA	Westlake Vl., Advanced Prods. Sls.	818-706-8351
MD	Laurel, CSDS Inc.	301-490-3800
MA	Needham, Addelco Corp.	617-444-4754
NY	Fayetteville, Martin P. Andrews	315-637-5291
TX	Houston, Scientific Sls.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Fairfax, CSDS Inc.	703-385-0139
Can	Downsview, Ont., Tradeport Elctrns. Grp.	416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 200; *Sls. Mgr.:* Richard M. Weiner .... **C•1421**

Local Sales Offices & Reps

AL	Huntsville, DHR Mkyg., Inc.	205-536-9775, FAX:205-539-8313
AZ	Scottsdale, Trinity Sls.	602-483-1943, FAX:602-483-2038
AR	Mabelvale, Erickson Sls., Inc.	501-455-0618
CA	Campbell, PCA	408-559-2866,FAX:408-559-8277
CA	Dana Point, PCA ...	714-493-9822,FAX:714-240-1894
CO	Englewood, Omega Ltd.	303-762-1921, FAX:303-762-1928
CT	Hartford, D.A. Crowley & Assocs.	203-956-9007, FAX:203-956-5351
FL	Boca Raton, Tech Sls. Specialists	407-391-3718, FAX:407-750-1178
GA	Duluth, DHR Mktg., Inc.	404-564-0529, FAX:404-564-1127
GA	Roswell, Contact Factory	516-922-6000, FAX:516-922-9253
IL	Elk Grove Village, Control Sls.	708-595-2110, FAX:708-595-9592
IN	Indianapolis, M & L Sls.,Inc.	317-359-4742, FAX:317-359-0320
IN	Valparaiso, Catalyst Sls.	219-477-4004, FAX:219-477-4355
KS	Overland Park, Acorn Elctrns., Inc.	913-649-6402, FAX:913-649-8005
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MN	St. Paul, Johnson Co.	612-429-2544, FAX:612-429-3104
MO	St. Louis, Acorn Elctrns., Inc.	314-421-1751, FAX:314-421-1752
NH	Amherst, D.A. Crowley & Assocs.	603-673-7050, FAX:603-672-0817
NJ	Ft. Lee, Nexus Technlg.	201-947-0151, FAX:201-947-0163
NY	Fairport, Senntec	716-425-3954, FAX:716-425-7933
NC	Raleigh, Contact Factory	516-922-6000, FAX:516-922-9253
OH	Dayton, Catalyst Sls. Co.	513-256-3344, FAX:513-256-1173
OR	Tigard, Halbar-RTS, Inc.	503-624-5741, FAX:503-684-1803
PA	Doylestown, G. A. Recentio Assocs.	215-348-7577, FAX:215-348-8458
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434, FAX:412-826-3436
TX	Dallas, Erickson Sls., Inc.	214-739-5833, FAX:214-739-2329
WA	Redmond, Halbar-RTS, Inc.	206-882-0990, FAX:206-881-3323
WI	Brookfield, Control Sls.	414-797-9500, FAX:414-797-0784
Can	Mississauga, True North Technlg.	416-677-9788, FAX:416-677-8048
Can	Montreal, Que., True North Technlg. ...	514-343-9393, FAX:514-343-9390
Can	Ottawa, True North Technlg.	613-564-0629

Local Distributors

AL	Huntsville, Electronic Fasteners	205-430-0400
AL	Huntsville, Nu Horizons	205-722-9330
AZ	Phoenix, Aero-Space Southwest	602-582-2779
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tucson, Pioneer Screw & Nut	602-623-9800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Anaheim, Bisco	714-635-0380
CA	Chatsworth, Alatec Prods.	818-727-7800
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fremont, Acacia/Deanco	510-623-7500
CA	Fremont, Alatec Prods.	510-657-7701
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Los Gatos, Gourmet Elctrns.	408-374-0552
CA	North Hollywood, Electronic Hardware	818-982-6100
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Jose, Bisco	408-435-8980
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Pro-Fasteners	408-943-9177
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Sunnyvale, PSC	408-737-1333
CO	Denver, Hardware Specialty	303-371-8553
CO	Wheatridge, Acacia/Deanco	303-421-7004
CT	Southbury, Heilind Elctrns	203-262-1700
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Ft. Lauderdale, Nu Horizons	305-735-2555
FL	Sanford, Elctrn Fasteners	407-321-4000
FL	Sunrise, All American	305-572-7999
FL	Tampa, Century Fasteners	813-886-5770
GA	Norcross, Atlanta Hardware Specialty	404-449-3000
GA	Norcross, Nu Horizons	404-416-8666
IL	Addison, Belford Elctrns.	708-691-1100

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IN	Indianapolis, PEI/Genesis Elctrns.	317-328-7700
IN	South Bend, PEI/Genesis Elctrns.	800-348-2996
LA	Shreveport, Carlton-Bates	318-636-9975
MD	Columbia, Nu Horizons	301-995-6330
MD	Gaitherburg, Capitol Fasteners	301-948-9310
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Hunt Valley, Alatec Prods.	301-667-0063
MD	Ijamsville, Hardware Specialty	301-831-1212
MA	Marlborough, Hardware Specialty	508-481-8622
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Wakefield, Nu Horizons	617-246-4442
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Wyoming, North Coast Comps.	616-452-0800
MN	Minneapolis, Aero-Space Computer	612-884-4725
MN	Roseville, Chris Elctrns.	612-631-2647
MO	Kansas City, Aero-Space Computer	913-432-8508
MO	Springfield, Carlton-Bates	417-862-1699
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Blackwood, Hardware Specialty	609-228-6800
NJ	Mt. Laurel, Nu Horizons	609-231-0900
NJ	Pine Brook, Nu Horizons	201-882-8300
NJ	Union, Meridian Supply	908-687-6220
NM	Albuquerque, Bestech Sls.	505-298-0034
NY	Amityville, Nu Horizons	516-226-6000
NY	Bohemia, Car-Lac	516-567-4200
NY	Bohemia, Edge Elctrns.	516-567-6300
NY	Buffalo, Rome Elctrns.	716-626-1602
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Mineola, Hardware Specialty	516-741-7100
NY	Penn Yan, Advacom	315-536-2221
NY	Rochester, Help Elctrns.	716-475-0850
NY	Rochester, Nu Horizons	716-292-0777
NY	Rochester, Rome Elctrns.	716-248-0160
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Ronkonkoma, All American	516-981-3935
NY	Ronkonkoma, Jet Comps.	516-471-3124
NY	Syracuse, Hardware Specialty	315-434-9093
NC	Raleigh, Century Fasteners	919-787-1800
OH	Akron, Aesco Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OH	Dayton, Advacom	513-274-5900
OH	Warren, REM Elctrns.	216-373-1300
OK	Oklahoma City, Carlton-Bates	405-681-4446
OK	Tulsa, Carlton-Bates	918-250-1626
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Comp. Resources	503-641-8488
PA	Erie, REM Elctrns.	814-453-5626
PA	Export, Advacom	412-325-7551
PA	Harrisburg, Ad-Tech	717-561-9905
PA	McKean, Advacom	814-476-7774
PA	North Huntingdon, REM Elctrns.	412-864-7423
PA	Philadelphia, PEI/Genesis	800-523-0727
TN	Memphis, Carlton-Bates	901-365-3539
TX	Allen, Prime Distbg.	214-231-0170
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	El Paso, McNicol Elctrns.	915-566-2936
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Houston, Carlton-Bates	713-956-2244
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-351-2255
TX	Richardson, Off The Shelf Comp.	214-238-0808
UT	Salt Lake City, Standard Supply	801-486-3371
WA	Kent, Comp. Resources	206-340-1646
WA	Redmond, Acacia/Deanco	206-881-5566
WI	Brookfield, Bisco Inds.	414-789-7325
WI	Milwaukee, Progressive Image	414-321-4722

FAX: 310-430-8309

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 310-598-2454; FSC No.: 34238; Empl.: 50; *Sls. Mgr.:* S. Kistner; *Dist. Mgr.:* C. Brown ...... **A•1987**

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Sacramento, Mills Resistor Co.	916-422-5461
CT	Rocky Hill, Jim McPhail	203-721-1802
MA	Waltham, Dynasel Assocs.	617-890-6777
MI	Milford, Elctrn. Comp. Sls., Inc.	313-360-3790
OR	Gaston, SPS Elctrns.	206-323-4140
PA	Montgomeryville, Quick Response Tech. Sls.	215-362-9225
TX	Houston, Ev Smith Co.	713-649-5756
WA	Seattle, SPS Elctrns.	206-323-4140

Local Distributors

FL	Ft. Lauderdale, Jaro Elctrns.	800-327-5551
PA	Harrisburg, ADTECH	717-939-8337
PA	McKean, Advacom	814-476-7774

MILTON ROSS CO., 262 Valley Rd., Warrington, PA 18976, Tel: 215-491-0600, FAX: 215-491-9479; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Marianne Skukowski

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, 516-756-7650, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650; *Sls. Mgr.:* Robert Ceonzo

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 750; *Sls. Mgr.:* Frederick S. Korb; *Dist. Mgr.:* William Jennings

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 75; *Sls. Mgr.:* John Dorsha ...... **A•1988-1992**

Local Sales Offices & Reps

CA	San Carlos, Electro Pacific	415-441-5541
IL	Arlington Heights, Kettner & Assocs.	708-364-0830
NC	Kernersville, Heritage Elctrl. Sls.	919-996-4484
MA	Stoughton, EECS-Mel Botsian	617-344-5139
MN	Plymouth, Kettner & Assocs.	612-559-5150
NY	Rochester, Gislason Sls.	716-328-7400
NY	Whitestone, M. H. Lynn co.	718-352-9233
NC	Kernersville, Heritage Electrical Assoc.	800-877-4372
OH	Westlake, Assocd. Elctrl. Comps.	216-835-9960
WI	Mequon, Kettner & Assocs.	414-241-4697

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINC INCORPORATED, 6755 Earl Dr., Colorado Springs, CO 80918, Tel: 719-590-1155, FAX: 719-590-7330; *Sls. Mgr.:* David Niehaus

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 575; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 3160 Pullman, Costa Mesa, CA 92626, Tel: 714-434-7312, FAX: 714-434-7431; FSC No.: 54455

MINELCO INC. Talley™ Industries

FAX: 203-283-6527

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261; FSC No.: 07479; Empl.: 70; *Sls. Mgr.:* James A. Myles ... **B•1175**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, James Gerry Co.	213-283-7694
CA	Alhambra, James Gerry Co.	213-283-7694
CO	Centerville, West Inc.	208-888-6227
CO	Denver, West Inc.	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Longwood, Delmac	407-831-0040
GA	Atlanta, L & D, Inc.	404-395-7079
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
KS	Wichita, Magna Eng. Sls. Co.	316-744-0851
MD	North East, Magna Eng. Sls. Co.	410-398-4215
MA	Burlington, F.J.S. Assocs.	617-273-5959
MO	St. Louis, Magna Eng. Sls. Co. Inc.	314-849-6590
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Dayton, Electro Mktg. Grp.	513-890-8322
OR	Lake Oswego, Caruso & Assocs.	503-635-5282
TX	Dallas, Kruvand Assoc., Inc.	214-437-3355
WA	Bellevue, Caruso & Co.	206-455-8811

MINGSTON ELECTRONICS, INC., MEC Inc.(Taiwan), 14145 Proctor Ave. Unit 8, City of Industry, CA 91746, Tel: 818-330-2086, FAX: 818-330-9988; Empl.: 3; *Sls. Mgr.:* Johnny Chao

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 13 Neptune Avenue, P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Intl.); FSC No.: 15542 ...... **A•1724-1845**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Tustin, Youngewirth & Olenick Assocs.	714-838-5144
CO	Parker, W. Howard Assocs.	303-841-5755
FL	Clearwater, Beacon Microwave & Instrmn., Inc.	813-796-2378
FL	Longwood, Beacon Microwave & Instrs.	407-332-1940
GA	Atlanta, Beacon Microwave & Instrmn., Inc.	404-256-9640
IL	Mundelein, Cain-Forlaw, Inc.	708-540-9962
IN	Wolcottville, Cain-Forlaw Co., Inc.	219-854-2632
MD	Columbia, M. Lader Co.	800-442-3177
MA	Chelmsford, Advanced Technlg. Mktg., Inc.	508-458-0200
MO	Mini-Circuits	417-335-5935,FAX:417-335-5945
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343
NY	Bklyn (Distbn. Ctr.), Mini-Circuits	800-654-7949
NY	Hartsdale, Spectrum Sls., Inc.	914-472-8600
NY	Skaneateles, Robtron, Inc.	315-685-5731
NC	Greensboro, M. Lader Co.	800-442-3177
OH	Worthington, Cain-Forlaw Co. Inc.	614-436-3004
OR	Aloha, Cain-Sweet Co.	503-591-0647
PA	Conshohocken, M. Lader Co.	215-825-3177, 800-442-3177
TX	Richardson, Beacon Microwave & Instrn., Inc.	214-437-1505
TX	Round Rock, Beacon Microwave & Instrmn. Inc.	512-244-6675
VA	Strasburg, M. Lader Co.	800-442-3177
WA	Bellevue, Cain-Sweet Co.	206-462-2118
Can	Burnaby, B.C., Giga-Tron Assocs. Ltd.	604-299-4244
Can	Burnaby, BC, Cain-Sweet Co.	604-420-6886
Can	Ottawa, Ont., Giga-Tron Assocs., Ltd.	613-225-4090

Local Distributors

AL	Huntsville, Component Distrs., Inc.	205-851-7800, 800-888-0331
AZ	Arizona/New Mexico, Mini-Circuits	800-654-7949
CA	Los Altos, Mini-Circuits	415-948-6533, 800-654-7949
CA	Tustin, Mini-Circuits	714-838-5144,800-654-7949
FL	Palm Bay, Component Distrs., Inc.	407-724-9910, 800-558-2351
GA	Norcross, Component Distrs., Inc.	404-441-3320, 800-874-7209
IL	Mundelein, CFC Distrs., Inc.	708-540-9962
MD	Columbia, MLC Distrs.	800-442-3177
MO	Mini-Circuits	417-335-5935
NM	Mini-Circuits	800-654-7949
NC	Greensboro, MLC Distrs.	800-442-3177
PA	Conshohocken, MLC Distrs.	215-825-3177, 800-442-3177
TX	Dallas, Comp. Distrs., Inc.	214-644-0373, 800-848-4234
WA	Bellevue, Mini-Circuits	206-462-2118,800-654-7949

M S I

FAX: 508-695-8758

MINI-SYSTEMS, INC., Electronic Package Div. 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel 508-695-2000; *Sls. Mgr.:* Heather Edwards ...... **A•1710, 199**

Local Sales Offices & Reps

CA	L.S. Engrg.	415-967-5880,FAX:415-967-5884
CA	S. California Tech. Sls.	818-704-9087, FAX:818-704-8632
FL	JDM Assocs.	407-725-2823,FAX:407-725-7861
IL	ABC Elctrn. Sls.	708-924-9974,FAX:708-924-9975
MN	InterTec Associates	612-921-8443, FAX:612-929-4488
NH	Shain Assocs.	603-881-4881,FAX:603-880-8924
NY	LFG Micro	516-399-3199,FAX:516-399-3182
VA	Glasscock Assocs.	804-798-2125, FAX:804-798-2109
WA	Bellevue, Advanced Power Comps.	206-641-9127, FAX:206-641-8655
Can	Ontario, ON, Intrade Canada	613-727-1272, FAX:613-727-0246

M S I

FAX: 508-695-6076

MINI-SYSTEMS, INC., Thick/Thin Film Division, 20 David Rd., North Attleboro, MA 02761, Tel: 508-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 163 .... **A•1993**

Local Sales Offices & Reps

AZ	Scottsdale, IMA Sls., Inc.	602-946-4940, FAX:602-947-7638
CA	Brea, S.C.T.S.	213-691-1114,FAX:213-690-0504
CA	Mountain View, L.S. Engrg.	415-967-5880, FAX:415-967-5884
CA	Woodland Hills, S.C.T.S.	818-704-9087, FAX:818-704-8632
FL	Palm Bay, JDM Assocs.	407-725-2823, FAX:407-725-7861
FL	Pompano Beach, J.P. Elctrns.	305-782-6830, FAX:305-782-1640
IL	Elk Grove, ABC Elctrns.	708-228-1204, FAX:708-228-1249
ME	Bethel, Shain Assocs., Inc.	207-836-3200
MA	Norwell, Shain Assocs., Inc.	617-982-1474, FAX:617-740-2680
MN	Minneapolis, Intertec Assocs.	612-921-8443, FAX:612-929-4488
NH	Nashua, Shain Assocs., Inc.	603-881-4881, FAX:603-880-8924
NJ	Princeton, Wexler-Court Sls. Co.	609-452-8670, FAX:609-452-9213
NY	Mastic Beach, LFG Micro	516-399-3199, FAX:516-399-3182
NY	Rochester, Phase Two Sls.	716-235-3889, FAX:716-235-1351
NY	Rockville Centre, Milano Bros. Intl.	516-764-2200, FAX:516-764-4006
TX	Richardson, Barry Sls.	214-234-0255, FAX:214-235-0271
VA	Ashland, Glasscock Assoc.	804-798-2125, FAX:804-798-2109
WA	Bellevue, Advanced Power Comps.	206-747-9127, FAX:206-641-8655
Can	Nepean, Ont., Intrade Canada	613-727-1272, FAX:613-727-0246

MINI-SYSTEMS, INC., Sunbelt Microelectronic Division, 237 Enterprise Rd., Deltona, FL 32725, Tel: 407-574-0208, FAX: 407-574-8262 .... **A•1993**

MINNESOTA WIRE & CABLE CO., 1835 Energy Park Drive, St. Paul, MN 55108-2721, Tel: 612-642-1800 , 1-800-258-6922(MWCC), FAX: 612-642-9201; Empl.: 165; *Sls. Mgr.:* Paul Wagner

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-433-6886, FAX: 201-893-1399; *Sls. Mgr.:* Tom Fitzhenry

MINT SYSTEMS CORPORATION, 1633 South Main Street, Milpitas, CA 95035-6262, Tel: 408-262-7171, FAX: 408-262-5387; *Sls. Mgr.:* Rudy Juang .... **D•1300-1301, 2283**

MIRAGE/KLM, 16890 Church St., P.O. Box 1000, Morgan Hill, CA 95037, Tel: 408-779-7363, FAX: 408-779-8845; Empl.: 50; *Sls. Mgr.:* Nancy Nykaza

MISCO

MISCO

FAX: 612-825-7010

MISCO/MINNEAPOLIS SPEAKER CO., INC., 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010; FSC No.: 14208; *Sls. Mgr.:* Tad Thompson .... **D•1052**

Local Sales Offices & Reps

CA	Newport Bch., Spa Elctrn. Sls.	714-863-1193
FL	Longwood, M & H Assocs.	407-332-7912
OH	Brecksville, Audio Mktg. Assocs.	216-526-2426
TX	Arlington, Electronic Prod. Reps.	817-467-0377
WA	Lynnwood, Pacnor Mktg., Inc.	206-771-6016

MITCHELL ELECTRONICS CORP., 84 West Grand Street, Mt. Vernon, NY 10552, Tel: 914-699-3800, TELEX: 914-699-1022; Empl.: 25; *Sls. Mgr.:* Jonathan Lerner .... **A•2433**

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, 800-724-3911, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 115; *Sls. Mgr.:* J. Robinson

MITECH ELECTRONICS CORP., 411 Washington St., Otsego, MI 49078, Tel: 616-694-9471, FAX: 616-692-2651; Empl.: 78; *Sls. Mgr.:* Kendall Meyer

MITEL SEMICONDUCTOR DIV. OF MITEL CORP., 360 Legget Dr., P.O. Box 13089, Kanata, Ont., Canada K2K 1X3, Tel: 613-592-2122, TELEX: 053-3221, TWX: 613-562-8529; Empl.: 1000; *Sls. Mgr.:* Ron Chon

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-436-7430; Empl.: 350

MITRONICS, P.O. Box 2129, Rolling Hills, CA 90274, Tel: 310-377-2022

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Bob Crooks, V.P. Sls.; *Dist. Mgr.:* Bob Crooks, V.P. Sls.

MITSUBISHI ELCTRNS. AMERICA, INC., Elctrn. Device Grp., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-730-4972; Empl.: 200; *Sls. Mgr.:* Mike Bocian; *Dist. Mgr.:* Tom Zellman

Local Sales Offices & Reps

CA	Cypress, Mitsubishi Elctrns. Sls. Reg. Off.	714-236-6270
CA	San Diego, Mitsubishi Elctrns. Reg. Sls. Off.	619-451-9618
CA	Sunnyvale, Mitsubishi Elctrns.-Reg. Sls. Off.	408-730-5900
CA	Torrance, Mitsubishi Elctrns. (Southwest)	213-515-3993
CO	Denver, Mitsubishi Elctrns. (Rocky Mtn.)	303-740-6775
CO	Englewood, Mitsubishi Elctrns. Reg. Sls. Off.	303-220-0744
FL	Boca Raton, Mitsubishi Elctrns.	407-487-7747
GA	Mitsubishi Elctrns. (S. Atlantic)	404-368-4850
GA	Norcross, Mitsubishi Elctrns. Reg. Sls. Off.	404-448-1263
IL	Mt. Prospect, Mitsubishi Elctrns.-Reg. Sls. Off.	708-298-9223
MA	Woburn, Mitsubishi Elctrns. (Northeast)	617-932-5700
MA	Woburn, Mitsubishi Elctrns. Sls. Reg. Off.	617-937-4300
MN	Minnetonka, Mitsubishi Elctrns.-Reg. Sls. Off.	612-938-7779
NJ	Somerset, Mitsubishi Elctrns.-Reg. Sls. Off.	201-469-8833
NY	Fishkill, Mitsubishi Elctrns. Reg. Sls. Off.	914-896-0896
NC	Cary, Mitsubishi Elctrns. Reg. Sls. Off.	919-460-0404
TX	Carrollton, Mitsubishi Elctrns. Reg. Sls. Off.	214-245-0047
TX	Carrollton, Mitsubishi Elctrns.-Reg. Sls. Off.	214-484-1919
TX	Irving, Mitsubishi Elctrns. Sls. Reg. Off.	214-929-0046
Can	Kanata, Ont., Mitsubishi Elec. Sls. Canada, Inc.	613-591-3348
Can	Mississauga, Mitsubishi Elctrns.Reg. Sls. Off.	416-670-8711

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711, FAX: 913-894-9713; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 508-975-2350, 800-227-8766, TELEX: 94-9375, FAX: 508-975-0094; Empl.: 500

MLT/MICRO-LITE TECHNOLOGY, 1811 S. 39th St., Ste. 99, Mesa, AZ 85206, Tel: 602-545-1113, FAX: 602-545-0072; *Sls. Mgr.:* R.L. Dohanian, Dir. Sls. Dev.

MLT/MICRO-LITE TECHNOLOGY, 1811 S. 39th St., Ste 99, Mesa, AZ 85206, Tel: 602-545-1113, FAX: 602-545-0072; *Sls. Mgr.:* R. L. Dohanian, Dir. Sls. Dev.

MMG-NORTH AMERICA, 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, FAX: 201-345-1172; Empl.: 150

MOBILE-TRONICS CO., INC., Box 1147, San Clemente, CA 92674, Tel: 714-361-4305, FAX: 714-361-4356; Empl.: 2

MODOR TECHNICAL PRODUCTS INC., 13400 Wright Cir., Tampa, FL 33626, Tel: 813-855-5736, FAX: 813-855-7942; Empl.: 13; *Sls. Mgr.:* S. James Bottone

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., Brookhaven R & D Plaza, One Roned Road, Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman .... **D•1837-1844, 2136**

Local Sales Offices & Reps

CA	Murrieta, MIL-COM Sls., Inc.	714-677-2097
CA	Santa Clara, Integrated Tech Sls.	408-727-3406
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Clearwater, CM Mktg.	813-443-6390
KS	Prairie Village, Thunderbird Tech. Sls.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls.	316-636-5777
MD	Towson, Advanced Tech. Sls., Inc.	410-296-9360
MN	St. Paul, K-Rep	612-681-9510
MO	Maryland Heights, Thunderbird Tech. Sls.	314-298-8940
NY	Great Neck, F & F Metro Inc.	516-482-4080
NY	Williamsville, NV Elect. Assoc.	716-632-1347
OH	Dover, A-J Assocs.	216-343-2224
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Dallas, M-Rep Co.	214-484-5711

MODULAR DEVICES INC., 4115 Spencer St., Torrance, CA 90503, Tel: 310-542-8561, FAX: 310-371-6331; Empl.: 250; *Sls. Mgr.:* Tom Miller

MODULAR MINING SYSTEMS, INC., 3289 E. Hemisphere Loop, Tuscon, AZ 85706, Tel: 602-746-9127, FAX: 602-889-5790; Empl.: 60; *Sls. Mgr.:* J.Michael Canty

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 5; *Sls. Mgr.:* H. N. Patel

M MODUPOWER by SEMTECH

MODUPOWER, INC., See Semtech Corporation

MOHAWK/CDT, 9 Mohawk Dr., Leominster, MA 01453, Tel: 508-537-9961, 800-422-9961, FAX: 508-537-4358; Empl.: 140

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., P.O. Box 369, LaVerne, CA 91750-0369, Tel: 909-392-5833, FAX: 909-392-5838; Empl.: 25; *Sls. Mgr.:* Gabriel Cote, Jr.

MOLDCON DIV. OF CONTEX ELECTRONICS, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, FAX: 413-736-9716; Empl.: 158; *Sls. Mgr.:* Chris Stone

MOLDTRONICS, INC., 703 Rogers St., Downers Grove, IL 60515, Tel: 708-968-7000, FAX: 708-968-5068; Empl.: 100; *Sls. Mgr.:* J.D. Wilson

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 908-938-9473, TWX: 710-723-6943; Empl.: 125

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 708-969-4550, TELEX: 25-4069, FAX: 708-969-1352; Empl.: 7,483; *Sls. Mgr.:* Bill Cox; *Dist. Mgr.:* Bill Hickey

MOLI ENERGY LIMITED, 20000 Stewart Crescent, Maple Ridge, B.C., Canada V2X 9E7, Tel: 604-465-7911/1-800-663-MOLI, TELEX: 04-356708, FAX: 604-465-4398; FSC No.: 6140; Empl.: 160; *Sls. Mgr.:* Mary Connolly; *Dist. Mgr.:* Mary Connolly

MOLON MOTOR & COIL CORPORATION, 3737 Industrial Avenue, Rolling Meadows, IL 60008, Tel: 708-253-6000, FAX: 708 259-5491; *Sls. Mgr.:* Timothy Wiemer

MONARCH INSTRUMENT, Monarch International Inc., 11 Columbia Drive, Amherst, NH 03031, Tel: 603-883-3390, 800-999-3390, FAX: 603-886-3300; FSC No.: Cage Code 1Z500; Empl.: 26; *Sls. Mgr.:* Richard Peters, Paul Coughlin, Prod. Mgrs.; *Dist. Mgr.:* Myron Kasok

MONICOR ELECTRONIC CORP., 2964 N.W. 60th St., Ft. Lauderdale, FL 33309, Tel: 305-979-1907, FAX: 305-979-2611; Empl.: 6

MONITOR PC

FAX: 619-434-0255

MONITOR PRODUCTS CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510; FSC No.: Cage Number 54331; *Sls. Mgr.:* Pat Courington, East. Reg. Mgr.; *Dist. Mgr.:* Robert Blasier, West. Reg. Sls. Mgr.
A•1324, 1424-1429

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Eltron	602-266-2164
CA	Mountain View, Straube Assocs.	415-969-6060
CA	Oceanside, Monitor Prods. Co.	619-433-4510
CO	Westminster, Straube Assocs.	303-426-0890
FL	Coral Springs, Graham Assocs.	305-341-5102
FL	Jacksonville, Monitor Prods. Co.	904-725-4384
FL	Largo, Graham Assocs.	904-523-0996
FL	Melbourne, Graham Assocs.	407-773-6631
FL	Palm Beach, Graham Assocs.	407-622-4049
FL	Winter Garden, Graham Assocs.	407-656-9369
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Boise, Jas. J. Backer Co.	208-378-4680
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
KS	Overland Park, Markline Tech.	913-681-8880
MD	Baltimore, Muncy Sls. Assocs.	410-484-6376
MA	Chelmsford, Technlg. Reps.	508-250-4762
MN	Anoka, Technical Solutions, Inc.	612-785-9303
NH	Technlg. Reps.	603-774-6323
NC	Matthews, CSR Elctrns.	704-847-5806
NC	Raleigh, CSR Elctrns.	919-878-9200
OR	Beaverton, Jas. J. Backer Co.	503-627-0168
RI	Technlg. Reps.	401-789-7530
TN	Knoxville, CSR Elctrns.	615-637-0293
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Richardson, Mil-Rep Assocs.	214-644-6731
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Huntsville, Component Distr.	205-851-7800
AL	Huntsville, Resistacap, Inc.	205-883-4270
AL	Huntsville, Time Elctrns.	205-721-1134
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Scottsdale, Added Value Elec.	602-951-9788
AZ	Tempe, Timer	602-967-2000
CA	Agoura Hills, Time Elctrns.	818-707-6223
CA	Chatsworth, Passive Technlg.	818-882-2277
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Culver City, Combined Services	213-558-2859
CA	Culver City, Time Elctrns.	213-558-2859
CA	El Segundo, Force Elctrns.	213-522-1324
CA	San Diego, Added Value Elec.	619-558-8890
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Sherman Oaks, Delay Line Distrs.	818-986-9455
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	310-320-0880
CA	Tustin, Added Value Elctrns.	714-259-7986
CA	Tustin, Time Elctrns.	714-669-8719
CA	Westlake Village, Added Value Elec.	818-889-2861
CO	Colorado Springs, Time Elctrns.	719-637-0055
CO	Engelwood, Component Distrib.	303-770-6214
CO	Engelwood, Time Elctrns.	303-721-8882
CO	Wheatridge, Added Value Elctrn.	303-422-1701
CT	Bridgeport, Park Distrs.	203-366-7200
FL	Boca Raton, NRC Elctrns.	507-241-8600
FL	Clearwater, Component Distrib.	813-796-0466
FL	Ft. Lauderdale, Component Distrib.	305-973-6175
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Melbourne, Comp. Dist.	407-724-9910
FL	Melbourne, Rome Elctrns.	407-242-8151
FL	Orlando, Time Elctrns.	407-841-6565
GA	Atlanta, Time Elctrns.	404-984-0126
GA	Norcross, Component Distrib.	404-441-3320
GA	Norcross, Time Elctrns.	404-368-0969
IL	Franklin Park, Stetco, Inc.	708-671-4208
IL	Schaumberg, Time Elctrns.	708-303-3000
MD	Columbia, Time Elctrns.	301-964-3090
MA	Pepperell, DSC, Inc.	508-433-9524
MN	Edina, Time Elctrns.	612-830-1252
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Louis, Rictronics, Inc.	314-997-4707
NH	Salem, Diamond Elect.	603-894-4420
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Wayne, Time Elctrns.	201-685-8250
NY	Deer Park, Brookdale Elec.	516-242-8033
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Hauppauge, Time Elctrns.	516-434-3344, 516-273-0100
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Rome, Rome Elctrns.	315-337-5400
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Time Elctrns.	919-847-9650
OH	Columbus, Time Elctrns.	614-794-3301
OK	Tulsa, Carlton-Bates	918-250-1626
OR	Portland, Time Elctrns.	503-626-2979
PA	Levittown, Aim Elctrns.	215-946-3900
TX	Allen, Sunbelt Elctrns.	214-235-0587
TX	Austin, Carlton-Bates	512-837-9098
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Component Distrs., Inc.	214-644-0373
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Ft. Worth, Carlton-Bates	817-831-0395
TX	Richardson, Time Elctrns.	214-644-4644
UT	W. Valley City, Added Value Elec.	801-975-9500
UT	W. Valley City, Time Elctrns.	801-973-8494
WA	Kirkland, Time Elctrns.	206-820-1525
Can	Time Elctrns.	416-672-5300

MONOLITHIC SYS. CORP., 7050 South Tuscan Way, Englewood, CO 80112, Tel: 303-790-7400, FAX: 303-790-7118; Empl.: 50; *Sls. Mgr.:* C. Edward O'Neal; *Dist. Mgr.:* C. Edward O'Neal

MONROE ELECTRONICS, INC., 100 Housel Ave., Lyndonville, NY 14098, Tel: 716-765-2254, FAX: 716-765-9330; Empl.: 50; *Sls. Mgr.:* Steven D. Kelly

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, TELEX: 650-397-7820, FAX: 314-694-7625; Empl.: 39,281

MONTROSE/CDT, Cable Design Technologies, 28 Sword Street, Auburn, MA 01501, Tel: 508-791-3161, FAX: 508-793-9862; Empl.: 250; *Sls. Mgr.:* Michael McLaughlin, OEM Sls. Mgr.; *Dist. Mgr.:* Bill Wilmot

MOODY TOOLS, INC., 43 Crompton Ave., E. Greenwich, RI 02818-0230, Tel: 401-885-0911, FAX: 401-885-4565; FSC No.: 5120,5180; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

MOORE PRODUCTS CO., Sumneytown Pike, Spring House, PA 19477, Tel: 215-646-7400, FAX: 215-283-6358; Empl.: 10000; *Sls. Mgr.:* E.M. Coll

MOORE REED & CO. LTD., Southway Walworth, Andover, Hampshire SP 105AB, Tel: 0264-324155, TELEX: 47654, FAX: 0264-356561; Empl.: 150; *Sls. Mgr.:* W. North

MORGAN-MATROC, Electro Ceramics Division, 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, FAX: 216-232-8731; Empl.: 100; *Sls. Mgr.:* D.W. Bacso
B•1974

Local Sales Offices & Reps

CA	El Toro, Morgan Matroc, Inc.	714-768-8672

MORRIS, J. I., CO., 372 Elm St., Southbridge, MA 01550, Tel: 508-764-4394, FAX: 508-764-7350; FSC No.: 95548; Empl.: 25

MORRIS ENTERPRISES, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-894-9103, TELEX: 6-74681, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 54918; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MORS ASC

FAX: 617-245-4531

MORS COMPONENTS, 134 Water St., PO Box 544, Wakefield, MA 01880-4444, Tel: 617-246-1007; FSC No.: 54659; Empl.: 40; *Sls. Mgr.:* Mike Palmerino
B•1778-1781; C•1532

Local Sales Offices & Reps

AZ	Phoenix, More Sls., Inc.	602-331-8115
AR	Van Buren, Hightower Ind. Sls.	501-471-8116
CA	Arcadia, HMC, Inc.	818-447-0958
CA	San Jose, Vernexx	408-972-9072
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IL	Wheaton, CS Technical Sls.	708-653-8126
IN	Fort Wayne, Nationwide Comps., Inc.	219-436-6095
IA	Marion, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Frederick, Glasscock Assoc. Inc.	301-694-5048
MA	Andover, Crawford Assocs.	508-470-2122
MI	Brighton, W. R. Hummon	313-486-5333
MN	St. Paul, Countryman Assocs. Co.	612-645-9151
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Edison, R.E. Breuer Co., Inc.	908-561-6161
NY	Rochester, Lamb Comps.	716-328-6350
OH	Willoughby, Nationwide Comps.	216-946-3226
OR	Portland, Elctrn. Solutions.	503-292-8204
PA	Trevose, PSA, Inc.	215-245-0513
TX	Houston, Aticus	713-466-9994
TX	Plano, Aticus	214-964-0663
VA	Ashland, Glasscock Assoc.	804-798-2125
WA	Bellevue, E2	206-637-0302
WV	New Town, Nationwide Comps., Inc.	304-343-3167
EXP	Singapore, JFL Elctrns. Pte. Ltd.	65-382-5551
Can	Mississauga, Ont., InTELaTECH	416-629-0882

Local Distributors

AZ	Phoenix, Control Design Supp.	602-829-7981
AR	Little Rock, Carlton-Bates Co.	800-482-9313
CA	Burbank, Switching Devices	213-849-3211
CA	Fremont, KEA Elctrns.	510-651-2691
CA	Hayward, Electro Comps.	415-783-5800
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Milpitas, Sierra West	408-945-1050
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Santa Monica, Master Dists.	213-452-1229
CA	Tustin, Western Switches	714-259-8144
CO	Denver, Control Design	303-296-2010
CO	Littleton, Indelco	303-795-3431
CT	Wallingford, Control Design	203-269-9955
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
FL	Largo, Electronic Precepts	813-544-3636
GA	Atlanta, Motion Elctrns.	404-455-8262
GA	Roswell, Gateway Megatech	404-642-8787
IL	Bensenville, Voyager Elctrns.	708-860-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Carmel, Altex Elctrns.	317-848-1323
IA	Desmoines, Mid-State Distrbg.	515-244-7231
IA	W. Des Moines, Ramco Co.	515-225-6933
KS	Wichita, Radio, Inc.	316-264-2798
MD	Beltsville, PSI/Petricko Sls.	301-937-4960
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Marlboro, Hardware Specialty Co.	508-481-8622
MA	Westborough, In Stock Prods.	508-870-5750
MA	Wilmington, North Star Elec.	508-657-5155
MA	Woburn, Control Design	617-932-9404
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	St. Clair Shores, Spemco	313-771-2700
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Hibbing, MinnTech Elctrns.	218-262-5228
MN	Minneapolis, Tortec Corp.	612-866-3662
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NJ	E. Brunswick, Brothers Elctrns.	908-238-2200
NJ	Oakland, Relay Specialties	201-337-1000
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Woodside, Switches Unltd.	718-478-5000
NC	Raleigh, Century Elctrns	919-596-2220
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Tulsa, Radio Inc.	918-587-9123
OR	Portland, Radar Elctrns.	503-232-3404
PA	McKean, Advacom	814-476-7724

PA	Norristown, Century Elctrns.	215-631-5404
PA	Philadelphia, Shap Elctrns.	215-969-3300
RI	Pawtucket, Major/Edwards	401-725-7400
TX	Carrollton, LCD Elctrns.	214-245-0600
TX	Carrollton, North Star Elctrns.	214-980-2999
TX	Dallas, Omni Pro Elctrns.	214-233-0500
TX	Houston, Wofford Elctrns.	713-351-2255
UT	Nephi, Control Design Supply	801-530-4845
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Nep Elctrns.	414-785-9100
WI	Waukesha, Hawk Elctrns.	414-547-4457
Can	Mississauga, Ont., InTELaTECH	416-629-0082

MORS TECHNOLOGIES INC., Mors Group-France, 225 Industrielle, Delson, Quebec, Canada J0L 1G0, Tel: 514-638-4150, FAX: 514-638-2270

MOSAIC SEMICONDUCTOR INC., Implex Inc., 7420 Carroll Rd., San Diego, CA 92121, Tel: 619-271-4565, FAX: 619-271-6058; Empl.: 45; *Sls. Mgr.:* Steve Fallaize, Bob Lindskog; *Dist. Mgr.:* Ron Larose

MOSEL-VITELIC, 3910 N. First St., San Jose, CA 95134-1501, Tel: 408-433-6000, FAX: 408-433-0331

MOTION ENGINEERING, INC., 520 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-962-5409, FAX: 805-962-8001; Empl.: 6; *Sls. Mgr.:* Matt Cheresh

MOTION SCIENCE INC., 830-6 Jury Ct., San Jose, CA 95112, Tel: 408-993-0300, FAX: 408-993-0123; Empl.: 27

MOTION SENSORS, INC., 12 Park Street, Cranford, NJ 07701, Tel: 908-709-0025, FAX: 908-709-1144; Empl.: 6; *Sls. Mgr.:* Arthur Bergman

MOTOR CAPACITORS, INC., 6655 N. Avondale Ave., Chicago, IL 60631, Tel: 312-631-0713, FAX: 312-774-8778; Empl.: 14 **A•1116**

Local Sales Offices & Reps

CA	Santa Clarita, T & C Engrg.	805-254-8778
NY	Garden City, Maximum Sls.	516-294-5029
OH	Cincinnati, Technicol Engrg.	513-851-8549
PA	Pittsburgh, EJ Sls. Co.	412-967-0360
WI	Milwaukee, KMA Sls. Co.	414-259-1771

MOTOROLA CERAMIC PRODUCTS, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113, Tel: 505-822-8801, FAX: 505-822-8812; Empl.: 600; *Sls. Mgr.:* Tom Gilder

MOTOROLA INC., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., 4000 Commerical Ave., Northbrook, IL 60062, Tel: 708-205-2867, TELEX: 671-5420 MOT APD; Empl.: 2500

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, 2100 East Elliot, Tempe, AZ 85284, Tel: 602-244-6900, TWX: 910-951-1334; FSC No.: 04713; *Sls. Mgr.:* Ted Jaros; *Dist. Mgr.:* Brian Hilton

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 **B•1299-1301**

Local Sales Offices & Reps

OH	Dayton, Motor Technology, Inc.	513-294-1041

MOTORTEST, INC., PO Box 292633, Columbus, OH 43229, Tel: 614-882-7821, FAX: 614-841-9007

MOTOR-TRONICS, INC., 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7425, FAX: 619-727-4436; *Sls. Mgr.:* Bill Linko

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 800-346-6873, FAX: 619-449-6041; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* C. Degurse

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 800-346-6873, FAX: 817-483-0931; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* K. Jenkins

MOUSER ELECTRONICS, 370 Tomkins Court, Gilroy, CA 95020, Tel: 800-346-6873, FAX: 408-842-7375; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* J. Treadway

MOUSER ELECTRONICS, 12 Emery Ave., Randolph, NJ 07869, Tel: 800-346-6873, FAX: 201-328-7120; Empl.: 300

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 250

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; FSC No.: 40920; Empl.: 1900; *Sls. Mgr.:* T. A. Rudziensky; *Dist. Mgr.:* R. F. Chartier

MPC, Div. of Consulting Systems, 638 Main St., Danville, NH 03819, Tel: 603-642-5913, 1-800-238-8380, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse **D•1846**

Local Distributors

TN	Knoxville, Indl. Elctrns.	615-573-7135

MP/CAPAR, Multi Products International, 250 Lackawanna Ave., P.O. Box 737, West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; *Sls. Mgr.:* Irwin Wolberg, VP Sls. & Mktg.

MSC AUTOMATION, Miller Sales Co., 1111 Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-9200, 800-323-5294, FAX: 708-526-9206; Empl.: 23; *Sls. Mgr.:* Paula Bilinski; *Dist. Mgr.:* Dan de Ramos

Local Sales Offices & Reps

MN	Golden Valley, MSC Minn.	612-544-1045

MSD, INC., Magnecraft, 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, FAX: 803-393-4123; Empl.: 210; *Sls. Mgr.:* Bob Forbes

MSD3, 365 Woodview Ave., Ste. 700, Morgan Hill, CA 95037, Tel: 800-541-3526, 408-778-7267, FAX: 408-778-2597; *Sls. Mgr.:* Bill White

FAX: 408-778-2597

MSD3, 365 Woodview Ave., Morgan Hill, CA 95037, Tel: 800-541-3526, 408-778-7267; *Sls. Mgr.:* Bill White **A•1696-1697; D•1087**

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, FAX: 718-397-0972; FSC No.: 18518; Empl.: 18; *Sls. Mgr.:* A. Lederman

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Phoenix, Toward Engr. Assocs.	602-955-3193
CA	Los Angeles, RF Assocs.	213-478-1586
CA	Redwood City, Tri-Rep	415-364-2550
FL	Casselberry, Perrott Assoc.	407-830-0094
FL	Tampa, Perrott Assoc.	813-985-1900
IL	Chicago, Technical Sls.	312-237-7210
IN	Ft. Wayne, Menze Sls.	219-747-5616
MD	Laurel, CSDS Inc.	301-792-9850
MA	Chelmsford, BBC	508-937-3400
NC	Winston-Salem, Murcota	919-722-9445
WA	Bellevue, Caruso & Camelleri Assocs.	206-455-8811

MSI MICRO-MACHINING SYSTEMS INC., P. O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; Empl.: 4; *Sls. Mgr.:* Frank J. Andezzone

M. SYSTEM TECHNOLOGY, INC., 15028 Beltway Dr., Dallas, TX 75244, Tel: 800-544-3181, FAX: 214-385-2299; Empl.: 10; *Sls. Mgr.:* Jeff Blair

MTE CORP., W147 N 9525 Held Dr., Menomonee Falls, WI 53051, Tel: 414-253-8200, TELEX: 62939600, ESYLNK: 414-253-8222; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* John Houdek; *Dist. Mgr.:* John Houdek

M-TEK, 2419 Smallman St., Pittsburgh, PA 15222, Tel: 800-245-5101 , 412-261-9030, FAX: 412-261-7220; FSC No.: 56452; Empl.: 20; *Sls. Mgr.:* John Hartnett

MTI INTERNATIONAL INC., W133 N5139 Campbell Dr., Menomonee Falls, WI 53051, Tel: 414-783-6080, FAX: 414-783-4959; Empl.: 210

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603, FAX: 605-665-1709; FSC No.: 23875; Empl.: 200; *Sls. Mgr.:* Larry Barbary; *Dist. Mgr.:* Les Jensen **A•1431**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Mountain View, Bridge Mktg.	415-965-8045
CO	Denver, Promotech Sls.	303-692-8484
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Altomonte Springs, Ram Elctrns. Sls. Inc.	407-260-0904
IL	Arlington Hgts., KMA Sales	708-398-5300
IN	Ft. Wayne, Arete Sls., Inc.	219-423-1478
IN	Greenwood, Arete Sls., Inc.	317-882-4407
MA	Burlington, Gerber Sls., Inc.	617-229-1150
MA	Everett, Gerber Sls.	617-389-1957
MA	Marlboro, Gerber Sls., Inc.	508-460-9588
MA	Waltham, Gerber Sls. Corp.	617-893-1009
MA	Woburn, Gerber Sls., Inc.	617-933-8797
MI	Farmington Hills, Tritech Sales, Inc.	313-442-1200
MN	Edina, OHMS Technology Inc.	612-932-2920
NH	Hudson, Gerber Sls., Inc.	603-595-6568
NJ	E. Brunswick, Winch Sales Associates	201-613-1515
NJ	Medford, McCoy Grp. Inc.	609-953-0770
NJ	Mountain Lakes, Ergodyne Corp.	201-263-4585
NY	Pittsford, James E. Zimmerman Sales	716-381-3186
NY	Plainview, Winch Sales Associates	516-681-3163
NC	Raleigh, Tingen Tecn. Sls., Inc.	919-870-6670
OH	Dayton, Lyons Corporation	513-278-0714
OH	Richfield, Lyons Corporation	216-659-9224
OH	Westerville, Lyons Corporation	614-895-1447
OR	Portland, K-Tek Intl. Inc.	503-624-0315
TX	Austin, Ram Electronics Sales, Inc.	512-250-5082
TX	Houston, Ram Electronics Sales, Inc.	713-580-7394
TX	Plano, Ram Electronic Sales, Inc.	214-578-5400
UT	Midvale, Component Sales, Inc.	801-561-5099
WA	Redmond, S.E.A.	206-883-4999
WA	Vancouver, S.E.A.	503-643-3093
WI	Milwaukee, KMA Sales	414-259-1771
Can	Burnaby, BC., Kaytronics	604-294-2000
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kantata, Ont., Kaytronics	613-564-0080
Can	Ville St. Laurent, Que., Kaytronics	514-745-5800
Can	Vit Laurent, Que., Kaytronics	514-745-5800

Local Distributors

AZ	Phoenix, Sterling Electronics	602-437-5565
CA	Fremont, Acacia	510-623-7500
CA	Los Angeles, Bell Industries	310-447-6340
CA	Santa Clara, Kent, Shelly-Ragon Inc.	619-471-9561
CA	Sunnyvale, Bell Industries	408-745-0400
CO	Lakewood, Acacia	303-232-2882
FL	Miami, All American	305-621-8282
GA	Duluth, Pioneer Electronics	404-623-1003
IL	Elk Grove Vl., Bell Industries	708-640-1910
IN	Indianapolis, Pioneer Electronics	317-573-0880
MD	Columbia, Sterling	301-251-1205
MA	Andover, Bell Industries	508-474-8880
MN	Eden Prairie, Pioneer	612-944-3355
MN	Minneapolis, Stark Electronics	612-332-1325
MO	St Louis, Ric-tronics	314-997-4707
NJ	W. Berlin, GCI	609-768-6767
NY	Ronkonoma, M-tron Components	516-467-5100
OH	Dayton, Pioneer Electronics	513-236-9900
OR	Lake Oswego, Bell Industries	503-644-1500
NM	Betatron, Albuquerque	505-821-1122
TX	Houston, Kent, Shelly-Ragon Inc.	713-780-7770
TX	Houston, Sterling	713-627-9800
WA	Redmond, Kent, Shelly-Ragon Inc.	206-883-7200
WA	Redmond, Priebe Electronics	800-426-9911
Can	Mississauga, Ont., Zentronics	416-564-9600

MTS SENSORS DIVISION, MTS Sys. Corp., P.O. Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200

MTS SYSTEMS, 14000 Technology Dr., Eden Prairie, MN 55344, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 612-937-4515; Empl.: 1300; *Sls. Mgr.:* Ted Beaudoin

MTX OAKTRON, 700-30th St., Monroe, WI 53566, Tel: 608-328-5560, FAX: 608-328-5575; FSC No.: 07109; Empl.: 120; *Sls. Mgr.:* J. F. Disch

MUELLER ELEC. CO., 1583 E. 31st St., Cleveland, OH 44114, Tel: 216-771-5225, FAX: 216-771-3068; Empl.: 100; *Sls. Mgr.:* J. E. Wisneski

MULTICOMP., INC., 3005 S.W. 154th No. 3, Beaverton, OR 97006, Tel: 503-626-4200, FAX: 503-643-4889; Empl.: 150 **A•1255, 2434-2435**

Local Sales Offices & Reps

OR	Portland, Intertech Sls.	503-775-7885

FAX: 707-575-7573

MULTI-CONTACT USA, 5560 Skylane Blvd., Santa Rosa, CA 95403, Tel: 707-575-7575; *Sls. Mgr.:* Herbie Gander, West Coast Sls.; *Dist. Mgr.:* Walter Roberts, Genl. Mgr. **C•1422-1424**

Local Sales Offices & Reps

IL	Chicago, Multi-Contact	312-286-1666
MA	Woburn, Multi-Contact	617-935-4104
TX	Arlington, Multi-Contact	817-943-0031

MULTICORE SOLDERS, INC., 1751 Jay Ell Drive, Richardson, TX 75081, Tel: 214-238-1224, FAX: 214-437-0288; Empl.: 1000

MULTINATIONAL RESOURCES, INC., 19 Harvey Rd., Ste. 17, Bedford, NH 03110, Tel: 603-622-3550, FAX: 603-641-6991 ... **B•1044, 1853-1854; C•1584; D•1850**

MULTIPOWER, INC., Spectrum Electronics Corp., 3005 S.W. 154th Terrace No. 1, Beaverton, OR 97006, Tel: 503-646-4700, FAX: 503-643-4889; FSC No.: 75498; Empl.: 33 .... **D•1847**

MULTI PRODUCTS INTERNATIONAL, 250 Lackawanna Ave., West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; Empl.: 28; *Sls. Mgr.:* Irv Wolberg .... **A•2436; D•1848**

Local Sales Offices & Reps

AZ	Phoenix, JBS Assocs.	602-893-2382
CA	Santa Clara, Nova Tronix	408-727-9530
CO	Denver, Comp. Prods. Sls.	303-530-2800
FL	Melbourne, Phoenix Comps.	407-723-4414
GA	Lawrenceville, Tek Rep Mktg.	404-963-1600
IL	Des Plaines, Esco Assocs.	312-298-5310
IN	Frankfort, C-S Elctrns. Sls.	317-659-1874
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Sterling, Beacon North	703-478-2480
MA	Harvard, Cycle Sls.	508-456-6868
MI	Lathrup VL, R. C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Proud Inds.	612-646-9428
NY	Rochester, Ontec Elctrns.	714-464-8636
OH	Dayton, K.W. Elctrn.	513-890-2150
PA	Langhorne, Beacon North	703-478-2480
PA	Pittsburgh, KW Elctrns.	412-366-9396
TX	Dallas, AID Elctrns.	214-790-4761
WA	Bellevue, Eltech	206-643-4330
Can	Burlington, Ont., White Radio Ltd.	416-632-6894

MULTISENS INC, 2633 Blv. Le Corbusier, Laval, Que., Canada H7S 2E8, Tel: 514-973-8228, FAX: 514-973-1966; Empl.: 20; *Sls. Mgr.:* Jean-Francois Olivier; *Dist. Mgr.:* Alain Saint-Louis

MULTI-TECH INDUSTRIES, INC., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746, Tel: 908-462-6100, TELEX: 908-409-6695; FSC No.: 74217; Empl.: 40; *Sls. Mgr.:* J. L. Bernard

MULTI-TECH SYSTEMS, INC., 2205 Woodale Dr., Mounds View, MN 55112, Tel: 612-785-3500, 800-328-9717, FAX: 612-785-9874; Empl.: 235; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon/Jan Hubbard/Jim Stacklie

MUPAC CORP., Carlo Gavazzi Co., 10 Mupac Dr., Brockton, MA 02401, Tel: 508-588-6110, FAX: 508-588-0498; FSC No.: 51398; Empl.: 180; *Sls. Mgr.:* Ted Brewster

muRata ERiE

MURATA ERIE NORTH AMERICA

FAX: 404-436-3030

MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Dr., Smyrna, GA 30080, Tel: 404-436-1300, TELEX: 26-1301; Empl.: 1250; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* Barbara Buckalew, Dist. Mktg. Mgr. .... **A•1117-1121, 1256-1257, 1432-1436, 1571, 1660-1663, 1708-1709, 1847, 1995, 2110-2112; B•1326, 1885, 1976-1977; C•1425; D•1053-1055**

Local Sales Offices & Reps

AL	Huntsville, Jack Harvey & Assoc., Inc.	205-461-8591
AZ	Scottsdale, Thom Luke Sls.	602-451-5400
CA	Fountain Valley, Bager Elctrns.;Inc.	714-957-3367
CA	Long Beach, Murata Erie	310-436-8700
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, CK Assocs.	619-279-0420
CA	Woodland Hills, Bager Elctrns., Inc.	818-712-0011
CO	Englewood, Thom Luke Sls.	303-649-9717
FL	Deerfield Beach, Glen White Assocs.	305-570-8545
FL	Palm Harbor, Glen White Assoc.	813-787-8503
FL	Sanford, Glen White Assoc.	407-322-4875
GA	Alpharetta, Jack Harvey & Assocs.	404-475-2654
GA	Smyrna, Murata Erie	404-433-7867
IL	Park Ridge, Metcom Assoc. Corp.	708-696-1490
IN	Carmel, Jack Harvey & Assocs., Inc.	317-575-4600
IN	Kokomo, Jack Harvey & Assoc., Inc.	317-453-4260
IA	Cedar Rapids, Stan Clothier Co., Inc.	319-393-1576
KS	Lenexa, Stan Clothier Co., Inc.	913-492-2124
KY	Prospect, Jack Harvey & Assoc., Inc.	502-228-4100
MD	Bowie, Glen White Assoc.	301-805-1989
MD	Glen Arm, Glen White Assoc.	410-592-9105
MD	Townson, Glen White Assoc.	301-337-7008
MA	Braintree, Murata Erie	617-356-4155
MA	Needham, Apex Assocs.	617-444-8070
MI	Hudsonville, Jack Harvey & Assoc., Inc.	616-669-7980
MI	W. Bloomfield, Jack Harvey & Assoc., Inc.	313-737-9122
MN	Eden Prairie, Stan Clothier Co., Inc.	612-944-3456
MO	St. Charles, Stan Clothier Co., Inc.	314-928-8078
NJ	Springfield, Radix, Inc.	201-467-4970
NY	Fairport, Technology Sls., Inc.	716-223-7500
NY	Ithaca, Technlg. Sls., Inc.	607-257-7070
NY	Pleasant Valley, Jack Harvey & Assoc., Inc.	914-635-2711
NC	Huntersville, Glen White Assoc.	704-875-3777
NC	Raleigh, Glen White Assoc.	919-848-1931
OH	Dayton, KW Electrn. Sls., Inc.	513-890-2150
OH	Shaker Hgts., KW Elctrn. Sls., Inc.	216-491-9177
OR	Beaverton, Murata Erie	503-646-4973
OR	Beaverton, Westmark Elec., Inc.	503-641-8780
PA	Allison Park, KW Elctrn. Sls., Inc.	412-492-0777
TN	Gray, Glen White Assoc.	615-477-8850
TN	Knoxville, Jack Harvey & Assoc., Inc.	615-694-7541
TX	Austin, RAM Elec. Sls., Inc.	512-250-5082
TX	Houston, RAM Elec. Sls., Inc.	713-580-7394
TX	Plano, RAM Elec. Sls., Inc.	214-578-5400
VA	Lynchburg, Glen White Assocs.	804-385-6110
WA	Bellevue, Westmark Elect., Inc.	206-454-1944
WI	West Allis, Metcom Assoc. Corp.	414-476-1300
PR	Hato Rey, Semtronic Assocs., Inc.	809-766-0700
Can	Mississauga, Ont., Gidden Morton Assocs.	416-671-8111
Can	Nepean, Ont., Gidden Morton Assocs.	613-820-3822
Can	St. Laurent, Que., Gidden Morton Assocs.	514-335-9572

Local Distributors

AL	Huntsville, Future Elctrns.	205-830-2322
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Future Elctrns.	602-968-7140
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Phoenix, Time Elctrns.	602-967-2000
AZ	Phoenix, TTI, Inc.	602-861-0222
AZ	Tempe, Acacia Sls./Deanco	602-894-2874, 602-882-9054
AZ	Tempe, Time Elctrns.	602-967-2000
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Camarillo, Milgray Elctrns.	805-484-4055
CA	Chatsworth, Future Elctrns.	818-772-6240
CA	Chatsworth, Sterling Elctrns.	818-407-8850
CA	Culver City, Avnet, Inc.	310-558-2973
CA	Fremont, Acacia/Deanco	510-623-7500
CA	Garden Grove, Natl. Elctrns. Corp.	800-854-2451
CA	Inglewood, Newark Elctrns., Inc.	310-672-8548
CA	Irvine, Acacia/Deanco	213-971-2428,714-660-0834
CA	Irvine, Future Elctrns.	714-250-4141
CA	Irvine, Milgray Elctrns.	714-753-1282
CA	Milpitas, TTI, Inc.	408-946-5577
CA	Mission Hills, TTI, Inc.	818-891-8885
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Future Elctrns.	619-625-2800
CA	San Diego, Sterling Elctrns.	619-560-8097
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Diego, TTI, Inc.	619-748-2025
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Future Elctrns.	408-434-1122, 408-434-1114
CA	San Jose, Passive Technlg.	408-435-5566
CA	San Jose, TTI, Inc.	408-946-5577
CA	Santa Ana, TTI, Inc.	714-641-9393
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Tustin, Sterling Elctrns.	714-259-0900
CA	Tustin, Time Elctrns.	714-669-0100
CA	Woodland Hills, Time Elctrns.	310-320-6372
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Sterling Elctrns.	303-792-3939
CO	Englewood, Time Elctrns.	303-721-8882
CO	Lakewood, Future Elctrns.	303-232-2008
CO	Westminister, TTI, Inc.	303-429-6806
CO	Wheatridge, Acacia/Deanco	303-421-7004
CT	Bethel, Future Elctrns.	203-743-9594
CT	Milford, Milgray Elctrns.	203-878-5538
CT	Wallingford, Sterling Elctrns.	203-265-9535
CT	Wallingford, TTI, Inc.	203-284-7474
DC	D.C. Area, TTI, Inc.	301-621-5335
FL	Altamonte Springs, Future Elctrns.	800-950-0168
FL	Lake Mary, Milgray Elctrns.	407-321-2555
FL	Largo, Future Elctrns.	813-530-1222
FL	Orlando, Time Elctrns.	407-841-6565
FL	Orlando, TTI, Inc.	407-859-1000
GA	Athens, Dixie Elctrns.	706-613-7755
GA	Norcross, Future Elctrns.	404-441-7676
GA	Norcross, Milgray Elctrns.	404-446-9777
GA	Norcross, TTI, Inc.	404-662-0911
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Hoffman Estates, Future Elctrns.	708-882-1255
IL	Palatine, Milgray Elctrns.	708-202-1900
IL	Rosemont, Advent Elctrns., Inc.	708-297-6200
IL	Schaumburg, Sterling Elctrns.	708-303-9900
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Schaumburg, TTI, Inc.	708-884-6500
IN	Time Elctrns.	800-331-5114
IN	Indianapolis, Advent Elctrns., Inc.	317-872-4910
IA	Time Elctrns.	800-325-9085
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
KS	Time Elctrns.	800-325-9085
KS	Lenexa, Sterling Elctrns.	913-492-5406
KS	Overland Park, Milgray Elctrns.	913-236-8800
KY	Time Elctrns.	800-331-5114
MD	Baltimore, Resco(Baltimore)	410-931-8200
MD	Beltsville, Resco(Washington)	301-937-9100
MD	Columbia, Future Elctrns.	301-290-0600
MD	Columbia, Milgray Elctrns.	410-995-6169
MD	Columbia, Sterling Elctrns.	301-290-3800
MD	Columbia, Time Elctrns.	301-964-3090
MD	Columbia, TTI, Inc.	410-995-1331
MA	Bolton, Future Elctrns.	508-799-3000
MA	Hopkinton, Interface Elctrns. Corp.	508-435-0100
MA	Peabody, Time Elctrns.	508-532-9900
MA	Wilmington, Milgray Elctrns.	508-657-5900
MA	Wilmington, TTI, Inc.	508-658-4700
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Time Elctrns.	800-331-5114
MI	Farmington Hills, Advent Elctrns., Inc.	313-477-1650
MI	Livonia, Future Elctrns.	313-261-5270
MI	Oak Park, Newark Elctrns.	313-967-1570
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Sterling Elctrns.	612-831-2666
MN	Minnetonka, TTI, Inc.	612-933-8555
MO	Manchester, Time Elctrns.	314-230-7500
MO	St. Louis, Future Elctrns.	314-469-6805
NE	Time Elctrns.	800-325-9085
NJ	Edison, Sterling Elctrns.	201-417-1000
NJ	Marlton, Future Elctrns.	609-596-4080
NJ	Marlton, Interface Elctrns.	609-988-5448
NJ	Marlton, Milgray Elctrns.	609-983-5010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NJ	Parsippany, Future Elctrns.	201-299-0400
NJ	Parsippany, Milgray Elctrns.	201-335-1766
NJ	Rockaway, Tonar Inds.	201-586-9000
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Hauppauge, Future Elctrns.	516-234-4000
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Pittsford, Milgray Elctrns.	716-381-9700
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Time Elctrns.	716-383-8853
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Syracuse, Future Elctrns.	315-451-2371
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Concord, Future Elctrns.	704-455-9030
NC	Hickory, Dixie Elctrns.	704-328-1130
NC	Raleigh, Future Elctrns.	919-790-7111
NC	Raleigh, Milgray Elctrns.	800-562-3118, 919-790-8094
NC	Raleigh, Sterling Elctrns.	819-790-8634
NC	Raleigh, Time Elctrns.	800-638-1812
NC	Winston Salem, Dixie Elctrns.	919-724-5961
OH	Centerville, Elctrn. Mktg. Corp.	513-439-4711
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Cleveland, Newark Elctrns.	216-391-9330
OH	Cleveland, Newark Elctrns.	216-886-6463
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Columbus, Time Elctrns.	614-794-3301
OH	Columbus, Time Elctrns.	800-331-5114
OH	Dayton, TTI, Inc.	513-898-8330
OH	Highland Hgts., Elctrn. Mktg. Corp.	216-442-3441
OH	Independence, TTI, Inc.	216-328-9755
OH	Mayfield Heights, Future Elctrns.	216-449-6996
OH	Solon, Sterling Elctrns.	216-248-1122
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Future Elctrns.	503-645-9454
OR	Portland, Time Elctrns.	503-684-3780
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Time Elctrns.	215-337-0900

SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Gaffney, Newark Elctrns.	803-487-1982
SC	Greenville, Dixie Elctrns.	803-297-1430
SC	N. Charleston, Dixie Elctrns.	803-552-2671
SD	Time Elctrns.	800-331-5114
TN	Gray, Dixie Elctrns.	615-477-2131
TN	Oak Ridge, Dixie Elctrns.	615-481-3393
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Austin, Time Elctrns.	512-346-7346
TX	Carrollton, Sterling Elctrns.	214-243-1600
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Ft. Worth, TTI, Inc.	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-740-9000
TX	Ft. Worth, TTI, Inc.	817-834-2202
TX	Ft. Worth, TTI, Inc. Intl.	817-740-9191
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Future Elctrns.	713-556-8696
TX	Houston, Newark Elctrns.	713-270-4800
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Time Elctrns.	713-530-0800
TX	Richardson, Future Elctrns.	214-437-2437
TX	Richardson, Time Elctrns.	214-644-6668
TX	Stafford, Milgray Elctrns.	713-240-5360
UT	Murray, Milgray Elctrns.	801-261-2999
UT	Salt Lake City, Future Elctrns.	801-972-8489
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
UT	W. Valley City, Time Elctrns.	801-973-8494
VA	Richmond, Sterling Elctrns.	804-323-5510
WA	Bothell, Future Elctrns.	206-489-3400
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Acacia/Deanco	206-881-5566
WA	Redmond, TTI, Inc.	206-882-0291
WI	Time Elctrns.	800-331-5114
WI	Mequon, Taylor Elec. Co., Inc.	414-241-4321
WI	Yaukesha, Future Elctrns.	414-786-1884
Can	Calgary, Alberta, Future Elctrns.	403-250-5555
Can	Edmonton, Alb., Future Elctrns.	403-438-2858
Can	Mississauga, Ont., Future Elctrns.	416-612-9200
Can	Mississauga, Ont., Migray Elctrns.	416-678-0958
Can	Mississauga, Ont., Time Elctrns.	416-601-4368
Can	Montreal, Que., Future Elctrns.	514-694-7710
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pointe Claire, Que., Tonar Inds.	514-694-5293
Can	Pointe-Claire, PQ, Milgray Elctrns.	514-426-5900
Can	Quebec, PQ, Future Elctrns.	418-877-6666
Can	Vancouver, BC, Future Elctrns.	604-294-1166
Can	Winnipeg, Man., Future Elctrns.	204-786-7711

MURATA MANUFACTURING CO., LTD., 26-10, Tenjin 2 Chome, Nagaoka-Kyo-Shi, Kyoto, Japan 617, Tel: 075-951-9111, TELEX: MURATA J 64270, FAX: 075-955-6526; Empl.: 21,696; *Sls. Mgr.:* O. Otaka

MUSASHINO Corporation

FAX: 714-458-1166

MUSASHINO CORPORATION, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-458-1155 ...... **A•1437-1439; C•1649-1651**

THE MUSHIELD CO. INC., P.O. Box 439, 5 Springfield Rd., Goffstown, NH 03045, Tel: 603-666-4433, TELEX: 95-5439, FAX: 603-666-4013; FSC No.: 57284; Empl.: 8 ...... **C•1698**

MUTUAL INDUSTRIES, INC., 707 West Grange Street, Philadelphia, PA 19120, Tel: 215-927-6000, FAX: 215-927-3388

MWS

Wire Industries

FAX: 818-706-0911

MWS WIRE INDUSTRIES, 31200 Cedar Valley Dr., Westlake Village, CA 91362, Tel: 818-991-8553; FSC No.: 51668; Empl.: 65; *Sls. Mgr.:* Greg Fancon ...... **C•1764-1767**

NAMCO CONTROLS CORPORATION, 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, TELEX: 24-1566, FAX: 216-946-1228; Empl.: 200; *Sls. Mgr.:* Jon Slaybaugh, Pres.; *Dist. Mgr.:* Bill Carson, Bill O'Brien

NAMIKI, Precision of America, Inc., 201 West Passaic St., Rochelle Park, NJ 07662, Tel: 201-368-0123, FAX: 201-368-2244

NANONICS CORPORATION, 21636 N. 14th Ave., Phoenix, AZ 85027, Tel: 602-581-6188, FAX: 602-581-8242; Empl.: 15

NATEL

FAX: 805-584-4357

NATEL ENGINEERING CO., INC., 4550 Runway St., Simi Valley, CA 93063-3449, Tel: 805-581-3950, TWX: 910-494-1959; Empl.: 171; *Sls. Mgr.:* Tom Guerriere ...... **D•1196-1197**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
CA	Newbury Park, Natel Engrg. Co., Inc.	805-376-5500
CA	Simi Valley, Natel Engrg. Co., Inc.	805-581-3950
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Melbourne, Saber Assocs.	800-432-6288
MA	Topsfield, Natel Engrg. Co., Inc.	508-887-7939
NY	Bohemia, Natel Engrg. Co., Inc.	516-563-4911
OH	Dayton, Rixan Assocs., Inc.	513-222-0011
OH	Stow, Rixan Assocs., Inc.	216-686-2909
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	Salt Lake City, Krebill Comp. Sls.	801-943-5311
WA	Mercer Island, Eagle Entprs., Inc.	206-232-7401

Local Distributors

FL	Orlando, Florida Electro Comps.	407-282-3454
MO	Florissant, Central Tech Sls.	314-831-4069
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Bellevue, Advanced Power Comps., Inc.	206-747-9217

NATIONAL CONTROLS CORP., 1725 Western Dr., W. Chicago, IL 60185, Tel: 708-231-5900, FAX: 708-231-1377; Empl.: 250; *Dist. Mgr.:* Cy Pfeifer

NATIONAL ELECTRONICS CORP., 11731 Markon Dr., Garden Grove, CA 92641, Tel: 714-892-7749, 800-854-2451, FAX: 714-898-6769; Empl.: 50

NATIONAL INFORMATION SYSTEMS, INC., 4040 Moorpark Ave., San Jose, CA 95117-1852, Tel: 408-985-7100, 800-441-5758, FAX: 408-246-3127; Empl.: 50

NATIONAL INSTRUMENTS, 6504 Bridge Point Pkwy., Austin, TX 78730-5039, Tel: 512-794-0100, TELEX: 756737 Nat Inst Aus, FAX: 512-794-8411; Empl.: 7000; *Sls. Mgr.:* Don Nadon, VP Sls. ...... **D•1147, 1198, 1302**

Local Sales Offices & Reps

CA	Manhattan Beach, Natl. Instrs.	310-546-8591
CA	Milpitas, Natl. Instrs.	408-453-3120
CA	Ontario, Natl. Instrs.	714-360-3565
CA	Riverside, Natl. Instrs.	714-275-0655
CO	Colorado Springs, Natl. Instrs.	719-542-3036
CT	Southington, Natl. Instrs.	203-276-8176
FL	Orlando, Natl. Instrs.	407-438-8700
GA	Kennesaw, Natl. Instrs.	404-499-0505
IL	Plainfield, Natl. Instrs.	815-436-7775
MD	Rockville, Natl. Instrs.	301-258-0125
MA	Norwell, Natl. Instrs.	617-659-9444
MA	Woburn, Natl. Instrs.	617-938-8508
MI	Brighton, Natl. Instrs.	313-227-9773
MN	Minneapolis, Natl. Instrs.	612-374-5488
NJ	Rutherford, Natl. Instrs.	201-460-7883
NY	Bayshore, Natl. Instrs.	516-666-0062
NY	Rochester, Natl. Instrs.	716-227-7530
OH	Mogadore, Natl. Instrs.	216-325-3156
TX	Austin, Natl. Instrs.	512-261-6338
TX	Richardson, Natl. Instrs.	214-699-7474
WA	Bellevue, Natl. Instrs.	206-451-9161
Can	Cambridge, Ont., Natl. Instrs.	519-622-9310
Can	Pointe-Claire, Que., Natl. Instrs.	514-694-8521

Local Distributors

Can	Mississauga, Ont., Allan Crawford Assocs.	416-890-2010
Can	N. Vancouver, BC, Allan Crawford Assocs.	604-988-2195
Can	Ottawa, Ont., Allan Crawford Assocs.	613-596-9300
Can	Pointe-Claire, PQ, Allan Crawford Assocs.	514-697-3333

NATIONAL LAMINATION CO., National Material Ltd., 555 Santa Rosa Dr., Des Plaines, IL 60018, Tel: 708-298-7676, FAX: 708-635-8624; Empl.: 225; *Sls. Mgr.:* J. Timothy Bross

NATIONAL MANUFACTURING CO., INC., 12 River Rd., Chatham, NJ 07928, Tel: 201-635-8846, FAX: 201-635-7810; Empl.: 150; *Sls. Mgr.:* Otto Stahl, Jr.

NATIONAL POWER TECHNLG., See Intelligence Power Technology

NATIONAL SEMICONDUCTOR, 2900 Semiconductor Dr., Santa Clara, CA 95052-8090, Tel: 800-272-9959, FAX: 800-432-9673; Empl.: 26,000

NATIONAL SEMICONDUCTORS, LTD., See Silonex Inc.

NATIONAL TELEPHONE & ELECTRONICS INC., 2350 N.W. 96 Avenue, Miami, FL 33172, Tel: 305-592-0551, FAX: 305-599-0948; Empl.: 50

N

FAX: 213-225-4630

NATIONAL WIRE & CABLE CORP., 136 San Fernando Rd., Los Angeles, CA 90031-1780, Tel: 213-225-5611; FSC No.: 04569; Empl.: 225 ...... **C•1768-1790**

Local Sales Offices & Reps

AZ	Mesa, System Sls.	602-464-9989
AR	Mt. Home, P.M.I. Sls. Co.	501-425-4101
CA	San Diego, C.K. Sales	619-279-0420
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Arvada, Arrowhead Sls. Co.	303-423-5597
CT	Avon, Tom Maguire Assoc.	203-673-3019
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
IL	Northfield, H. S. Tollaksen	708-441-6644
MD	Glen Burnie, Faion Lott	410-744-4611
MA	Norwood, Tom Maguire Assocs., Inc.	617-551-0500
MI	Brighton, W.R. Hummon & Assocs.	313-486-5333
NH	Windham, Tom Maguire Assocs.	603-437-1245
NJ	Wayne, GT Assoc.	201-694-6040
NM	Albuquerque, Sys. Sls. of New Mexico	505-889-2901
NY	Sodus, S.T. Woolard	315-655-8145
OH	Cincinnati, Century Tech. Sls., Inc.	513-677-1788
OH	Cleveland, Century Tech. Sls., Inc.	216-871-2854
PA	Hatboro, Jacobsen Assocs.	215-674-2937
TX	Austin, Tesco, Inc.	512-834-8374
TX	Dallas, Tesco, Inc.	214-553-1200
TX	Houston, Tesco, Inc.	713-690-4909
UT	Odgen, Summit Mktg.	801-479-7151
WA	Redmond, Halbar Assocs.	206-882-0990

NATIONWIDE ELECTRONIC SYSTEMS, See Weschler Instruments, Hughes Corp.

NAVAN CORPORATION, P.O. Box 1329, Media, PA 19063, Tel: 215-352-8464; FSC No.: 7042; Empl.: 6; *Sls. Mgr.:* Howland St. Clair

NCE:NATIONAL CUSTOM ENTERPRISES, INC., 400 Gateway Blvd., Burnsville, MN 55337-2559, Tel: 612-890-1360, FAX: 612-890-1014; FSC No.: 25441; Empl.: 25; *Sls. Mgr.:* J. A. Carlson

NCGI/STRUTHERS-DUNN, INC., INDUSTRIAL/COMMERCIAL RELAYS, See MSD, Div. of Magnecraft

NCI, 6438 University Drive, Huntsville, AL 35806, Tel: 205-837-6667, FAX: 205-837-5221; Empl.: 8; *Sls. Mgr.:* Hal Newcomb; *Dist. Mgr.:* David Newcomb

NCR COMTEN, INC., NCR Corp., 2700 Snelling Avenue N., St. Paul, MN 55113, Tel: 612-638-7777, TELEX: 6879018 Comten, FAX: 612-638-8573; FSC No.: 7025-0010; Empl.: 1000; *Sls. Mgr.:* Gerry Fisher; *Dist. Mgr.:* Gerry Fisher

NCR CORPORATION, Microelectronics Products Division, 2001 Danfield Court, Fort Collins, CO 80525, Tel: 303-226-9500, FAX: 303-226-9556

NDK

FAX: 415-623-6590

NDK AMERICA, INC., 47671 Westinghouse Dr., Fremont, CA 94539, Tel: 415-623-6500; Empl.: 28; *Sls. Mgr.:* Mike Kurihara, VP ...... **A•1440-1441**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Carefree	602-951-9121
CA	Irvine, Quad-Rep South, Inc.	714-727-4222
CA	Orangevalle, I Square, Inc.	916-989-0843
CA	San Diego, Quad-Rep.	619-560-8330
CA	Santa Clara, I Square, Inc.	408-988-3400
CO	Englewood, CSI	303-779-8060
CT	Woodbury, Anacon	203-266-0707
GA	Atlanta, Elctrn. Mktg. Assoc.	404-448-1215
ID	Boise, Intermountain Tech.	208-888-6071
IL	Chicago, M. Gottlieb & Assocs.	312-775-1151
IN	Carmel, Fred A. Dorsey & Assocs.	317-844-4842
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Annapolis, E.E.S Assoc.	301-269-4234
MA	Burlington, Anacon Sls. Assocs., Inc.	617-272-9080
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MO	St. Louis, Rush & West Assocs.	314-965-3322
MT	Boise, Inter-Mtn. Tech.	208-888-6071
NE	Davenport, Rush & West	319-388-9494
NV	Santa Clara, I Squared	408-988-3400
NY	Syracuse, Rep Tech., Inc.	315-437-2845
NJ	Fairfield, Tech. Applications & Mktg.	201-575-4130
NY	Fairfield, TAM	201-575-4130
NC	Raleigh, Elctrn. Mktg. Assoc.	919-847-8800
OH	Cincinnati, Makin Assocs.	513-871-2424
OH	Columbus, Makin Assocs.	614-848-5424
OH	Solon, Makin Assocs.	216-248-7370
OR	Tigard, Comps. West	503-684-1671
PA	Solon, Makin Assocs.	216-248-7370
SC	Greenville, Elctrn. Mktg. Assoc.	803-233-4637
TX	Dallas, T.L. Mktg.	214-490-9300
UT	Boise, Inter-Mtn Tech.	208-888-6071
VT	Wilmington, Anacon	617-270-3712
WA	Redmond, Comps. West	206-885-5880
WI	Chicago, M. Gottlieb Assocs.	312-775-1151

Local Distributors

AL	Huntsville, Time Elctrns.	214-721-1134
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Chatsworth, Time Elctrns.	818-988-7200
CA	Orange, Capstone Elctrns.	714-730-0349
CA	San Diego, Time Elctrns.	619-986-0129
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Englewood, Time Elctrns.	303-721-8882
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
GA	Norcross, Time Elctrns.	404-448-4488
IL	Chicago, Capstone Elctrns.	708-250-0300
MD	Columbia, Time Elctrns.	301-964-3090
MA	Boston, Capstone Elctrns.	508-657-5874
MA	Peabody, Time Elctrns.	508-532-9900
MN	Edina, Time Elctrns.	612-943-2433
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Marlton, Capstone Elctrns.	609-596-7500
NJ	Marlton, Time Elctrns.	609-996-6700
NM	Los Alamos, Capstone Elctrns.	505-662-0745
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Time Elctrns.	516-434-3344
NC	Raleigh, Capstone Elctrns.	919-954-0600
OH	Columbus, Time Elctrns.	614-794-3309
OR	Portland, Time Elctrns.	503-684-3782
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Capstone Elctrns.	214-380-9049
UT	West Valley City, Time Elctrns.	801-973-8494
WA	Kirkland, Time Elctrns.	206-820-1525
Can	Ontario, Capstone Elctrns.	416-670-2010
Can	Ontario, Time Elctrns.	416-672-5300

NEARFIELD SYSTEMS, INC., 1330 E. 223rd St. 524, Carson, CA 90745, Tel: 310-518-4277, FAX: 310-518-4279; Empl.: 6

NEC

FAX: 1-800-729-9288

NEC ELECTRONICS, INC., 475 Ellis Street, Mountain View, CA 94039-7241, Tel: 1-800-366-9782, TWX: 910-379-6985; Empl.: 1650; *Sls. Mgr.:* Mike Despotes, Sls. V.P.; *Dist. Mgr.:* Richard Calogero .... **A•1122-1129; B•1088-1090, 1327-1335, 1566-1570**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999,	FAX:205-464-0895
AZ	Phoenix, Oasis Sls., Inc.	602-277-2714,	FAX:602-263-9352
CA	Encino, NEC Elctrns., Inc.	818-342-3112,	FAX:818-342-0842
CA	San Diego, Mission Technlg.	619-674-6191,	FAX:619-674-6196
CA	San Jose, Exis	408-456-1650,	FAX:408-433-0450
CA	Santa Ana, NEC Elctrns.	714-546-0501,	FAX:714-432-8793
CA	Santa Clara, NEC Elctrns.	408-986-1020,	FAX:408-988-4165
CO	Aurora, NEC Elctrns.	303-755-6353,	FAX:303-755-6728
CO	Englewood, Compass Mktg. & Sls., Inc. of Colo.	303-721-9663,	FAX:303-721-0195
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311,	FAX:203-272-7672
FL	Altamonte Springs, V.G. Sls., Inc.	407-831-8688,	FAX:407-830-0627
FL	Cooper City, NEC Elctrns., Inc.	305-436-8114,	FAX:305-436-8116
FL	Ft. Lauderdale, V.G. Sls. Inc.	305-938-4333,	FAX:305-938-4331
FL	Largo, V.G. Sls. Co., Inc.	813-536-7787,	FAX:813-530-9126
FL	Maitland, NEC Elctrns.	407-875-1145,	FAX:407-875-0962
GA	Norcross, NEC Elctrns.	404-447-4409,	FAX:404-447-8228
GA	Norcross, 20th Century Mktg. Inc.	404-446-1999,	FAX:404-662-8128
IL	Arlington Hgts., NEC Elctrns.	708-577-9090,	FAX:708-577-2147
IL	Schaumburg, Martan Inc.	708-303-5660,	FAX:708-303-5745
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462,	FAX:317-573-5472
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553,	FAX:219-432-5555
IN	Kokomo, Technlg. Mktg. Corp.	317-459-5152,	FAX:317-457-3822
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576,	FAX:319-393-7317
KS	Overland Pk., AME Sls.	913-492-3971,	FAX:913-492-4002
KY	Louisville, Technlg. Mktg. Corp.	502-245-7411,	FAX:502-245-4818
MD	Glen Burnie, TRI-MARK Inc.	301-761-6000,	FAX:301-761-6006
MA	Natick, NEC Elctrns.	508-650-4100,	FAX:508-655-1605
MA	Woburn, Compass Technlg.	617-933-3336,	FAX:617-932-3354
MI	Dearborn, NEC Elctrns., Inc.	313-336-5225,	FAX:313-336-7922
MI	Kentwood, Miltimore Sls.	616-554-9292,	FAX:616-554-9210
MI	Novi, Miltimore Sls.	313-349-0260,	FAX:313-349-0756
MI	Troy, NEC Elctrns.	313-680-0506,	FAX:313-680-1015
MN	Eden Prairie, Stan Clothier Co.	612-944-3456,	FAX:612-944-6904
MN	Minneapolis, NEC Elctrns.	612-844-0209,	FAX:612-844-0509
MO	St. Charles, AME Sls.	314-928-2599,	FAX:314-447-8797
NJ	Fairfield, Metro Logic Corp.	201-575-5585,	FAX:201-575-8023
NJ	Moorestown, TAI Corp.	609-778-5353,	FAX:609-778-7828
NY	Fairport, NEC Elctrns.	716-425-4590,	FAX:716-425-4594
NY	Fishkill, NEC Elctrns.	914-897-2101,	FAX:914-897-2215
NY	Pittsford, Elcom Sls.	716-385-1400,	FAX:716-248-8531
NY	Skaneateles, Elcom Sls.	315-685-8245,	FAX:315-685-6273
NC	Cary, NEC Elctrns.	919-460-1890,	FAX:919-469-5926
NC	Charlotte, Quantum Mktg. Inc.	704-523-8822,	FAX:704-527-3222
NC	Raleigh, Quantum Mktg. Inc.	919-846-5728,	FAX:919-847-8271
OH	Centerville, TMC of Ohio	513-898-8867,	FAX:513-271-6321
OH	Cincinnati, TMC of Ohio	513-271-3860,	FAX:513-271-6321
OH	Columbus, NEC Elctrns.	614-436-1778,	FAX:614-436-1769
OH	Middleburg Hgts., TMC of Ohio	216-885-5544,	FAX:216-885-5011
OH	Pepper Pike, NEC Elctrns.	216-831-0067,	FAX:216-831-0758
OR	Portland, Venture Elctrns.	503-624-0617,	FAX:503-620-4682
OR	Tigard, NEC Elctrns.	503-671-0177,	FAX:503-643-5911
PA	Allentown, NEC Elctrns.	215-391-9094,	FAX:215-391-9107
PA	Trevose, NEC Elctrns., Inc.	215-244-8196,	FAX:215-244-9071
TN	Erwin, 20th Century Mktg.	615-531-6854,	FAX:615-539-0676
TX	Austin, TL Mktg., Inc.	512-837-7272,	FAX:512-837-6886
TX	Dallas, NEC Elctrns.	214-931-0641,	FAX:214-931-1182
TX	Dallas, TL Mktg., Inc.	214-490-9300,	FAX:214-960-6075
TX	Houston, NEC Elctrns.	713-320-0524,	FAX:713-320-0574
TX	Houston, TL Mktg., Inc.	713-587-8100,	FAX:713-580-7517
UT	Salt Lake City, Compass Mktg. & Sls., Inc.	801-355-9663,	FAX:801-264-6607
WA	Bellevue, Venture Elctrns.	206-454-4594,	FAX:206-454-9003
WI	Mequon, Martan Inc.	414-241-4955,	FAX:414-241-8365
PR	Mayaguez, V. G. Sls. Co., Inc.	809-831-4150,	FAX:809-831-4050
Can	Burnaby, BC, Kaytronics Western	604-294-2000,	FAX:604-294-4585
Can	Calgary, B.C., Kaytronics	403-275-7000,	FAX:403-295-0732
Can	Kanata, Ont., Kaytronics	613-592-6606,	FAX:613-592-0373
Can	Mississauga, Ont., Kaytronics	416-507-6400,	FAX:416-507-6444
Can	Ville St.-Laurent, Que., Kaytronics	514-745-5800,	FAX:514-745-5858

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9235,	FAX:205-881-1490
AL	Huntsville, Reptron Elctrns.	205-722-9500,	FAX:205-722-9565
AZ	Phoenix, Marshall Inds.	602-496-0290,	FAX:602-893-9029
AZ	Phoenix, Sterling Elctrns.	602-437-5565,	FAX:602-437-5588
AZ	Tempe, Insight Elctrns.	602-829-1800,	FAX:602-967-2658
CA	Agoura Hills, Western Microtechnology	818-707-0731,	FAX:818-706-7651
CA	Calabasas, Marshall Inds.	818-878-7000,	FAX:818-880-6846
CA	Camarillo, Milgray Elctrns.	805-484-4055,	FAX:805-388-8169
CA	Chatsworth, Sterling Elctrns.	818-407-8850,	FAX:818-407-1837
CA	Costa Mesa, Eric Elctrns.	714-751-1185,	FAX:714-432-7365
CA	El Monte, Marshall Inds. Corp.	818-307-6000,	FAX:818-307-6297
CA	Fountain Valley, Bell Microproducts	714-963-0667,	FAX:714-968-3195
CA	Irvine, Insight Elctrns.	714-727-3291,	FAX:714-727-1804
CA	Irvine, Marshall Inds.	714-859-5050,	FAX:714-581-5255
CA	Irvine, Milgray Elctrns.	714-753-1282,	FAX:714-753-1682
CA	Milpitas, Bell Micro Corp.	408-434-1150	
CA	Milpitas, Marshall INds.	408-942-4600,	FAX:408-262-1224
CA	Orange, Western Microtechnology	714-637-0200,	FAX:714-998-1883
CA	Rancho Cordova, Marshall Inds.	916-635-9700,	FAX:916-635-6044
CA	San Diego, Insight Elctrns. Corp.	619-587-9757,	FAX:619-587-1380
CA	San Diego, Marshall Inds.	619-578-9600,	FAX:619-586-0469
CA	San Diego, Western Microtechnology	619-453-8430,	FAX:619-453-1465
CA	San Jose, Bell Microproducts	408-451-9400,	FAX:408-451-1600
CA	San Jose, Eric Elctrns. Corp.	408-432-1111,	FAX:408-434-0309
CA	San Jose, Merit Elctrns., Corp.	408-434-0800,	FAX:408-434-0935
CA	San Jose, Milgray Elctrns.	408-456-0900,	FAX:408-456-0300
CA	San Jose, Sterling Elctrns.	408-435-0835,	FAX:408-428-0108
CA	Saratoga, Western Micotechnlg. Corp.	408-725-1660,	FAX:408-255-6491
CA	Sunnyvale, Insight Elctrns.	408-720-9222,	FAX:408-720-8390
CA	Tustin, Sterling Elctrns.	714-259-0900,	FAX:714-259-0946
CA	Westgate Vlg., Bell Microproducts	805-496-2606,	FAX:805-496-6119
CA	Westlake, Insight Elctrns.	818-707-2101,	FAX:818-707-0321

CO	Englewood, Sterling Elctrns.	303-792-3939,	FAX:303-792-3433
CO	Thornton, Marshall Inds.	303-451-8383,	FAX:303-457-2899
CT	Milford, Milgray Elctrns.	203-878-5538,	FAX:203-878-6970
CT	Wallingford, Marshall Inds.	203-265-3822,	FAX:203-284-9285
CT	Wallingford, Sterling Elctrns.	203-265-9535,	FAX:203-269-9742
FL	Altamonte Springs, Marshall Inds.	407-767-8585,	FAX:407-767-8676
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880,	FAX:305-977-4887
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112,	FAX:305-735-1121
FL	Lake Mary, Milgray Elctrns.	407-321-2555,	FAX:407-322-4225
FL	St. Petersburg, Marshall Inds.	813-573-1399,	FAX:813-573-0069
FL	Tampa, Reptron Elctrns. Corp.	813-854-2351,	FAX:813-855-0942
GA	Norcross, Marshall Inds.	404-923-5750,	FAX:404-923-2743
GA	Norcross, Milgray Elctrns.	404-446-9777,	FAX:404-446-1186
GA	Norcross, Reptron Elctrns.	404-446-1300,	FAX:404-446-2991
IL	Palatine, Milgray Elctrns.	708-202-1900,	FAX:708-202-1985
IL	Schaumburg, Marshall Inds.	708-490-0155,	FAX:708-490-0569
IL	Schaumburg, Reptron Elctrns.	708-882-1700,	FAX:708-882-8904
IL	Schaumburg, Sterling Elctrns.	708-303-9900,	FAX:708-303-9933
IN	Indianapolis, Marshall Inds.	317-297-0483,	FAX:317-297-2787
KS	Lenexa, Marshall Inds.	913-492-3121,	FAX:913-492-6205
KS	Lenexa, Sterling Elctrns.	913-492-5406,	FAX:913-492-6681
KS	Overland Park, Milgray Elctrns.	913-236-8800,	FAX:913-384-6825
MD	Columbia, Milgray Elctrns.	301-995-6169,	FAX:301-381-3066
MD	Columbia, Sterling Elctrns.	301-290-3800,	FAX:301-290-3876
MD	Columbia, Vantage Comps.	301-720-5100,	FAX:301-381-2172
MD	Silver Springs, Marshall Inds.	301-622-1118,	FAX:301-622-0451
MA	Burlington, Western Microtechnology	617-273-2800,	FAX:617-229-2815
MA	Hopkinton, Interface Elctrns. Corp.	508-435-0100,	FAX:508-435-6516
MA	Wilmington, Bell Microproducts	508-658-0222,	FAX:508-694-9987
MA	Wilmington, Marshall Inds.	508-658-0810,	FAX:508-657-5931
MA	Wilmington, Milgray Elctrns.	508-657-5900,	FAX:508-658-7989
MA	Woburn, Sterling Elctrns.	617-938-6200,	FAX:617-933-5468
MI	Livonia, Marshall Inds.	313-525-5850,	FAX:313-525-5855
MI	Livonia, Reptron Elctrns.	313-525-2700,	FAX:313-525-3209
MN	Minneapolis, Sterling Elctrns.	612-831-2666,	FAX:612-831-3043
MN	Minnetonka, Reptron Elctrns.	612-938-0000,	FAX:612-938-3995
MN	Plymouth, Marshall Inds.	612-559-2211,	FAX:612-559-8321
MO	Bridgeton, Marshall Inds.	314-291-4650,	FAX:314-291-5391
NJ	Clifton, Vantage Comps. Corp.	201-777-4100,	FAX:201-777-6194
NJ	Edison, Sterling Elctrns.	908-417-1000,	FAX:908-417-1017
NJ	Fairfield, Marshall Inds.	201-882-0320,	FAX:201-882-0095
NJ	Marlton, Interface Elctrns.	609-988-5448,	FAX:609-988-5566
NJ	Marlton, Milgray Elctrns.	609-983-5010,	FAX:609-985-1607
NJ	Marlton, Western Microtechnology	609-596-7775,	FAX:609-985-2797
NJ	Mt. Laurel, Marshall Inds.	609-234-9100,	FAX:609-778-1819
NJ	Parsippany, Milgray Elctrns.	201-335-1766,	FAX:201-335-2110
NM	Albuquerque, Sterling Elctrns.	505-884-1900,	FAX:505-884-1904
NY	Bohemia, Edge Elctrns. Corp.	516-567-6300,	FAX:516-567-0611
NY	Endicott, Marshall Inds.	800-678-0010,	FAX:607-785-5546
NY	Farmingdale, Milgray Elctrns.	516-420-9800,	FAX:516-752-9870
NY	Pittsford, Milgray Elctrns.	716-381-9700,	FAX:716-381-9495
NY	Rochester, Marshall Inds.	716-235-7620,	FAX:716-235-0052
NY	Smithtown, Vantage Comps.	516-543-2000,	FAX:516-543-2030
NC	Raleigh, Marshall Inds.	919-878-9882,	FAX:919-872-2431
NC	Raleigh, Milgray Elctrns.	919-790-8094,	FAX:919-872-8851
NC	Raleigh, Reptron Elctrns.	919-870-5189,	FAX:919-870-5210
OH	Colmbus, EMC (Elctrn. Mktg.) Corp.	614-299-4161,	FAX:614-299-4121
OH	Dayton, Marshall Inds.	513-898-4480,	FAX:513-898-9363
OH	Highland Heights, Electronic Mktg.	216-442-3441,	FAX:216-442-8122
OH	Independence, Milgray Elctrns.	216-447-1520,	FAX:216-447-1761
OH	Solon, Marshall Inds.	216-248-1788,	FAX:216-248-2312
OH	Solon, Reptron Elctrns.	216-349-1415,	FAX:216-349-1634
OH	Solon, Sterling Elctrns.	216-248-1122,	FAX:216-248-0554
OH	West Chester, Sterling Elctrns.	513-779-0418,	FAX:513-779-0418
OK	Tulsa, Sterling Elctrns.	918-663-2410,	FAX:918-663-6212
OR	Beaverton, Insight Elctrns.	503-644-3300,	FAX:503-641-4530
OR	Beaverton, Marshall Inds.	503-644-5050,	FAX:503-646-8256
OR	Beaverton, Western Microtechnology	503-629-2082,	FAX:503-629-8645
PA	Pittsburgh, Marshall Inds.	412-788-0441,	FAX:412-788-0447
TX	Austin, Marshall Inds.	512-837-1991,	FAX:512-832-9810
TX	Austin, Sterling Elctrns.	512-836-1341,	FAX:512-836-3279
TX	Carrollton, Sterling Elctrns.	214-243-1600,	FAX:214-243-4091
TX	Dallas, Milgray Elctrns.	214-248-1603,	FAX:214-248-0218
TX	Houston, Marshall Inds.	713-467-1666,	FAX:713-467-9805
TX	Houston, Sterling Elctrns. Corp.	713-627-9800,	FAX:713-629-3939
TX	Mansfield, Mouser Elctrns. Corp.	800-346-6873,	FAX:817-483-0931
TX	Richardson, Insight Elctrns.	214-783-0800,	FAX:214-680-2402
TX	Richardson, Marshall Inds.	214-705-0600,	FAX:214-705-0675
TX	Stafford, Milgray Elctrns.	713-240-5360,	FAX:713-240-5404
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UT	Salt Lake City, Marshall Inds.	801-973-2288,	FAX:801-973-2296
UT	Salt Lake City, Sterling Elctrns.	801-972-5444,	FAX:801-972-5498
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WA	Kirkland, Insight Elctrns.	800-677-7716,	FAX:206-821-2976
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WI	Milwaukee, Marsh Elctrns. Corp.	414-475-6000,	FAX:414-771-2847
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Can	Brampton, Ont., Marshall Inds.	416-458-8046,	FAX:416-458-1613
Can	Burnaby, B.C., ITT Multicomps.	604-421-6222,	FAX:604-421-0582
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Can	Concord, Ont., ITT Multicomps. Corp.	416-798-4884,	FAX:416-798-4889
Can	Mississauga, Ont., Milgray Elctrns.	416-678-0958,	FAX:416-678-1213
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FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
FL	Ft. Lauderdale, Over & Over, Inc.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Mt. Prospect, The Dombrow Co., Inc.	708-253-3326
IN	Carmel, Frank E. Kahsar Sls.	317-844-9353
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
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MA	Harvard, Cycle Sls. Inc.	508-456-6868
MI	Muskegon, Frank E. Kahsar Sls.	616-798-4451
MI	Sterling Heights, Frank E. Kahsar Sls.	313-795-3530
MN	New Brighton, Boerger & Assocs.	612-636-4339
MO	Florissant, Spectrum Sls.	314-921-1313
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NC	Raleigh, Over & Over Inc.	919-876-7338
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OH	Elyria, Frank E. Kahsar Sls.	216-365-5219
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FL	Sunrise, All American Semiconductor Inc.	305-572-7999
FL	Tampa, Dow Elctrns.	813-626-5191
FL	Tampa, Elctrn. Equip.	813-988-0810
FL	West Palm Beach, Atlantic Elctrns., Inc.	407-686-8553
GA	Albany, Dow Elctrns.	912-435-1711
GA	Athens, Dixie Elctrns., Inc.	706-613-7755
GA	Norcross, Dow Elctrns.	404-446-3190
GA	Norcross, Whitehead Elctrns.	404-923-6667
GA	Savannah, Dow Elctrns.	912-234-1684
D	Boise, Kimball Elctrns., Inc.	208-342-3559
D	Pocatello, Kimball Elctrns., Inc.	208-232-2201
L	Addison, Belford Elctrns.	708-691-1100
L	Addison, L Comp, Inc.	708-628-1400
L	Algonquin, Marshall Wolf Automation	708-658-8130
L	Bensenville, Goold Elctrns.	708-860-7171
L	Chicago, Leeds Electro Comps.	312-625-3800
L	Crystal Lake, Sub-Sem Inc.	815-459-4139
L	Geneva, Whitehead Elctrns.	708-232-8050
L	Palatine, Ohm Elctrns.	708-359-5500
L	Palatine, Powell Elctrns.	708-776-9060
L	Wheeling, Hawk Elctrns., Inc.	708-459-4030
	Wood Dale, Nep Elctrns.	708-595-8500
N	Elkhart, Bursma Elctrns. Distrbg.	219-295-4205
N	Ft. Wayne, L R P Elctrns.	419-228-1220
N	Indianapolis, CAM RPC	317-578-1111
N	Indianapolis, Meunier Elctrn. Supp.	317-635-3511
N	Indianapolis, MAR Elctrns.	317-633-6699
N	Indianapolis, RM Elctrns.	317-291-7110
N	South Bend, Whitehead Elctrns.	219-299-0804
A	Sioux City, Sioux City Wintronic	712-255-8023
KS	Wichita, Airtechnics, Inc.	316-267-2849
KS	Wichita, Radio Inc.	316-264-2798
KS	Wichita, RSC Elctrns., Inc.	316-267-5213
KY	Florence, URI Elctrns., Inc.	606-371-4423
KY	Louisville, Peerless Elctrn. Supps.	502-637-7674
A	Baton Rouge, Southern Radio Supp. Co.	504-355-0396
A	New Orleans, Southern Radio Supp. Co.	504-524-2343
MD	Aberdeen, Harco Elctrns.	301-838-7990
MD	Annapolis Jct., Powell Elctrns.	301-880-3255
MA	Billerica, Mayer Elctrns.	617-229-2255
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Gaithersburg, Capitol Radio Wholesalers	301-840-5700
MD	Kensington, Marine Air Supply Co.	301-949-9560
MD	Rockville, All American Semiconductor Inc.	301-251-1205
MD	Salisbury, Harco Elctrns.	410-548-1800
MA	Avon, Controller Svc. & Sls.	508-584-9010
MA	Billerica, Mayer Elctrns. Co.	617-229-2255
MA	Middleboro, Glynn Elctrns., Inc.	508-947-4262
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Newton, Greene Shaw Elctrns.	617-969-8900
MA	Wakefield, All American Semiconductor Inc.	617-246-2300
MA	Westborough, Powell Elctrns.	508-366-6100
MA	Worcester, Greene-Shaw Elctrns.	508-751-4904
MI	Ann Arbor, Wedemeyer Elctrn. Supp.	313-665-8611
MI	Bay City, Bursma Elctrns. Distrbg.	517-892-1594
MI	Benton Harbor, Bursma Elctrn. Distrbg.	616-927-3519
MI	Grand Rapids, Bursma Elctrn. Distrbg.	616-459-4325
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Lansing, Wedemeyer Elctrn. Supp.	517-484-9009
MI	Mt. Clemens, Sine Companies, Inc.	313-465-3131
MI	St. Clair Shores, Spemco Switches	313-771-2700
MI	Traverse City, Bursma Elctrn. Distrbg.	616-941-5015
MN	Brooklin Center, Powell Elctrns.	612-566-8682
MN	Burnsville, Cassidy Elctrns.	612-895-9026
MN	Eden Prairie, All American Semiconductor Inc.	612-944-2151
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Stark Elctrns. Supp., Inc.	612-332-1325
MN	Minneapolis, Tor Tec	612-866-3662
MN	Plymouth, Leeds Electro Comps.	612-557-1277
MN	Proctor, Parts 1	218-624-0651
MN	Roseville, Parts 1	612-633-8079
MS	Columbus, Bluff City Elctrns.	601-328-6212
MS	Tupelo, Bluff City Elctrns.	601-842-6832
MO	Kansas City, L Comp., Inc.	816-241-0111
MO	Kansas City, Walters Indl.	816-531-7015
MO	Maryland Hgts., L Comp., Inc.	314-291-6200
MO	St. Louis, Franklin Elctrns. Co.	314-429-3111
NE	Lincoln, Scott Elctrns.	402-466-8221
NE	Omaha, Scott Elctrns.	402-734-6750
NV	Las Vegas, Kiesub Corp.	702-733-0024
NH	Manchester, Controller Svc. & Sls.	603-623-7225
NH	Manchester, Cronin Elctrns., Inc.	603-624-0105
NH	Manchester, Glynn Elctrns., Inc.	603-622-8131
NH	Salem, Diamond Elctrns.	603-894-4420
NJ	Cliffwood, Federated Purchaser	908-290-2900
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NM	Farmington, Farmington Wintronics	505-327-6356
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NY	Copiague, EECO Elctrns.	516-842-0110
NY	E. Rochester, Rome Elctrns.	716-248-0160
NY	Hauppauge, Broadline Elctrns. Distrbg.	516-231-4100
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
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NY	Troy, Trojan Elctrn. Supp. Co.	518-274-4481
NY	Williamsville, Rome Elctrns.	716-626-1602
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NC	Raleigh, Dixie Elctrns., Inc.	919-829-0704
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NC	Winston-Salem, Dixie Elctrns., Inc.	919-724-5961
OH	Cincinnati, Schuster Elctrns.	513-723-8800
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Columbus, Wedemeyer Elctrn. Supp. Co., Inc.	614-436-9600
OH	Columbus, Whitehead Elctrns.	614-851-5500
OH	Dayton, Dayton Wintronic Co.	513-293-0871
OH	Dayton, Whitehead Elctrns.	513-438-8600
OH	Highland Hgts., CAM RPC Elctrns.	216-461-4700
OH	Lima, LRP Elctrns.	419-228-1220
OH	Toledo, Wedemeyer Elctrn. Supp. Co.	419-248-3364
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OH	Warren, REM Elctrns.	216-373-1300
OK	Oklahoma City, Oklahoma City Wintronic Co., Inc.	405-682-0545
OK	Oklahoma City, Radio, Inc.	405-789-0741
OK	Oklahoma City, RSC Elctrns.	405-631-7729
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OK	Tulsa, Radio, Inc.	918-587-9123
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PA	Erie, Rem Elctrns.	814-453-5626
PA	Lancaster, Harco Elctrns.	717-291-1861
PA	N. Huntington, Rem Elctrns.	412-864-7423
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Pittsburgh, CAM RPC Elctrns.	412-963-6202
PA	Reading, Barbey Elctrns.	215-376-7451
PA	Wilkes-Barre, Wallco, Inc.	717-823-6181
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RI	Providence, Controller Svc. & Sls.	401-781-7100
SC	Columbia, Dixie Elctrns.	803-779-5332
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SC	N. Charleston, Dixie Elctrns.	803-552-2671
SC	Taylors, Cantrell Whlse. Prods.	803-268-1194
SD	Mitchell, Wholesale Elctrns.	605-996-2233
TN	Chattanooga, Dow Elctrns.	615-624-1040
TN	Gray, Dixie Elctrns.	615-477-2131
TN	Knoxville, Knoxville Wintronic	615-671-1345
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Bluff City Elctrns.	615-871-4700
TN	Oak Ridge, Dixie Elctrns.	615-481-3393
TX	Austin, Austin Wintronic	512-832-9645
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Brownsville, Carden Indl. Grp.	512-541-3660
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Corpus Christi, Sherman Elctrns. Supp., Inc.	512-888-9454
TX	Dallas, Off The Shelf Comps., Inc.	214-247-0052
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TX	Dallas, Wofford Elctrns.	214-340-8555
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TX	El Paso, Rem Elctrns.	915-778-7333
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TX	Ft. Worth, Ft. Worth Wintronic	817-534-7696
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TX	Irving, Powell Elctrns.	214-550-0547
TX	Laredo, REM Elctrns.	512-725-3100
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TX	Richardson, Off the Shelf Comps., Inc.	214-238-0808
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TX	Richardson, Southwest Elctrns.	214-234-3050
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UT	Salt Lake City, Kimball Elctrns.	801-328-2075
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
UT	West Balley City, Salt Lake Beta Wintronic	801-966-0378
VA	Harrisonburg, Harco Elctrns.	703-434-8420
VA	Norfolk, Priest Elctrns.	804-855-0105
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Can	Nepean, Ont., ITT Multicomps.	613-596-6980
Can	Ottawa, Ont., SEMAD	613-727-8325
Can	Pointe Claire, Que., SEMAD	514-694-0860
Can	St. Laurent, PQ, ITT Multicomps.	514-335-7697
Can	Waterloo, ON, Sanbek Sls.	519-746-5801
Can	Winnipeg, Manitoba, ITT Multicomps.	403-273-2780

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NMB TECHNOLOGIES INC., 9730 Independence Avenue, Chatsworth, CA 91311, Tel: 818-341-3355; *Dist. Mgr.:* Brian Lennox .... **B•1303; C•1630-1631**

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CA	Chatsworth, NMB Technlgs.	818-341-3355
CA	San Jose, NMB Technlgs.	408-283-1700
GA	Atlanta, NMB Technlgs.	404-409-9340
IL	Hoffman Estates, NMB Technlgs.	708-843-0202
PA	Bethlehem, NMB Technlgs.	215-882-0682
NH	Bedford, NMB Technlgs.	603-626-4643
TX	Austin, NMB Technlgs.	512-441-3979
TX	Dallas, NMB Technlgs.	214-243-0600
PR	San Juan, Puerto Rico, Elctrl. Tech. Sls., Inc.	809-798-1300
Can	Mississauga, Ont., NMB Precision	416-890-0570

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AZ	Tempe, Bell Inds.	602-966-7800
CA	Agoura Hills, Bell Inds.	818-706-2608
CA	Canoga Park, Newark Elctrns.	818-888-3718
CA	Chatsworth, Sterling Electrns.	818-407-8850
CA	Culver City, Newark Elctrns.	213-670-0020
CA	Cypress, Bell Inds.	714-895-7801
CA	Dublin, Mechatronics	415-829-4014
CA	Foster City, Newark Elctrns.	415-572-8300
CA	Gardena, Bell Inds.	213-515-1800
CA	Irvine, ITT Multicomponents	714-727-4001
CA	Orange, Newark Elctrns.	714-634-8224
CA	Redondo Beach, Mechatronics	213-318-3382
CA	Rocklin, Bell Inds.	916-652-0414
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Sterling Elctrns.	619-271-6555
CA	San Jose, ITT Multicomponents	408-453-1404
CA	Santa Ana, El-Com/Cabletek	714-432-6630
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Tustin, Sterling Elctrns.	714-259-0900
CO	Arvada, Denver Beta Wintronic	303-431-7161
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Sterling Elctrns.	303-792-3939
CO	Westminster, ITT Multicomponents	303-451-8740
CO	Wheatridge, Bell Inds.	303-424-1985
CO	Wheatridge, Bell Inds. - JIT	303-431-8732
CT	Wallingford, Sager Elctrns.	203-265-4600
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Altamonte Spring, Bell Inds.	407-339-0078
FL	Deerfield Beach, Bell Inds.	305-421-1997
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Miami Lakes, Mechatronics	305-822-5823
FL	Orlando, Hammond Elctrns.	407-849-6060
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Reptron Elctrns.	404-446-1300
ID	Couer D'alene, A-1 Consolidated, Inc.	208-765-3280
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Elk Grove, Bell Inds.	312-640-1910
IL	Northbrook, Classic Comps.	312-272-9650
IL	Schaumburg, Newark Elctrns.	312-843-0700
IL	Schaumburg, Reptron Elctrns.	312-882-1700
IL	Urbana, Bell Inds.	217-328-1077
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Bell Inds.	319-395-0730
KS	Lenexa, Sterling Elctrns.	913-942-5406
MD	Columbia, Sager Elctrns.	301-995-6580
MD	Savage, Pyttronic Inds.	301-792-0780
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Livonia, Reptron Elctrns.	313-525-2700
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MA	Winchester, Bell Inds.	617-729-5800
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Ann Arbor, Bell Inds.	313-971-9093
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Burnsville, Newark Elctrns.	612-884-2799
MN	Edina, Bell Inds.	612-941-1493
MN	Edina, Berquist	612-835-2222
MN	Minneapolis, Aero-Space Computer Supply	612-884-4725
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Sterling Elctrns.	612-831-2666
MN	Minnetonka, Reptron Elctrns.	612-938-0000
NH	Hudson, Bell Inds.	603-882-1133
NH	Nashua, Mechatronics	603-888-3054
NJ	Bellmawr, Mid-Atlantic	609-931-5303
NJ	Moorestown, Marlac Elctrns.	609-234-4200
NJ	So. Plainfield, Sterling Elctrns.	201-769-7000
NM	Albuquerque, International Elctrns.	505-291-9951
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NM	Bell Inds., Albuquerque	505-292-2700
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OH	Dayton, Stotts-Friedman	513-298-5555
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OR	Lake Oswego, Bell Inds.	503-635-6500
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PA	Montgomeryville, Pyttronic Inds.	215-643-2850
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TX	Houston, Newark Elctrns.	713-270-4800
TX	Houston, Sterling Elctrns.	713-623-6600
TX	Richardson, Bell Inds.	214-690-0466
UT	Midvale, Bell Inds.	801-255-9611
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
UT	West Valley City, Denver Beta Wintronic Co.	801-966-0378
VA	Herndon, Sterling Elctrns.	703-742-8400
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Newark Elctrns.	206-641-9800
WA	Mercer Island, Mechatronics SAB, Inc.	206-232-4800
WA	Redmond, Bell Inds.	206-885-9963
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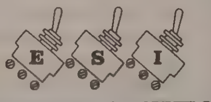

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CA	Los Gatos, Stewart-Fullerton Assocs.	408-376-0368
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IN	Indianapolis, Fred A. Dorsey Assoc.	317-872-6780
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KY	Frankfort, Fred A. Dorsey Assoc.	502-695-2250
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MI	Plymouth, M Rep	313-420-2233
MN	Minneapolis, Holmgren Assoc.	612-574-9983
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PA	Flourtown, C.G.M. Inc.	215-233-0333
TX	Austin, Design Mktg.	512-263-9151
TX	Dallas, Design Mktg.	214-247-4745
WA	Bellevue, Quest Mktg.	206-747-9424
WI	Brookfield, DTS Assocs.	414-781-4475
Can	Calgary, Alb., Current Corp.	403-680-2452
Can	Dorvac, Que, Current Corp.	514-631-7193
Can	Pickering, Ont., Current Corp.	416-428-3413
Can	Port Moody, BC, Current Corp.	604-937-5559

Local Distributors

CA	Irvine, ITT Multicomps.	714-727-4001
CA	San Jose, ITT Multicomps.	408-453-1404
IL	Addison, Belford Elctrns.	708-691-1100
MI	Grand Rapids, RM Elctrns.	616-531-9300
MO	St. Louis, Franklin Elctrns.	314-429-3111
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700

NOETIC TECHNOLOGIES, 4031 NE 17 Terr., Pompano Beach, FL 33064, Tel: 305-941-6343, 800-780-6343, FAX: 305-941-9413; FSC No.: 6625 SIC:3357; *Sls. Mgr.:* Philip S. Lipofsky

NOHAU CORPORATION, 51 E. Campbell Ave., Campbell, CA 95008, Tel: 408-866-1820, 408-866-4493, FAX: 408-378-7869 .... **D•1304-1309**

Local Sales Offices & Reps

CA	San Diego, Microware Technlg. Inc.	619-693-4280
CT	Old Saybrook, AD Elctrns.	203-388-2204
FL	West Melbourne, Trilogic Sunforce	407-722-1324
MI	Farmington Hills, The Dearborn Grp., Inc.	313-932-1850
NY	Glen Cove, J. Kunze Co.	516-671-2376
PA	Hatboro, Delta Tech. Sls.	215-957-0600
VA	Herndon, Embedded Technlgy.	703-742-0040
WA	Bothell, Exectronics	206-947-2115
Can	Laval,Que., Techmatron, Inc.	514-689-5889

NOISE COM INC., E. 49 Midland Ave., Paramus, NJ 07652, Tel: 201-261-8797, FAX: 201-261-8339; FSC No.: 65185; Empl.: 28; *Sls. Mgr.:* Gary Simonyan .... **A•1848; D•1298, 1311**

Local Sales Offices & Reps

CA	Los Angeles, McDougall/Mc Laughlin	213-477-8556
CA	San Jose, Allis Assocs., Inc.	408-252-2883
FL	Clearwater, Beacon Microwave	813-796-2378
MD	Columbia, Creative Mktg. Assoc.	301-880-4161
MA	Reading, Geder Assoc.	617-944-3105
WA	Kirkland, Allis Northwest	206-828-0444
EXP	Palo Alto, Ca, Radar Systems	415-322-7448

NOLATRON, P.O. Box 4042, Harrisburg, PA 17111, Tel: 717-564-3398, FAX: 717-939-5831; Empl.: 5

NOLL, J. A. CO., P.O. Box 312, Monroeville, PA 15146, Tel: 412-856-7566, FAX: 412-372-1752; *Sls. Mgr.:* P. Carson; *Dist. Mgr.:* P. Carson

NON-LINEAR SYSTEMS, 4174 Sorrento Valley Blvd., San Diego, CA 92121, Tel: 619-535-2161, FAX: 619-535-2169; FSC No.: 03626; Empl.: 25; *Sls. Mgr.:* Charlotte Gresham; *Dist. Mgr.:* Charlotte Gresham

NORDION INTERNATIONAL, 447 March Rd., Kanata, Ontario, Canada K2K 1X8, Tel: 613-592-2790, TELEX: 053-4162, FAX: 613-592-6937

NOREN PRODUCTS INC., 1010 O'Brien Drive, Menlo Pk., CA 94025, Tel: 415-322-9500, TELEX: 17-1410 Noren MNPK, FAX: 415-324-1348; *Sls. Mgr.:* Dennis Fleming

NORGREN, 5400 South Delaware, Littleton, CO 80120-1663, Tel: 303-794-2611, FAX: 303-795-9487; Empl.: 661; *Sls. Mgr.:* James Smith; *Dist. Mgr.:* James Smith

NORITAKE CO., INC., Electronics Division, LA Branch, 2050 E. Vista Bella Way, Compton, CA 90220, Tel: 310-603-9770; FAX: 310-603-9810; FSC No.: 213-772-3918; Empl.: 200; *Sls. Mgr.:* Ted Suzuki

Noritake

FAX: 708-593-2285

NORITAKE CO., INC., 2635 Clearbrook Dr., Arlington Heights, IL 60005, Tel: 708-439-9020; Empl.: 2000; *Sls. Mgr.:* Albert Smith .... **A•1711; B•1094-1095**

Local Sales Offices & Reps

CA	Compton, Noritake Co., Inc.	310-603-9770
IL	Arlington Heights, Noritake Co., Inc.	708-439-9020
MA	Burlington, Noritake Co., Inc.	617-270-0360
NJ	Secaucus, Noritake Co., Inc.	201-319-0600
TX	Dallas, Noritake Co., Inc.	214-742-9389

NORPLEX OAK INC., P.O. Box 1448, La Crosse, WI 54602-1448, Tel: 608-784-6070, TELEX: 59-2257; Empl.: 2,200

NORTH AMERICAN CAPACITOR CO., 7545 Rockville Rd., Indianapolis, IN 46224, Tel: 317-273-0090, FAX: 317-273-2400; Empl.: 200; *Dist. Mgr.:* Tom Green, V.P. Sls. & Mktg. .... **A•1130-1135**

Local Sales Offices & Reps

AL	Huntsville, Mtn. Electro Mktg.	205-461-8420
AZ	Phoenix, C.T. Carlberg & Assocs., Inc.	602-468-0750
CA	Huntington Bch., West Elect. Sls. Co.	714-375-6500
CA	Mountain View, Straube Assocs., Inc.	415-969-6060
CA	San Diego, West Elect. Sls. Co.	619-566-8430
CO	Englewood, Delltron Co.	303-741-2122
FL	Orlando, Comp. Design Mktg.	407-240-3903
IL	Mount Prospect, The Dombrow Co.	708-253-3326, 414-263-4116
GA	Norcruss, Mtn. Electro Mktg.	404-448-5594
IN	Indianapolis, D-M Assocs.	317-842-4424
IA	Cedar Rapids, KKB & Co.	319-373-1730
MA	Wellesly, Logan Sls.	617-235-6868
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	Blue Springs, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NM	Albuquerque, C.T. Carlberg & Assocs., Inc.	505-899-2155
NY	Fairport, LamTec Sls. Corp.	716-377-1210
NY	Hauppauge, Aurora Mktg., Inc.	516-434-1313
NY	Manlius, LamTec Sls. Corp.	315-682-4780
NC	Wendell, Mtn. Electro Mktg.	919-365-5674
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
TX	Hurst, Pro-Comp Sls. Co.	817-589-0336
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
Can	Pickering, Ont., A. C. Simmonds & Sons	416-839-8041

Local Distributors

NJ	Lawrenceville, DVS Co.	609-896-1112
OR	Beaverton, Jas. J. Backer	503-627-0775
WA	Seattle, Jas. J. Backer	206-285-1300

NORTH AMERICAN PHILIPS CONTROLS CORP., See Airpax Corporation, Cheshire Div.

FAX: 516-567-1823

NORTH ATLANTIC INSTRUMENTS, INC., 170 Wilbur Place, Bohemia, NY 11716-2416, Tel: 516-567-1100; FSC No.: 0VGU1; Empl.: 30; *Sls. Mgr.:* William Cullum .... **D•1312**

Local Sales Offices & Reps

AL	Huntsville, Teqspec, Inc.	205-883-6699
AZ	Mesa, SDW Moutain States	602-839-6626
CA	Los Alamitos, Tritek-SDW Inc.	714-236-1190
CA	San Diego, Tritek-SDW, Inc.	619-455-1911
CA	Santa Clara, Tritek-SDW, Inc.	408-554-0455
CO	Louisville, SDW Mountain States	303-665-8089
FL	Cape Canaveral, TeqSpec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
GA	Snellville, Teqspec	404-972-7955
IL	Chicago, Pat Lind Elctrns.	312-726-3513
IN	Indianapolis, Pat Lind Elctrns.	317-632-7444
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
MI	Madison Heights, WKM Assoc.	313-588-2300
MI	Troy, WKM Assocs., Inc.	313-588-2300
MN	Circle Pines, Pat Lind Elctrns.	612-786-5770
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NH	Nashua, Intersell	603-880-6500
NM	Albuquerque, SDW Mountain States	505-883-3668
NC	Winston-Salem, Teqspec III	919-765-5553
OH	Dayton, WKM Assoc.	513-434-7500
OH	Independence, WKM Assocs., Inc.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
PA	Pittsburgh, WKM Assocs., Inc.	412-892-2953
PA	Southampton, Eastern Instrmn. of PA	215-355-3469
TX	Austin, Testech, Inc.	512-338-9246
TX	Euless, Testech, Inc.	817-540-1944
TX	Houston, Testech, Inc.	713-893-9661
TX	Richardson, Testech, Inc.	214-644-5010
VA	Fairfax, Scientific Assocs., Inc.	703-385-0600
WA	Bellevue, Syntek, Inc.	206-462-7700
WI	Milwaukee, Pat Lind Elctrns.	414-224-0146

NORTHEAST INNOVATIONS, INC., PO Box 1214, Concord, NH 03302, Tel: 603-736-8260, FAX: 603-736-4506; Empl.: 15; *Sls. Mgr.:* Robert Shipione

NORTHERN AMPOWER CORP., 47087 Grand River, Novi, MI 48374, Tel: 313-349-4860, FAX: 313-349-5692; Empl.: 30; *Sls. Mgr.:* Ronald Kirsch

NORTHERN MAGNETICS INC., 16124 Wyandotte, Van Nuys, CA 91406, Tel: 818-997-8675, FAX: 818-997-3935; Empl.: 12

NORTHERN PRECISION LABS., 11 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-4800, FAX: 201-575-5973; Empl.: 95; *Sls. Mgr.:* P. Pytal

NORTHERN TECHNOLOGIES INC., 35 Rivera Dr., Unit No. 5, Markham, Ont., CAN L3R 8N4, Tel: 416-475-9320, 1-800-456-1875, FAX: 416-475-5719; Empl.: 95; *Sls. Mgr.:* Mark A. Finlay

North Hills
A Porta Systems Company

FAX: 516-682-7704

NORTH HILLS SIGNAL PROCESSING, 575 Underhill Blvd., Syosset, NY 11791, Tel: 516-682-7740; FSC No.: 98821; Empl.: 40; *Sls. Mgr.:* Steve Muth .... **A•2438-2441**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Eng. Sls.	602-265-0344
CA	Campbell, Sedillo Co., Inc.	408-374-5222
CA	North Palo Alto, Tri-Rep	415-965-1822
CA	Palo Alto, Tri Rep	415-965-1822
CA	South El Toro, Par Mktg.	714-768-6021
CO	Littleton, Mercier & Assoc.	303-770-0666
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
FL	Clearwater, Brennan Assocs.	813-446-5006
IL	Wheaton, Vine Tech. Sls.	913-642-7220
IA	Cedar Rapids, Tech Alliance	319-373-0686
MD	Baltimore, Stemler Assocs. Inc.	410-944-8080
MD	Laurel, CSDS	301-953-7884
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MI	Farmington Hills, Rathsburg Assoc. Inc.	313-489-1500
MN	Eden Prairie, COM-TEK Sls.	612-941-7181
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Alpha Tech. Sls.	314-537-2647
MO	St. Louis, Thunderbird Tech. Sls.	314-298-8984
NJ	Kenville, CFE Gray	201-927-6662
NY	Whitney Point, T.A.E. Reps	607-692-3705
PA	Philadelphia, Paragon Sls.	215-778-6328
TX	Argyle, Milestek, Inc.	817-455-7444
TX	Boerne, Max Lipscomb & Assoc.	512-981-8708
TX	Dallas, C.J. Tellier	214-231-6348
TX	Houston, Ocean Electric	713-441-1481
WI	Genoa City, Vine Tech. Sls.	414-279-3871
Can	Montreal, Componetics Ltd.	514-331-9930

Local Distributors

MD	Laurel, Rayma	1-800-447-2962
TX	Argyle, Miles Tek, Inc.	817-455-7444

NORTH IOWA ELECTRONICS, INC., Winnebago Industries, Inc., 325 N. State St., Garner, IA 50438, Tel: 515-923-3751, FAX: 515-923-2325; Empl.: 90

NORTHLAKE ENGINEERING, INC., 8320 193 Rd., Bristol, WI 53104-0370, Tel: 414-857-9600, FAX: 414-857-6819; FSC No.: 50638; Empl.: 120; *Sls. Mgr.:* W. A. Hardt

NORTH TEXAS CIRCUIT BOARD, 1501 W. Shady Grove Rd., Grand Prairie, TX 75050, Tel: 214-790-7610, FAX: 214-986-2381; FSC No.: 5S424; Empl.: 70; *Sls. Mgr.:* Keith Larson; *Dist. Mgr.:* Keith Larson

NORTHWEST ANALYTICAL INC., 520 N. W. Davis St., Portland, OR 97209, Tel: 503-224-7727, FAX: 503-224-5236; Empl.: 26; *Sls. Mgr.:* Lynn Theis; *Dist. Mgr.:* Kathryn Botsford

NORTHWEST ETCH TECHNOLOGY, 2601 So. Hood St., Tacoma, WA 98409, Tel: 206-572-2401, 1-800-343-2401, FAX: 206-383-8325; Empl.: 30

FAX: 503-929-6428

NORTHWEST MICROCIRCUITS, INC., 211 S. 9th - P.O. Box 1479, Philomath, OR 97370, Tel: 503-929-6424; Empl.: 15; *Sls. Mgr.:* Matt Graham .... **A•1712**

NORTON ASSOCIATES, INC., 9 Endo Blvd., Garden City, NY 11530, Tel: 516-745-1411, FAX: 516-745-1412; FSC No.: 08739

NORWESCO, INC., See Norwesco Interconnect Devices

NORWESCO INTERCONNECT DEVICES, 2633 Plastics Drive, Gastonia, NC 28053, Tel: 704-868-3581, FAX: 704-867-0577; Empl.: 80; *Sls. Mgr.:* Gary Munn

NOVA ELECTRIC CORP., Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Kenneth Niovitch .... **D•2284-2285**

Local Sales Offices & Reps

CO	Englewood, Odyssey 1	303-773-8176
CT	W. Hartford, Power Factor Assoc.	203-233-0600
FL	Orlando, Truex Assoc.	407-859-2160
KS	Kansas City, Harris-Hansen Co.	816-763-6200
MD	Columbia, Delta III Assoc.	410-730-4700
MA	Whitinsville, Power Factor Assoc.	508-234-6415
MI	Detroit, Comtel	313-358-2505
OH	Cleveland, Comtel Assoc.	216-442-8080
PA	Philadelphia, Rabal Assoc.	215-922-6914
TX	Dallas, Carey McMahill Assoc.	214-681-1414
UT	Odyssey 1.	801-485-4728
WA	Bellevue, Topp	206-747-5400
Can	Ottawa, Ont., Subtec	613-723-7720

NOVOTECHNIK U.S., INC., 237 Cedar Hill St., Marlborough, MA 01752, Tel: 508-485-2244, FAX: 508-485-2430; FSC No.: MULTIPLE; Empl.: 8 .... **A•2114**

NRD INC., Subsidiary of Mark IV Inds., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, FAX: 716-773-7744; Empl.: 100; *Sls. Mgr.:* James Curtis; *Dist. Mgr.:* Larry Keating

NTE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, FAX: 201-748-6224; FSC No.: 7T184; Empl.: 60; *Sls. Mgr.:* Cindy Habick; *Dist. Mgr.:* Mary Damiano .... **A•2149; B•1572-1576**

NTK
TECHNICAL CERAMICS

FAX: 708-390-6482

NTK TECHNICAL CERAMICS, NGK Spark Plugs (USA), 1200 Business Ctr. Dr., Suite 300, Mt. Prospect, IL 60056, Tel: 708-824-1133; FSC No.: 95-246-1286; *Sls. Mgr.:* Ted Kato, Sls. Mgr.; *Dist. Mgr.:* Manabu Sato .... **A•1664-1667, 1849**

Local Sales Offices & Reps

AZ	Mesa, NTK Tech. Ceramics	602-820-4900
CA	San Jose, NTK Tech. Ceramics	408-727-5180
FL	Longwood, D-Assocs.	407-321-9594
IL	Mt. Prospect, NTK Tech. Ceramics	708-824-1133
IN	Ft. Wayne, T.X. Sls.	219-489-4447
MA	Farmingham, NTK Tech. Ceramics	508-820-0220
MI	Detroit, NTK Tech. Ceramics	313-489-0123
NJ	Millburn, NTK Tech. Ceramics	201-376-6070
TX	Dallas, NTK Tech. Ceramics	214-404-1173
Can	Ontario, NGK Spark Plugs Canada	416-291-9746

NUCLEAR MEASUREMENTS GROUP, Oxford Instruments, Inc., PO Box 2560, Oak Ridge, TN 37831-2560, Tel: 615-483-8405, TELEX: 557482, TWX: 810-572-1018, FAX: 615-483-5891; Empl.: 120; *Sls. Mgr.:* Roger Stevens

NUCLEAR RESEARCH CORP., 125 Titus Ave., Box H, Warrington, PA 18976, Tel: 215-343-5900, TELEX: 510-665-8525 NRC WNTN, FAX: 215-343-4670; FSC No.: 96696; Empl.: 130; *Sls. Mgr.:* Tom O'Malley; *Dist. Mgr.:* Tom O'Malley

NUCLEONIC PRODS., See Thomson Electron Tube & Devices Corp. Thomson CSF

NU-CONCEPT SYSTEMS, 2725 Advance La.,P. O. Box 587, Colmar, PA 18915, Tel: 215-822-8400, 800-762-4278, FAX: 215-822-1427; FSC No.: 58561; Empl.: 10; *Sls. Mgr.:* Robert F. Scheuerle

NU DATA, INC., 32 Fairview Ave., Little Silver, NJ 07739, Tel: 908-842-5757, FAX: 908-842-1161; Empl.: 20; *Sls. Mgr.:* Mark Leiberman; *Dist. Mgr.:* George Serbe

NWL CAPACITORS, NWL Transformers, 1 Industrial Drive, Snow Hill, NC 28580, Tel: 919-747-5943, FAX: 919-747-8979; Empl.: 39; *Sls. Mgr.:* Gary W. Greiser .... **A•1136-1138**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968
CA	Marrieta, Mil-Com Sls.	714-677-2097
CT	Darien, C.W. Assocs.	203-656-2339
FL	Tampa, SRT Mktg.	813-884-4805
IL	Arlington Heights., Berndt Assocs., Inc.	708-632-0900

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[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

MI	Livonia, Amtech Reps., Inc.	313-474-8300
NJ	Haddonfield, M&S Mesa Inc.	609-429-7055
NM	Albuquerque, TMMI Westfahl	505-268-1433
NY	Nassau, Jones Sudders	518-766-9575
OH	Maineville, George Barnett & Co.	513-677-0922
OR	Lake Oswego, Salestech Assocs.	503-636-9559
TX	Euless, Fralia Co. & Assocs.	817-354-1144
VT	White River Jct., Cornerstone Inds.	802-295-5260
WA	Redmond, Salestech Assocs.	206-869-5412
WI	Milwaukee, Berndt Assocs., Inc.	414-545-8400

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 225; *Sls. Mgr.:* Helmut Herder .... **A•1136-1138, 2437; D•1851**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968
CA	Murrieta, Mil Com Sls.	714-677-2097
NJ	Princeton, Mutronics Assocs.	609-394-3737
NM	Albuquerque, Westfahl & Assocs.	505-268-1433
WA	Redmond, Salestech Assocs.	206-869-5412

WILLIAM F. NYE, INC., P.O. Box 8927, New Bedford, MA 02742-8927, Tel: 508-996-6721, TELEX: 940807, FAX: 508-997-5285; Empl.: 36; *Sls. Mgr.:* Donald R. Fairbanks .... **C•1134**

Local Sales Offices & Reps

IL	Elgin, Mark C. Biteler	708-697-5446
MI	Pleasant Ridge, Brian C. Holley	313-542-2720

NY-GLASS PLASTICS INC., Calnetics Corp., 1255 Railroad St., Corona, CA 91720, Tel: 909-737-9110, FAX: 909-737-9815; Empl.: 90; *Sls. Mgr.:* Chris Ward

NYTRON INDUCTORS, INC.(VSD, INC.), Offered by: Dale Electronics, Inc., E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301, FAX: 605-665-1627; FSC No.: 83125; Empl.: 450; *Sls. Mgr.:* Mike Husman .... **A•1231**

OAKGRIGSBY

FAX: 708-556-4216

OAKGRIGSBY INC., 88 N. Dugan Rd., Sugar Grove, IL 60554, Tel: 708-556-4200; FSC No.: 76854; Empl.: 300; *Sls. Mgr.:* Lou Falco .... **B•1654, 1790-1795, 1979**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Scottsdale, Carefree Elctrns. Sls.	602-951-9121
CA	Laguna Hills, Fitch Assocs.	714-951-0196
CA	San Jose, Vernex & Assocs.	408-972-9072
FL	Longwood, Septer & Assocs.	407-774-3161
GA	Duluth, New Age Elctrns.	404-476-0079
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IL	Sugar Grove, OakGrigsby, Inc.	708-556-4200
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
IA	Cedar Rapids, Pattison Sls.	319-395-9866
KS	Parker, S.W. Wollard Assocs.	913-898-6552
MA	Acton, James Inds. East	508-264-4456
MN	Bloomington, Murnco & Assocs.	612-854-4161
NY	Fairport, A.C.S.	716-223-2430
OH	Beachwood, Elctrn. Sls. Masters, Inc.	216-831-8647
PA	Plymouth Meeting, CMS Sls. & Mktg., Inc.	215-834-6840
TX	Dallas, Dal/Tex Rep., Inc.	214-991-7799
Can	Mississauga. Ont., GMA (Toronto)	416-671-8111
Can	Nepean, Ont., GMA (Ottawa)	613-820-3822
Can	St. Laurent, Que., GMA (Montreal)	514-335-9572

Local Distributors

AZ	Tempe, L-Comp.	602-730-1633
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Gardena, Cal Switch	310-538-9830
FL	Pompano, Peerless	305-973-4141
FL	W. Palm Bch., Wings Electro Sls. Co.	407-798-6606
GA	Atlanta, Peerless	404-612-9090
ID	Boise, Radar	208-336-2227
IL	Addison, L Comp	708-628-1400
IL	Chicago, Newark	312-907-5453
IL	Crystal Lake, Sub Sem	815-459-4139
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
IL	Rosemont, Advent Elctrns.	708-297-6200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IN	Indianapolis, Advent Elctrns.	317-872-4910
MD	Columbia, Peerless	410-997-1717
MA	Canton, Richey/Impact Elctrns.	617-821-1500
MA	Walpole, Richey Impact	508-668-8200
MA	Westborough, In-Stock Prods.	508-870-5750
MA	Wilmington, North Star	508-657-5155
MA	Wilmington, North Star Elctrns.	508-657-5155
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Berquist	800-328-3882
MO	Kansas City, L-Comp	816-241-0111, FAX:816-241-7373
MO	Maryland, L-Comp	314-291-6200, FAX:314-298-7231
NY	Hauppauge, Fairmont Elec.	516-231-3313
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, FAX:516-593-2179
NY	Rockville Centre, Advantage Elctrns.	516-678-6956,FAX:516-678-7966
NC	Raleigh, Component Distr.	919-787-7311
OH	Centerville, IPD	513-435-2086
OR	Portland, Radar Electric Co., Inc.	503-232-3404, FAX:503-235-0428
TX	Austin, Wofford Elctrns., Inc.	512-339-1131, FAX:512-835-7351
TX	Carrolton, Northstar Elctrns.	214-980-2999, FAX:214-980-2997
TX	Dallas, Component Distr.	214-644-0373
TX	Dallas, Wofford Elctrns., Inc.	214-340-8555, FAX:214-340-9555
TX	El Paso, Ideal Indl. Elctrns.	915-779-6647, FAX:915-779-0617
TX	El Paso, Ideal Indl. Elec.	915-779-6647
TX	Houston, Wofford Elctrns., Inc.	713-351-2255, FAX:713-351-2722
WI	Milwaukee, Progressive Image, Inc.	414-321-4722
WA	Richland, Radar Electric Co., Inc.	509-943-8336, FAX:509-943-6790
WA	Seattle, Radar Electric Co., Inc.	206-282-2511, FAX:206-282-1598
WA	Spokane, Radar Electric Co., Inc.	509-747-3053, FAX:509-456-8069
WI	Milwaukee, Progressive Image	414-321-4722, FAX:414-321-4665
Can	Downsview, Ont., Westburne Elctrns.	416-635-2980,FAX:416-635-0019
Can	Downsview, Ont., Westburne Elec. Supp.	416-635-2980
AZ	Tucson, Carefree Elctrns. Sls.	602-882-8642

OAK SWITCH SYSTEMS, See OakGrigsby, Inc.

OAL ASSOCIATES, INC., 16744 W. Bernardo Dr., Rancho Bernardo, CA 92127-1904, Tel: 619-451-1799, FAX: 619-451-2799; Empl.: 18; *Sls. Mgr.:* Dave Dorfman

OAS INC., See Optimum Applied Systems

OCEAN MOTIONS CO., P.O. Box 130, Barrington, RI 02806, Tel: 401-246-1394, FAX: 401-246-0075; FSC No.: 64654; *Sls. Mgr.:* C. Thorp .... **B•1980**

Local Sales Offices & Reps

CO	Denver, Control Agcy., Inc.	303-694-9214
UT	Salt Lake City, Control Agcy.	801-268-9880, FAX:801-268-9924

OCE GRAPHICS USA, INC., 385 Ravendale Dr., Mountain View, CA 94039-7169, Tel: 415-964-7900, FAX: 415-961-6152; *Sls. Mgr.:* Gary Gedeon; *Dist. Mgr.:* Gary Gedeon

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-430-1500, FAX: 303-426-8126

OCULAR INC., 746 Lingco Dr., Richardson, TX 75081, Tel: 214-437-3888, FAX: 214-437-2562; Empl.: 110; *Sls. Mgr.:* Marvin Smith .... **B•1096-1097**

Local Sales Offices & Reps

AL	Madison, Southern Elctrn. Reps.	205-461-8925
AZ	Phoenix, JBS Assocs., Inc.	602-244-1212
CA	Huntington Beach, Solutech, Inc.	714-374-0130
CA	San Jose, Kottmeier Assocs.	408-371-8700
CO	Arvada, Arrowhead Sls.	303-423-5556
FL	Hollywood, Advantage Comp.	305-962-2255
FL	Hollywood, Advantage Comps.	305-962-2255
GA	Atlanta, Southern Elctrn. Reps.	404-458-3577
IL	Arlington Hgts., Coombs & Assocs.	708-439-9810
IN	Fort Wayne, Menze Sls.	219-747-5616
KS	Kansas City, EPI, Inc.	913-432-1792
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
MA	Swansea, Wm. Poisson & Assocs.	508-677-3655
MN	Hopkins, Pathway Sls.	612-891-4841
NV	Sacramento, Kottmeier Assocs.	408-371-8700
NJ	Wayne, Breen Assocs.	201-696-8683
NM	Albuquerque, Nelco Electronix	505-293-1399
PA	Newtown, Industrial Sls. Assocs.	215-860-2076
TX	Dallas, Component Technlg.	214-783-8831
WA	Renton, K.R. Jensen Sls. Co.	206-277-2772
WI	Milwaukee, Coombs & Assocs.	414-351-6123
Can	Montreal, A.R. Greg & Assocs.	514-694-6378

ODU-USA, INC., ODU-Kontakt GmbH, Germany, 4620 Calle Quetzal, Camarillo, CA 93012, Tel: 805-484-0540, FAX: 805-484-7458; Empl.: 5; *Sls. Mgr.:* Ona Collins; *Dist. Mgr.:* Kenneth E. Rhines

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350, FAX: 503-653-6310; FSC No.: 95266; Empl.: 700; *Sls. Mgr.:* Dave Fuller, VP Sls.

OFTI, 2 Liberty Way, Westford, MA 01886, Tel: 508-692-6606, FAX: 508-692-6620; Empl.: 72

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4740; Empl.: 51; *Sls. Mgr.:* Doug Groteluschen

OGDEN MANUFACTURING CO., 48 W. Seegers Road, Arlington Heights, IL 60005, Tel: 708-593-8050, FAX: 708-593-8062; Empl.: 250; *Dist. Mgr.:* Gordon D. Hollander

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FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 47; *Sls. Mgr.:* G. Clagett .. **B•1982-2003; D•1313**

Local Sales Offices & Reps

AL	Huntsville, Datarep Inc.	205-881-0361
CA	Costa Mesa, FLW of Northern CA	510-651-6511
CA	Fremont, FLW of Southern CA	714-751-7512
CO	Denver, MC Squared Inc.	303-286-1414
FL	Margate, Datarep	305-968-6568
FL	Orlando, Datarep	407-843-5224
GA	Marietta, FLW	404-424-1731
IL	Columbia, R.L. Weisheimer & Assocs.	314-487-7328
IL	Park Ridge, Elctrn. Instr. Assocs.	708-298-2290
KS	Kansas City, R.L. Weisheimer & Assocs.	816-561-1711
MD	Mt. Airy, Strayton Assocs., Inc.	301-831-7007
MI	Livonia, TMS Inc.	313-462-2100
MN	Minneapolis, The Mark Co.	612-933-3026
NJ	Garwood, E.R. Mertz, Inc.	201-232-4643
NJ	Haddonfield, G.L. Williams & Assoc.	609-428-6060
NY	Latham, L-Tron Corp.	518-785-5032
OH	Columbus, Ohio Semitronics Inc.	614-486-9561
OH	Dayton, Mohawk Intronics	513-434-8873
OH	No. Ridgeville, TMS, Inc.	216-327-3527
OK	Stillwater, Acudata Inc.	405-743-1886
PA	Pittsburg, TMS	412-221-2338
RI	Narragansett, Pat Assocs.	401-783-9598
SC	Marion, Zelco Assocs.	803-423-0299
TX	Austin, Acudata Inc.	214-424-3561
TX	Houston, Acudata Inc.	713-580-2451
TX	Plano, Acudata Inc.	512-478-1018
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
WA	Vancouver, Syntek	206-737-2957
Can	Brossard, Ont., CTH Industrial Controls.	514-671-2181
Can	Edmonton, Alb., CTH Instrs.	403-466-2900
Can	Sarnia, Ont., Armatek Controls	519-332-0100
Can	Toronto, Ont., Armatek Controls	416-251-3111

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OHMITE MANUFACTURING CO., 3601 W. Howard St., Skokie, IL 60076, Tel: 708-675-2600, TELEX: 72-4433; FSC No.: 44655; *Sls. Mgr.:* Kirk Schwiebert; *Dist. Mgr.:* Ed Kason .... **A•1259, 1996-2000, 2442; D•1056**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Tempe, Elctrn. Dev. Sls.	602-438-1547
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Denver, West, Inc.	303-477-8180
FL	Altamonte Spgs., Over & Over	407-332-1222
GA	Norcross, Over & Over	404-449-6205
IL	Mt. Prospect, Dombrow Co.	708-253-3326
IN	Indianapolis, Leslie M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Pk., Spectrum Sls.	913-648-6811
MA	Norwood, MacInnis Co.	617-762-8090
MI	Farmington Hills, R.C. Merchant Co.	313-476-4600
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Florissant, Spectrum Sls.	314-921-1313
NY	Manhasset, Win-Cor Sls.	516-627-9474
NY	Victor, Net Sls.	716-924-1844
NC	Charlotte, Over & Over	704-542-9111
NC	Raleigh, Over & Over	919-876-7338
OH	Westlake, Baehr Greenleaf & Assoc.	216-892-1770
OR	Portland, Caruso & Camelleri Assoc.	503-246-5439
PA	Narbeth, Bresson Assocs.	215-664-6460
PA	Warrendale, Baehr Greenleaf & Assoc.	412-934-3088
TX	Richardson, Pro-Comp Sls.	214-669-1500
WA	Bellevue, Caruso & Camelleri Assoc.	206-455-8811
EXP	Skokie, IL, Ohmite Mfg. Co.	708-675-2600
Can	Pickering, Ont., A.C. Simmonds & Sons	416-839-8041

Local Distributors

AR	Ft. Smith, Carlton Bates	501-646-8201
CA	El Monte, Kimball & Stark	818-444-2594
CA	Fountain Valley, Component Ctr.	800-879-3550
CA	Oakland, Brill Elctrns.	415-834-5888
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Hingham, Sager Elctrns.	617-749-6700
MI	Livonia, RS Elctrns.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-490-4900
NJ	Camden, GRS Elctrns.	609-964-8560
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rome, Rome Elctrns.	315-337-5400
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Warren, REM Elctrns. Supp.	216-373-1300
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Richardson, Altair Co.	214-231-5166
TX	Stafford, Harrison Equip.	713-879-2600
WA	Richland, Radar Elec.	509-943-8336
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Don Mills, Ont., Saynor Varah	416-445-2340
Can	Willowdale, Ont., Electro-Sonic	416-494-1666

OHMTEK INC., Vishay, 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025, FAX: 716-283-5932; FSC No.: 57489; Empl.: 205; *Sls. Mgr.:* William Cuviello .... **A•2001-2004**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, V.E.C.	619-535-9080
CA	Tustin, V.E.C.-Los Angeles	714-544-7024
CO	Loveland, V.E.C.-Rocky Mtn.	303-667-7500
GA	Roswell, JWL Assocs.	404-518-8500
IL	Skokie, IRI-Illinois	708-967-8430
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
MA	Sterling, Compatable Comps. Inc.	508-422-7641
MI	Plymouth, Jay Mktg. Assoc.	313-459-1200
MN	Bloomington, IRI of MN.	612-854-8027
NJ	Flanders, K & R Eng. Sls., Inc.	201-584-5235
NY	Fairport, L-Mar Assocs.	716-425-9103
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OR	Beaverton, Unicomp., Inc.	503-643-1645
PA	Horsham, TMI, Inc.	215-441-4300
TX	Austin, BPA, Inc.	512-346-9186
TX	Richardson, BPA, Inc.	214-234-8438
WA	Snohomish, UniComp	206-568-0511
WI	Brookfield, IRI-Wisconsin	414-789-9393
Can	Burnaby, B.C., Kaytronics	604-294-2000
Can	Calgary, Alberta, Kaytronics	403-275-7000
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Mississauga, Kaytronics, Inc.	416-669-2262
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

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OKAYA ELECTRIC AMERICA, INC., Okaya Electric Industries, Tokyo, Japan, 503 Wall Street, Valparaiso, IN 46383, Tel: 219-477-4488; Empl.: 11; *Sls. Mgr.:* David Rickards; *Dist. Mgr.:* David Rickards .... **A•1139-1140, 1598-1599; B•1098-1099**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assoc., Inc.	205-533-9108, FAX:205-533-4667
AZ	Scottsdale, Lindberg Co.	602-998-2944, FAX:602-998-2356
CA	Huntington Beach, Regan-Munro Sls.	714-841-1411,FAX:714-841-3598
CO	Denver, Lindberg Co.	303-758-9033, FAX:303-758-5863
IL	Highland Park, Bransky Sls.	708-433-2375, FAX:708-433-2377
IA	Cedar Rapids, Advanced Technical	319-393-8280, FAX:319-393-8273
KS	Olathe, Advanced Technical	913-782-8702, FAX:913-782-8641
MD	Cazenovia, St. Woolard Co., Inc.	301-371-4500, FAX:301-371-7353
MA	Milford, AFM Grp.	508-478-3355, FAX:508-478-4084
MI	Southfield, R.C. Nordstrom	313-559-7373, FAX:313-559-0075
MN	Minneapolis, Electro-Serv	612-338-3475, FAX:612-338-6048
MO	Bridgeton, Advanced Technical	314-291-5003, FAX:314-291-7958
NM	Albuquerque, Lindberg Co.	505-881-1006, FAX:505-881-1007
NY	Islip, Cogent Technlg. Assoc.	516-277-7101, FAX:516-277-7614
NC	Raleigh, Vantage Mktg.	919-870-7123, FAX:919-870-7772
OH	Cincinnati, Stegman Blaine	513-729-1969, FAX:513-729-1984
OH	Cleveland, Stegman Blaine	216-572-0003, FAX:216-238-3229
OH	Vandalia, Stegman Blaine	513-890-7975, FAX:513-890-5191
OH	Westerville, Stegman Blaine	614-523-1300, FAX:614-523-1333
OK	Tulsa, Delta Comps.	918-592-7711, FAX:918-587-9437
PA	Harleysville, Thomas Jackson Assoc.	215-256-8877,FAX:215-256-9255
TX	Seagoville, Delta Comps.	214-287-6333, FAX:214-287-1453
UT	Salt Lake City, Lindberg Co.	801-484-8689, FAX:801-484-9691
WA	Seattle, J.J. Assocs.	206-246-6619, FAX:206-241-8120
Can	Calgary, Alberta, Cana Rep. Grp.	403-255-0294, FAX:403-255-4902
Can	Montreal, Quebec, Cana Rep. Grp.	514-276-4477, FAX:514-276-3646
Can	Surrey, BC, Cana Rep. Grp.	604-599-1232, FAX:604-599-3616
Can	Willowdale, Ont., Cana Rep.Grp.	416-250-6683, FAX:416-250-6684

Local Distributors

CA	Chatsworth, E W Elctrns.	818-718-2500, FAX:818-718-9007
CA	Huntington Bch, Capacitor Assocs.	714-843-1815, FAX:714-843-0947
CA	Manhattan Bch., Prime Electro Prods.	310-379-3642,FAX:310-379-7768
CA	Santa Ana, BDS Elctrns.	714-662-1050, FAX:714-662-3929
CA	Santa Clara, Bravo Elctrns.	408-980-8500, FAX:408-980-0299
CO	Arvada, Denver Beta Wintronic Co.	303-431-7161, FAX:303-431-4964
CO	Littleton, Indelco, Inc.	303-795-3431, FAX:303-795-8298

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FL	Ft. Lauderdale, Gulf Comps., Inc.	305-525-2770, FAX:305-527-0049
FL	Melbourne, Pridmore Elctrns.	407-727-2491, FAX:407-723-1213
FL	Orlando, ATCOM	407-354-0435, FAX:407-354-0438
IL	Franklin Pk., Stetco Inc.	708-671-4208, FAX:708-671-5270
IL	Hillside, Schuten Elctrns.	708-544-9600, FAX:708-544-9684
IL	Morton Grove, Nedco Elctrns.	708-967-0500, FAX:708-967-0505
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699, FAX:317-633-6687
MA	Burlington, Atlantic Comps. Supp. (ATCOM)	617-270-0051,FAX:617-270-4056
MA	Sharon, Adcour, Inc.	617-784-8123, FAX:617-784-5563
MI	Battle Creek, Great Lakes Elctrns. Supp.	616-963-6282,FAX:616-963-3432
MI	Madison Hgts., Galco Indl. Elctrns., Inc.	313-542-9090,FAX:313-542-8031
MN	Eagan, Capacitor Assocs.	800-328-0003, FAX:612-456-5850
MN	Eitzen, Capacitor Assocs.	507-495-3306, FAX:507-495-3454
NJ	Wyckoff, B & R Elctrns.	201-670-7200, FAX:201-670-6849
OH	Chagrin Falls, Comm-Omni	216-247-7030, FAX:216-247-6199
PA	Philadelphia, Shap Elctrns. Co., Inc.	215-969-3300, FAX:215-934-5539
TX	Dallas, Comp. Dist., Inc.	214-644-0373, FAX:214-644-1115
WI	Mequon, Taylor Elctrc. Co.	414-241-4321, FAX:414-241-4025
Can	Gloucester, Ottowa, Elctrn. Whlsrs.	613-746-4413, FAX:613-746-6260
Can	Montreal, Que., Elctrn. Whlsrs.	514-769-8851, FAX:514-769-9060
Can	See-Foy, Que., Elctrn. Whlsrs.	418-657-5020, FAX:418-657-5234

OKI SEMICONDUCTOR, INC., 785 N. Mary Ave., Sunnyvale, CA 94086, Tel: 408-720-1900,800-TEAM-OKI, TELEX: 296687 OKI SNTA, FAX: 408-720-1918

OLFLEX WIRE & CABLE, INC., 30 Plymouth Street, Fairfield, NJ 07004, Tel: 201-575-1101, FAX: 201-575-7178; Empl.: 40; *Sls. Mgr.:* Dick Kopp

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07004, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Robert T. Mello

OLYMPUS CORPORATION, Industrial Fiberoptics Division, 4 Nevada Dr., Lake Success, NY 11042-1179, Tel: 516-488-3880, FAX: 516-488-3973

OMATION INC., 801 Presidental Dr., Richardson, TX 75081, Tel: 214-231-5167, 800-553-9119, FAX: 214-783-9072; Empl.: 15; *Sls. Mgr.:* Nancy James

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OMEGA ENGINEERING, Box 4047, Stamford, CT 06907, Tel: 800-826-6342; Empl.: 500; *Sls. Mgr.:* Peter Casiraghi .... **B•1796, 1886-1887, 2004-2005; C•1547, 1792; D•1016, 1101, 1166, 1199, 1314, 1362-1363, 1415**

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OMNICOMP GRAPHICS CORP., 1734 W. Sam Houston Pkwy N., Houston, TX 77043, Tel: 713-464-2990, TELEX: 285801, FAX: 713-827-7540; Empl.: 40

OMNIBYTE CORP., 245 W. Roosevlet Rd., Bldg. 1, West Chicago, IL 60185-3790, Tel: 708-231-6880, FAX: 708-231-7042; Empl.: 24; *Sls. Mgr.:* Greg Urban

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OMNIPRINT, INC., 6A Vanderbilt, Irvine, CA 92718, Tel: 714-457-0229, 800-878-6880; Empl.: 15; *Sls. Mgr.:* Stephen Bergeron; *Dist. Mgr.:* Rita Bell ... **D•1102-1104**

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FAX: 602-582-0665

OMNI SWITCH USA, INC., 21620 N. 19th Ave., Ste. A 103, Phoenix, AZ 85027, Tel: 602-582-0629; Empl.: 100; *Sls. Mgr.:* Peggy Ann Wenzel, V.P. .... **C•1137**

Local Sales Offices & Reps

AZ	Phoenix, Omni Switch USA, Inc.	602-582-0629
CA	Irvine, Vale Elctrns.	714-551-4004
CA	Santa Clara, Premier Tech. Sls.	408-736-2260
CO	Westminster, Glenmar	303-423-1572
CT	Darien, CW Assocs.	203-656-2339
GA	Lilburn, Pinnacle Mktg.	404-410-9980
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Indianapolis, C.C. Electro Sls.	317-921-5000
KS	Lenexa, Midtec Assocs.	913-541-0505
MI	Plymouth, C.C. Electro Sls.	313-455-0000
NM	Albuquerque, Power Entprs.	505-271-9266
NY	Eastchester, W.D. Sls.	914-779-8738
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OH	Cleveland, C.C. Electro Sls.	216-228-4338
TX	Dallas, Leon de Mexico	214-243-1089

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OMNI VISION INC., 168 N. Brandon Dr., Glendale Heights, IL 60139, Tel: 708-893-1720; *Sls. Mgr.:* Walt Kowalski .... **B•1101**

OMRON ELECTRONICS, INC., Control Components Division, 1 East Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, 1-800-626-6766, FAX: 708-843-7787; Empl.: 300; *Dist. Mgr.:* Mac Rowell

OMRON ELECTRONICS, INC., F A Systems Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, FAX: 708-843-7787; Empl.: 300; *Sls. Mgr.:* Sal Scafidi

ONAN POWER/ELECTRONICS, 9713 Valley View Rd., Minneapolis, MN 55344-3577, Tel: 612-943-4600, FAX: 612-943-4627; FSC No.: 3Z577; Empl.: 500; *Sls. Mgr.:* Jim Vogt

ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 708-816-6000,800-327-8801, TWX: 757024 ONEAC USA; Empl.: 150; *Sls. Mgr.:* Byron Brooks

ONSET COMPUTER CORP., 536 MacArthur Blvd., P.O. Box 3450, Pocasset, MA 02559-3450, Tel: 508-563-9000, FAX: 508-563-9477; Empl.: 12; *Sls. Mgr.:* Lon Hocker

ONSHORE TECHNOLOGY, 1917 W. 3rd St., Tempe, AZ 85281, Tel: 602-921-3000; Empl.: 200; *Sls. Mgr.:* R. Mandell; *Dist. Mgr.:* L. Anthole

ONTRACK DATA RECOVERY, INC., Ontrack Computer Systems, Inc., 6321 Bury Drive, Ste.15-19, Eden Prairie, MN 55346, Tel: 800-872-2599, FAX: 612-937-5750

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566, FAX: 213-462-6490; FSC No.: 24699; Empl.: 18 .... **D•1017**

OPTEK TECHNOLOGY INC., 1215 West Crosby Rd., Carrollton, TX 75006, Tel: 214-323-2200, FAX: 214-323-2396; Empl.: 2000; *Sls. Mgr.:* Cornelius Clark; *Dist. Mgr.:* Wayne Davis

OPTELECOM, INC., 9300 Gaither Rd., Gaithersburg, MD 20877, Tel: 301-840-2121, FAX: 301-948-6357; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* Harish K. Jain .... **B•1223-1227**

OPTICAL CABLE CORP., P.O. Box 11967, Roanoke, VA 24022-1967, Tel: 1-800-622-7711, TELEX: 705-290, FAX: 703-265-0724; FSC No.: 6Y528; Empl.: 68; *Sls. Mgr.:* Luke J. Huybrechts, VP/Sls.; *Dist. Mgr.:* Chuck Surat, Natl. Accts. Exec.

OPTICAL ELECTRONICS, INC., P.O. Box 11140, Tucson, AZ 85734, Tel: 602-889-8811

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, TELEX: 497-4643, FAX: 201-228-0915; Empl.: 33; *Sls. Mgr.:* Diane M. Fiore

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OPTIMA ELECTRONIC PACKAGING SYSTEMS, 2166 Mountain Industrial Blvd, Tucker, GA 30084-5088, Tel: 404-496-4000; FSC No.: 10110; Empl.: 150 .... **C•1056-1061**

Local Sales Offices & Reps

AL	Huntsville, Twentieth Century Mktg., Inc.	205-772-9999
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Garden Grove, Elsco Elctrns., Inc.	714-891-4621
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Oviedo, Conley & Assocs., Inc.	407-365-3283
GA	Tucker, Optima EPS	404-496-4000
IL	Arlington Heights, Berndt Assocs., Inc.	708-632-0900
MA	Milford, Selmark Assocs., Inc.	508-478-9088
MI	Madison Hgts., DEM Electronic Sls., Inc.	313-583-1500
MO	St. Louis, Rush & West Assocs., Inc.	314-965-3322
NJ	Berkeley Heights, Cambridge Allen & Assocs.	908-464-0203
NY	Manlius, Lamtec Sls. Corp.	315-682-4780
NC	Chapel Hill, T.A. Barker Assocs.	919-968-7808
OH	Cleveland, C.A. Robinson Co., Inc.	216-473-6044
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355
UT	Salt Lake City, Sierra Technical Sales	801-566-9719
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, El Tech	206-746-7780

OPTIMA PRECISION, INC., 775 SW Long Farm Rd., West Linn, OR 97068, Tel: 800-544-4118, 503-638-2525, FAX: 503-638-4545; Empl.: 6

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OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100, FAX: 914-741-0729; Empl.: 30

OPTIMUM APPLIED SYSTEMS, 145 Palisade St., Dobbs Ferry, NY 10522-1696, Tel: 914-693-9001, FAX: 914-693-8733; Empl.: 30; *Sls. Mgr.:* H. Joseph Brakl

OPT INDUSTRIES, INC., 300 Red School Lane, Phillipsburg, NJ 08865, Tel: 908-454-2600, FAX: 908-454-3742; FSC No.: 53342/80223; Empl.: 264; *Sls. Mgr.:* Frank McMahon; *Dist. Mgr.:* Pam Nolf, Sls. Adm.

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
AZ	Paradise Valley, Techrep-Arizona	602-991-6646
CA	Irvine, Componant Mktg. Assoc.	714-727-0688
CA	Milpitas, Marcon Sls.	408-263-3660
CO	Franktown, MRC	303-660-8750

CT	Canterbury, Deltech Sls.	203-546-6322
FL	Clearwater, Tech-Rep Assoc.	813-572-9900
FL	Ft. Lauderdale, Tech-Rep Assoc.	305-791-2708
FL	Merritt Island, Tech-Rep Assoc.	407-453-3313
GA	Lawrenceville, E-Squared Mktg.	404-995-7206
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Ft. Wayne, Johnson GP.	219-471-7100
IA	Cedar Rapids, C.H. Horn & Assoc.	319-393-8703
KS	Wichita, DLE Elctrns.	316-683-6400
MD	Annapolis, Elctrn. & Technlg. Sls.	410-974-9351
MA	Littleton, Deltech Sls.	508-486-8294
MA	Sharon, Cummings Assocs.	617-784-5600
MI	Spring Lake, Johnson Gp.	616-842-7706
NY	E. Rochester, Alan Lupton Assoc.	716-381-4800
NY	Glen Cove, Dyno Rep, Inc.	516-676-1598
OH	Cincinnati, Stegman Blaine Mktg.	513-521-0958
OH	Cleveland, Stegman Blaine Mktg.	216-572-9797
OH	Vandalia, Stegman Blaine Mktg.	513-890-7486
OR	Portland, E2	503-297-5968
OR	West Linn, Power Factor & Assoc.	503-657-6969
PA	Phila, Rabal Assoc.	215-922-6914
TX	Austin, Sunbelt Comps.	512-335-0499
TX	Dallas, Sunbelt Comps.	214-248-8000
TX	Missouri City, Sunbelt Comps.	713-499-4722
WA	Bellevue, E2	206-637-0302

Local Distributors

CA	Santa Ana, Norstan Elctrns. Inc.	714-NORSTAN
NY	Hauppauge, Jaco	516-273-5500
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
TX	Dallas, Assoctd. Aircraft Supp. Co., Inc.	214-331-4381

OPTIVISION, INC., 1477 Drew Ave., Suite 102, Davis, CA 95616, Tel: 916-757-4850, 800-562-8934, FAX: 916-756-1309; Empl.: 26; *Sls. Mgr.:* Kathy Ernest

OPTO DIODE CORP., 750 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-499-0335, FAX: 805-499-8108; FSC No.: 67109; Empl.: 12

OPTOELECTRONICS, INC., 5821 N.E. 14th Ave., Ft. Lauderdale, FL 33334, Tel: 305-771-2050, FAX: 305-771-2052; Empl.: 30; *Sls. Mgr.:* L. R. Hufft; *Dist. Mgr.:* L. R. Hufft

OPTOELECTRONICS TEXTRON, 1309 Dynamic St., P.O. Box 750039, Petaluma, CA 94975-0039, Tel: 707-763-5900, FAX: 707-762-7383; Empl.: 100

OPTO PLUS ò INC., 23382 Madero, Unit A, Mission Viejo, California, CA 92691, Tel: 714-380-8654, 800-554-6786, FAX: 714-380-0761; Empl.: 7

OPTO TECHNOLOGY, INC., 562 Chaddick Dr., Wheeling, IL 60090, Tel: 708-537-4277, FAX: 708-537-4785; Empl.: 25; *Sls. Mgr.:* Thomas W. Hegberg, Sls. Mgr.

OPTOTEK LIMITED, 62 Steacie Dr., Kanata, Ont., Canada K2K 2A9, Tel: 613-591-0336, FAX: 613-591-0584; FSC No.: 38183; Empl.: 30

OPTO 22, 43044 Business Park Dr., Temecula, CA 92590, Tel: 714-695-9299, FAX: 714-695-2712

PTREX, Asahi Glass, 23399 Commerce B-8, Farmington Hills, MI 48335, Tel: 313-471-6220; Empl.: 25

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FAX: 310-214-1721

PTREX/SATORI, 3830 Del Amo Blvd. Ste. 101, Torrance, CA 90503, Tel: 310-214-1791; Empl.: 12; *Sls. Mgr.:* David Liu; *Dist. Mgr.:* Dave Liu ..... **B•1102-1103**

Local Sales Offices & Reps

Z	Scottsdale, JKA Associates	602-990-8804
A	Santa Clara, Nova-Tronix	408-727-9530
A	Torrance, Satori Elec.	213-378-9478
O	Denver, Aki Entprs.	303-388-4488
O	Denver, AKI Entprs.	303-388-4488
A	Atlanta, Satori Elec.	404-320-8482
R	Portland, Venture Elctrns.	503-624-0617
R	Portland, Venture Elex	503-624-0617
VA	Seattle, Venture Elctrns.	206-454-4594
X	Dallas, Satori Elec.	214-518-1946
VA	Bellevue, Venture Elex.	206-454-4594
VA	Bellvue, Venture Elex	206-454-4594

Local Distributors

A	Buena Park, Cypress Elctrns.	213-744-0355
A	San Diego, Cypress Elctrns.	619-535-0011

CA	San Jose, Sierra West	408-435-7477
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Englewood, Cypress Elctrns.	303-792-5829
OR	Beaverton, Cypress Elctrns.	503-641-2233
OR	Beaverton, I E C	503-641-1690
OR	Beaverton, IEC	503-641-1690
WA	Bellevue, I.E.C.	206-455-2727
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Bothwell, Cypress Elctrns.	206-483-1144

OPTRONIC LABORATORIES, INC., 4470 35th St., Orlando, FL 32811, Tel: 407-422-3171, 800-899-3171, TELEX: 910-240-5263, FAX: 407-648-5412; FSC No.: 59938; Empl.: 36; *Sls. Mgr.:* William A. Schneider, VP of Sls. & Opers.

ORAM High Voltage

FAX: 409-258-5555

ORAM HIGH VOLTAGE, Klemp Road, P.O. Box 1176, Dayton, TX 77535, Tel: 409-258-5553; Empl.: 27; *Sls. Mgr.:* M. Su ..... **D•1852-1853**

ORBIT ADVANCED TECHNOLOGIES, 905 Sheehy Dr. Bldg., Horsham, PA 19044, Tel: 215-674-4220, FAX: 215-674-1102; Empl.: 140; *Sls. Mgr.:* Gerard Matyas

ORBIT INDUSTRIES, Countis Industries, 2670 Lockheed Way, Carson City, NV 89706, Tel: 702-882-6123; Empl.: 11; *Sls. Mgr.:* James T. Countis

ORBIT INSTRUMENT CORP., 80 Cabot Ct., Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122, FAX: 516-435-8458; FSC No.: 11263; *Sls. Mgr.:* Jeanne Szabodas ..... **B•1849; D•1167**

Local Sales Offices & Reps

CA	San Diego, D. Cary	619-222-8839
MA	Tweksbury, Delcon Sls.	508-851-9911

ORBIT INSTRUMENT OF CAL., Orbit Instrument Corp., 5606 Corporate Ave., Cypress, CA 90630, Tel: 714-527-0561, FAX: 714-527-7552; FSC No.: 11263; *Sls. Mgr.:* Graham Vernon ..... **B•1849; D•1167**

Local Sales Offices & Reps

CA	San Diego, D. Cary	619-222-8839

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Local Distributors

AZ	Scottsdale, Tusar	602-998-3688
CA	Garden Grove, Avcom EDA	714-897-0319
CA	San Diego, Insight Elctrns.	619-587-1100
CA	Sunnyvale, Avcom EDA	408-733-5000
FL	W. Melbourne, Trilogic Sunforce	407-722-1324
MA	Wilmington, Trilogic Inc.	508-658-3800
MI	Bloomfield Hills, MacKellar Assocs.	313-335-4440
NJ	Freehold, Beta Lambda, Inc.	908-294-9500
NC	Raleigh, Trilogic Sunforce	919-755-1700
OK	Tulsa, Abcor, Inc.	918-299-1468
TX	Dallas, Abcor, Inc.	214-739-3158
TX	Houston, Abcor, Inc.	713-486-9251
WA	Kirkland, Avcom EDA	206-828-2725

ORCUS, Box 16022, Kansas City, MO 64112, Tel: 913-897-5128, TELEX: 4994037, FAX: 913-897-5468; *Sls. Mgr.:* Manford Eaton

OREGON MICRO SYSTEMS, INC., 1800 N.W. 169th Pl., C100, Beaverton, OR 97006, Tel: 503-644-4999, 503-629-8081, FAX: 503-629-0688; Empl.: 12; *Sls. Mgr.:* Wayne Hunter

ORIEL CORP., 250 Long Beach Blvd., Stratford, CT 06497-0872, Tel: 203-377-8282, FAX: 203-378-2457; Empl.: 120; *Sls. Mgr.:* Thom. Connolly

ORIENTAL MOTOR USA CORP., 2580 W. 237th Street, Torrance, CA 90505-5217, Tel: 310-515-2264, FAX: 310-515-2879; Empl.: 60; *Sls. Mgr.:* 4; *Dist. Mgr.:* Greg Johnston

ORIGINAL ELECTRIC MFG. CO., INC., 123 Lincoln Blvd., Middlesex, NJ 08846, Tel: 908-271-5770, FAX: 908-271-5774

ORION DEVELOPMENT CORP., P.O. Box 2323, Merrifield, VA 22116-2323, Tel: 703-698-8126, 800-992-8170, FAX: 703-698-0857; Empl.: 2; *Sls. Mgr.:* Richard A. Long

ORION INSTRUMENTS, INC., 180 Independence Dr., Menlo Park, CA 94025, Tel: 415-327-8800, 800-767-4666, TELEX: 530942, FAX: 415-327-9881; *Sls. Mgr.:* Eric Mudama

ORLANDO DEVELOPMENT CENTER, Micro Energy Inc., 745 W. State Rd. 434, Longwood, FL 32750-4909, Tel: 407-831-2000, FAX: 407-831-1100; Empl.: 250; *Sls. Mgr.:* Bill Maxwell

ORMEC SYSTEMS CORP., 19 Linden Park, Rochester, NY 14625, Tel: 716-385-3520, FAX: 716-385-5999; Empl.: 50; *Sls. Mgr.:* Gregory Woods

ORTEL CORP., 2015 W. Chestnut St., Alhambra, CA 91803, Tel: 818-281-3636, TELEX: 752434, FAX: 818-281-8231; Empl.: 130; *Sls. Mgr.:* Bill Moore, V.P. of Sls.

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OSCILLATEK, A Dover Technologies Company, 620 North Lindenwood Dr., Olathe, KS 66062, Tel: 913-829-1777; FSC No.: 57693; Empl.: 80; *Sls. Mgr.:* William J. Beck ..... **A•1442-1448**

Local Sales Offices & Reps

AZ	Tempe, Cain Technlg.	602-966-4322
CA	Fahrner-Miller	408-727-9800
CA	Santa Clara, Fahrner Miller Assoc.	916-677-5838
CA	Van Nuys, Cain Technlg.	818-904-9392
CO	Englewood, Cain Technlg.	303-220-8118
CT	Adelco	617-444-4754
FL	Clearwater, Beacon Elctrns.	813-796-2378
GA	Atlanta, Beacon Elctrns.	404-449-8464
IL	RK Elctrns.	708-695-8552
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Gooddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Needham, Addelco Corp.	617-444-4754
MN	Chanhassen, Barnes Sls.	612-934-2907
MO	MTS	314-298-8787
NJ	Spectrum	914-472-8600
NY	Advanced	315-437-6700
NY	Advanced	607-785-3191
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Syracuse, Advanced Comps. Corp.	315-437-6700
OR	Thorson NW	503-293-9001
OR	Portland, Thorson Co. Northwest	503-293-9001
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
TX	Rep-Tec	214-956-8700
TX	Dallas, Rep-Tec	214-956-8700
VA	Alexandria, Mid States Mktg.	703-370-2600
WA	Thorson NW	206-455-9180
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Mississauga, BBD	416-821-7800

OSCILLOQUARTZ, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325, Tel: 818-993-0048, TELEX: 650 2068183, FAX: 818-993-5758; Empl.: 125; *Sls. Mgr.:* Alain Jendly

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OSHINO LAMPS LIMITED, 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, Japan 140, Tel: 03-3471-8548, TELEX: 0242-2117; Empl.: 300; *Sls. Mgr.:* T. Koyama ..... **B•1176-1177**

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OSLO CONTROLS, 328 Industrial Ave., Cheshire, CT 06410-1511, Tel: 203-272-2794; *Sls. Mgr.:* J. J. Martinez **B•1797**

Local Sales Offices & Reps

AZ	Scottsdale, Vikeland Sls.	602-948-7921
AZ	Tempe, Vikeland Sls.	602-839-9370
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Trabuco Canyon, Interconn	714-589-4655
CO	Englewood, CompuTech Mktg.	303-773-3981
CT	Glastonbury, Pace Assocs.	203-659-2266
FL	Maitland, Hawkins-Frederickson	407-831-2474
GA	Atlanta, Overton Assoc.	404-497-0166
IL	Lisle, W-G Controls	708-963-5954
IA	Cedar Rapids, W-G Controls	319-373-1009
MN	St. Paul, Vikeland Sls.	612-645-4647
MO	Creve Coeur, Hill & Co.	314-432-1136
NJ	Englewood, Gray Assocs.	201-894-0894
NJ	Kenvil, Gray Assoc.	201-927-6662
NY	Syracuse, Canavan-Scanlon Assocs., Inc.	315-437-1271
NY	Yaphank, Gray Assoc.	516-924-2471
OH	Cincinnati, O. H. Bromberg & Assocs.	513-771-9333
OR	Lake Oswego, Luscombe Engr.	503-636-6664
PA	Pittsburgh, Catalyst Sls.	412-733-5450
PA	West Chester, All Tech. Mktg.	215-344-0134
TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Dallas, Glidden Electro Equip.	214-341-0610
WA	Bellevue, Luscombe Engr.	206-223-1541
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, LComp., Inc.	602-730-1633
CA	Anaheim, Deco Elctrns., Inc.	714-630-8252
CA	Gardena, California Switch & Signal	1-800-421-2471
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Redwood City, HdB	415-368-1388
CA	San Diego, Deco Elctrns., Inc.	619-693-1595
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Tustin, Western Switches & Controls, Inc.	714-259-8144
CA	Van Nuys, Wes Garde Components	213-873-4802
CO	Aurora, Jet Elctrn. Supp., Co., Inc.	303-364-1000
CT	West Hartford, Wes Garde Components	203-527-7705
FL	Lakeland, A A Elec.	800-237-8274
FL	Lakeland, Wes Garde Components	813-644-7564
IL	Addison, LComp., Inc.	312-628-1400
IL	Carol Stream, Wes Garde Components	1-800-323-9431
IL	Crystal Lake, Sub Sem	815-459-4139
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Overland Park, Wes-Garde	913-262-2718
KS	Wichita, LComp.,Inc.	316-265-5100
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Walpole, Richey Impact	508-668-8200
MI	St. Clair Shores, SPEMCO, Inc.	313-771-2700
MN	Minneapolis, Dot Elctrns.	612-926-9505
MN	Minneapolis, Elctrn. Center, Inc.	612-371-5200
MO	Maryland Hgts., LCOMP, Inc.	800-325-1393
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NJ	Mt. Laurel, Wes Garde Components	609-778-8190
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Woodside, Switches Unltd., Inc.	718-478-5000
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Westerville, Wes Garde Components	614-885-0319
OR	Wilsonville, Wes Garde Comp.	503-682-1333
PA	Exton, USH Elctrns.	215-363-2250
PA	McKean, Advacom	814-476-7774
TX	Dallas, GEECO Sls. Co.	214-341-0610
TX	Dallas, Wes Garde Components	214-357-1768
WI	Grafton, Lakeview Elctrns.	414-377-8250
Can	Downsview, Ont., Westburne Elctrns.	416-635-2950

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OTTO CONTROLS, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, Tel: 708-428-7171; FSC No.: 21649; Empl.: 160; *Sls. Mgr.:* R. E. Sparks **B•1798-1799**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps. Corp.	602-481-0044, FAX:602-481-0072
CA	Anaheim, Gabriel & Assocs.	714-666-0660, FAX:714-666-0753
CA	San Jose, Westron Assocs.	408-264-4070, FAX:408-264-1808
CO	Denver, Advent Comps. Corp.	303-455-1985, FAX:303-455-0900
FL	Orlando, S. Atlantic Comp. Sls.	407-857-3650, FAX:407-857-3298
GA	Alpharetta, Pinnacle Marketing Inc.	404-410-9980, FAX:404-410-9981
IL	Itasca, LTD Technlgs., Inc.	708-773-2900, FAX:708-773-0358
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616, FAX:219-747-3561
KS	Prairie Vlg., Spectrum Sls.	913-648-6811, FAX:913-648-6823
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040,FAX:301-258-5146
MA	Norwell, Norris & Assocs.	617-659-7988, FAX:617-659-8172
MI	Royal Oak, Hilltronics Inc.	313-435-0920, FAX:313-435-3215
MN	Minneapolis, Josco Melius Inc.	612-861-3343, FAX:612-861-3046
MO	Florissant, Spectrum Sls.	314-921-1313, FAX:314-921-0701
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114,FAX:201-440-4623
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300, FAX:609-596-5367
NY	Skaneateles, Empire Technical Assocs.	315-685-5703,FAX:315-685-5979
NC	Raleigh, Pinnacle Mktg., Inc.	919-848-0404, FAX:919-848-0101
OH	Beavercreek, Electro Com (U.S. Gov't. Sls)	513-427-2696,FAX:513-427-2697
TX	Dallas, Control Comps. Corp.	214-458-8877, FAX:214-788-1259
WA	Kirkland, James Findlay Co.	206-822-1510, FAX:206-822-0359
WI	Mequon, Badgerep, Inc.	414-241-9200, FAX:414-241-8300
Can	Etobicoke, Ont., Millennium Mktg.	416-798-3044

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805, FAX:602-275-4807
AZ	Tempe, LCOMP	602-730-1633,FAX:602-831-8757
AZ	Tuscon, Beswitched	602-792-2554
CA	Cupertino, Cal Switch	408-973-7800, FAX:408-725-8885
CA	Gardena, Cal Switch	310-770-2330, FAX:310-327-2741
CA	Hayward, TPS Aviation	510-475-1010, FAX:510-475-8817
CA	Los Angeles, Electric Switches, Inc.	213-660-1310, FAX:213-660-5130
CA	Santa Ana, Norstan Elctrns.	714-540-4165, FAX:714-250-0135
CO	Aurora, Jet Elctrn. Supply Co., Inc.	303-364-1000, FAX:303-364-0800
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
FL	Lakeland, Wes-Garde Comps.	813-644-7564, FAX:813-644-1722
FL	Orlando, Sager Elctrns.	407-354-1130, FAX:407-354-1137
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141,FAX:305-977-4273
GA	Atlanta, Peerless Radio	404-612-9090, FAX:404-612-0242
GA	Norcross, Sager Elctrns.	404-446-0085
IL	Addison, LCOMP	708-628-1400, FAX:708-628-1400
IL	Carol Stream, Wes-Garde Comps. Grp.	708-653-1460,FAX:708-653-1491
KS	Wichita, Airtechnics, Inc.	316-267-2849, FAX:316-267-1482
MD	Columbia, Peerless Radio Corp.	800-225-0709
MD	Columbia, Sager Elctrns.	301-995-4900, FAX:301-381-9380
MD	Kensington, Marine Air Supp.	301-949-9560, FAX:301-942-1536
MD	Owings Mills, Miltech Elctrns.	410-356-3200, FAX:410-356-0967
MA	Hingham, Sager Elec. Supp.	617-749-6700, FAX:617-749-3842
MI	Grand Rapids, RM Elctrns.	616-531-9300, FAX:616-531-2990
MI	St. Clair Shores, Spemco	313-771-2700, FAX:313-771-3491
MO	Kansas City, LCOMP	816-241-0111, FAX:816-241-7373
MO	Maryland Heights, LCOMP	314-291-6200, FAX:314-298-7231
NH	Salem, Sager Electrl. Supply	603-898-1348
NY	Hauppauge, Sager Elctrns.	516-348-1300, FAX:516-348-1006
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, FAX:516-593-2179
NY	Rockville Centre, Advantage Elctrns.	516-678-6956,FAX:516-678-7966
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Dayton, Stotts Friedman/Sager	513-298-5555, FAX:513-298-3046
PA	Mars, Sager Elctrns.	412-772-2233
PA	Philadelphia, Sager Elctrns.	215-464-4336, FAX:215-464-4079
TX	Dallas, Associated Aircraft Supp.	214-331-4381, FAX:214-339-9840
WI	Milwaukee, Progressive Image Inc.	414-321-4722, FAX:414-321-4665
Can	St. Laurent, Que., Ferrotronic Comps. Inc.	514-333-7288,FAX:514-333-2881

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OTTOTEK, IMC, 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900; *Sls. Mgr.:* Otto H. Fest, Jr. **D•1364-1367**

Local Sales Offices & Reps

AZ	Tucson, IMC-OTTOTEK	602-748-7900
MA	Wilbraham, NEDT	413-596-8823
MI	Warren, Burcaw Co.	313-573-4605
MI	Wyoming, Burcaw Co.	616-532-2756
EXP	Tucson, AZ, OTTOTEK, Div. of IMC	602-748-7900

Local Distributors

AL	Birmingham, Brownell Electro, Inc.	205-332-3375
AL	Mobile, Brownell Electro, Inc.	205-479-5406
CO	Aurora, R&R Instrmn.	303-340-8728
CO	Denver, Brownell Electro, Inc.	303-333-3541
FL	Miami, Brownell Electro, Inc.	305-884-3197
FL	Orlando, Brownell Electro, Inc.	407-843-6771
GA	Forest Pk., Brownell Electro, Inc.	404-362-9009
IL	Chicago, Data Elctrns.	312-283-0674
IL	Wood Dale, Brownell Electro, Inc.	708-616-8770
MA	Woburn, Brownell Electro, Inc.	617-935-7820
MN	Edina, Brownell Electro, Inc.	612-942-8172
MO	Manchester, Universal Precision Instrs.	314-394-4693
NJ	Edison, Brownell Electro, Inc.	908-287-203
NY	New York, Brownell Electro, Inc.	212-924-600
NY	Rochester, Masline Elctrns.	716-546-537
NC	Charlotte, Brownell Electro, Inc.	704-597-127
NC	Raleigh, Brownell Electro, Inc.	919-876-652

OR	Portland, Brownell Electro, Inc.	503-226-3286
PA	Bridgeville, Brownell Electro, Inc.	412-221-0075
PA	Trevose, Brownell Electro, Inc.	215-364-1401
SC	Columbia, Brownell Electro, Inc.	803-772-6111
TN	Knoxville, Brownell Electro, Inc.	615-966-3441
TN	Nashville, Brownell Electro, Inc.	615-885-1302
TX	Grand Prairie, Brownell Electro, Inc.	214-988-0821
TX	Lubbock, Brownell Electro, Inc.	806-747-0211
UT	Salt Lake City, Brownell Electro, Inc.	801-262-8498
VA	Bluefield, Brownell Electro, Inc.	703-322-3402
VA	Norfolk, Brownell Electro, Inc.	804-855-2400
EXP	Tucson, AZ, OTTOTEK Div. of IMC	602-748-7900
Can	Brampton, Ont., Mod-Tronic Inst. Ltd.	416-457-6322
Can	Burlington, Ont., Tempotech Controls	416-336-3400
Can	Langley, B.C., Valax Ltd.	604-530-3189
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

OUPIIN AMERICA, INC., 65 W. Easy Street 201, Simi Valley, CA 93065, Tel: 805-520-0862, FAX: 805-520-0864; *Sls. Mgr.:* Randy Ryan

OUTLAND TECHNOLOGY INC., 1808-B Faith Pl., Gretna, LA 70056, Tel: 504-367-0104, FAX: 504-367-6754; Empl.: 4; *Sls. Mgr.:* George J. Mayfield; *Dist. Mgr.:* George J. Mayfield

OVENAIRE-AUDIO-CARPENTER, Oak Crystal Inc., 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 910-997-8053, FAX: 804-295-7265; FSC No.: 12020; Empl.: 190; *Sls. Mgr.:* Robert J. Mete

OVEN INDUSTRIES, 207 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055, Tel: 717-766-0721, FAX: 717-766-4786; FSC No.: 21302; Empl.: 48; *Sls. Mgr.:* T. M. Nolan

OXLEY INC., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, Tel: 203-488-1033, FAX: 203-481-6971; FSC No.: 3R006; *Sls. Mgr.:* Carol Carr

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Local Sales Offices & Reps

CT	Wallingford, Com Sls.	203-269-8252
MA	Needham, Com Sls.	617-444-8071

Local Distributors

CT	Danbury, Pilgrim	203-792-7274
FL	Melbourne, T. C. Pridmore	305-727-2491
IL	Hillside, Schuten Elctrns.	312-449-5430
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, M.A.R. Elctrns.	317-633-6699
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MI	Farmington Hills, Advent Elctrns.	313-477-1650
NH	Atkinson, Astrum Elctrns.	603-898-3399
NH	Salem, Diamond Elctrns.	603-894-4420
TX	Richardson, CTC	214-437-2211
WI	Neguon, Lakeview	414-377-8250
WA	Redmond, Priebe Elctrns.	800-426-9911

PACE, INC., 9893 Brewers Ct., Laurel, MD 20723-1990, Tel: 301-490-9860, TELEX: 198296, FAX: 301-498-3252; *Sls. Mgr.:* James K. Bausell

PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, FAX: 715-723-7890; FSC No.: 60162; Empl.: 7; *Sls. Mgr.:* Patrick Brennan; *Dist. Mgr.:* Patrick Brennan

PACER SYSTEMS, INC., 900 Technology Park Dr., Billercia, MA 01821, Tel: 508-667-8800, FAX: 508-663-5155; Empl.: 325; *Sls. Mgr.:* E. Childress

PACIFIC ATLANTIC ELCTRNS., Patronix, Inc., Box 754, El Cerrito, CA 94530, Tel: 510-237-5837, FAX: 510-524-9267; Empl.: 4; *Sls. Mgr.:* P. Yen; *Dist. Mgr.:* P. Yen

PACIFIC COAST CIRCUITS, INC., 189 Granada Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881, FAX: 805-544-6475; FSC No.: 66107; Empl.: 18; *Sls. Mgr.:* Chris Cofer

PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 310-532-6600, FAX: 310-532-5044; Empl.: 1000; *Sls. Mgr.:* Alan Manzo; *Dist. Mgr.:* Alan Manzo

PACIFIC ELECTRO DYNAMICS, INC., 11465 Willows Rd. N.E., Redmond, WA 98073-9745, Tel: 206-881-1700, TWX: 910-449-2977; Empl.: 420

PACIFIC INDUSTRIAL COMPONENTS CORP., See Altair Exchange Corp.

PACIFIC INDUSTRIAL COMPONENTS CORP., 24907 Avenue Tibbets Unit-C, Valencia, CA 91355, Tel: 805-257-7901, FAX: 805-257-6490; *Sls. Mgr.:* Ray Pross .... **B•1104**

Local Sales Offices & Reps

IL	Elk Grove Village, Pacific Comps.	708-228-0030

PACIFIC INSTRUMENTS INC., 215 Mason Circle, Concord, CA 94520, Tel: 510-827-9010, FAX: 510-827-9023; Empl.: 30

PACIFIC MICROCOMPUTERS, Fairway Optical Data Sys., Inc., 2440 Grand Ave. Ste. C, Vista, CA 92083, Tel: 619-727-9494, FAX: 619-727-9499; Empl.: 15; *Sls. Mgr.:* Guy Halac

PACIFIC MICROTRONICS CORP., 435 E. 79th St., New York, NY 10021, Tel: 212-517-5622, FAX: 212-517-5516; *Sls. Mgr.:* S. Miliziano; *Dist. Mgr.:* E. Dietz

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433, FAX: 714-891-1928; FSC No.: 57148; Empl.: 50; *Sls. Mgr.:* Russ Engle .... **D•2286-2290**

Local Sales Offices & Reps

AZ	Zeus Elctrns., Inc.	602-285-9126
AL	Huntsville, W A Brown Instrs.	205-830-9224
AZ	Phoenix, Zeus Elctrns. Inc.	602-263-6022
CA	Santa Clara, Amasco Corp.	408-987-7760
CA	Torrance, Amasco Corp.	310-781-9494
CO	Wheatridge, Zeus Elctrns., Inc.	303-321-4246
CT	Mt. Carmel, Sci. Dvcs.	203-248-9361
FL	Melbourne, W.A. Brown Instrs.	407-723-0766
FL	Orlando, W.A. Brown Instrs.	407-648-9660
GA	Norcross, W.A. Brown Instrs.	404-449-7160
ID	East, Zeus Elctrns., Inc.	800-528-4512
ID	West, Westcon Inc.	800-547-4515
IL	Elmhurst (N), Sector Eng. Sls. Inc.	708-530-7850
IN	Indianapolis, Sector Eng. Sls., Inc	317-253-9221
KS	Merriam, TecRep Corp.	913-262-9500
MA	Waltham, Sci. Dvcs.	617-890-2252
MI	Plymouth, EQS Sys.	313-455-7920
MN	Minnetonka, Elctrn. Instrs.	612-933-7793
MO	St. Louis, TecRep Corp.	314-454-9110
MT	Zeus Elctrns., Inc.	800-528-4512
NV	Zeus Elctrns., Inc.	800-528-4512
NY	Liverpool, Northern Tech. Sls. Assocs., Inc.	315-451-1091
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OH	Dayton, EQS Sys.	513-236-7676
OR	Portland, Westcon	503-283-0132
PA	Huntingdon Valley, Sci-Rep Inc.	215-322-6500
PA	Wexford, EQS Sys.	412-935-0455
TX	Richardson, Beacon Microwave	214-437-1505
TX	Round Rock, Beacon Microwave	512-244-6675
UT	Salt Lake City, Zeus Elctrns. Inc.	801-534-0500
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Kent, Westcon, Inc.	206-824-8922
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280
WY	Zeus Elctrns., Inc.	800-528-4512

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, FAX: 818-345-1507; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt ... **A•2006-2009**

Local Sales Offices & Reps

CA	San Jose, Comtech Mktg.	408-294-5448

Local Distributors

CA	San Jose, Comtech Mktg.	408-294-5448

PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61109, Tel: 815-226-3100, TELEX: 386743, FAX: 815-226-3122; Empl.: 350; *Dist. Mgr.:* Robert E. Burke

PACIFIC SCIENTIFIC, Electro Kinetics Division, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 210; *Sls. Mgr.:* Robert E. Lynch

PACIFIC TRANSDUCER CORP., 2301 Federal, Los Angeles, CA 90064-1482, Tel: 310-478-1134, FAX: 310-312-0826; Empl.: 22; *Sls. Mgr.:* Laura Barba

PACIFIC TRANSFORMER CORP., 4729 E. Wesley Dr., Anaheim, CA 92807, Tel: 714-779-0450, 1-800-325-0501, FAX: 714-779-0718; FSC No.: 66827; Empl.: 85; *Sls. Mgr.:* Bill Chidester

PACKAGING PLUS, INC., 5800 Main Steet NE, Minneapolis, MN 55432, Tel: 612-574-9909, FAX: 612-574-1441; Empl.: 25; *Sls. Mgr.:* Mike Hickman

PACKARD ELECTRIC, General Motors, P.O. Box 431, Warren, OH 44486, Tel: 216-373-2121, 1-800-PACKARD, FAX: 216-759-6195; Empl.: 64,000; *Sls. Mgr.:* George A. Kralovich, Dir. Sls. Engrg.

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PACTEC CORP., LAFRANCE CORP., 8425 Executive Ave., Philadelphia, PA 19153, Tel: 215-365-8400; Empl.: 250; *Sls. Mgr.:* Brian McHenry; *Dist. Mgr.:* Edward Fitzpatrick .... **C•1002, 1062-1068**

Local Sales Offices & Reps

AL	Madison, Scott Ray	205-464-0370
CA	Anaheim, Jonathan Winters	714-779-8092
CA	San Jose, Michael Bennett	510-625-6068
FL	Palm Harbor, Roger Hauck	813-784-7895
IL	Bolingbrook, John Nelson	708-852-9908
MA	South Easton, Maurice Raymond	508-238-9283
EXP	Philadelphia, PA, PacTec Export Sls. Dept.	215-365-8400
NC	Thomasville, Keith Pierce	919-869-0130
OH	Perrysburg, Bruce Brown	419-874-1110
PA	Philadelphia, Jim Bowdler	215-365-8400
TX	Dallas, Craig Ladue	214-340-6288
WA	Seattle, Mike Werttemberger	206-481-0998
WI	Appleton, Ed Sabish	414-731-7212

Local Distributors

AL	Birmingham, American Elctrns. Supp.	205-942-4656
AZ	Phoenix, Tri-Tek	602-371-0860
AZ	Tucson, Elctrn. City	602-662-1173
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Gardena, California Switch & Signal	800-225-7924
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Jose, Quement Elctrns.	408-998-5355
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Santa Clara, Force Elctrns.	408-748-1342
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CO	Aurora, Jet Elctrns.	303-364-1000
CO	Littleton, Display's Plus	303-730-7333
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, Sager Elec. Supp.	203-265-6865
FL	Largo, Electronic Precepts of FL	800-367-4649
FL	Orlando, Sager Elec. Supp.	407-354-1130
GA	Norcross, American Elctrn. Supp.	800-562-8740
GA	Norcross, Sager Elec. Supp.	404-446-0085
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove, Martec Assocs.	708-956-8090
IL	Mt. Prospect, Tri State Elctrns.	708-255-0600
IL	Northbrook, Classic Comps.	708-291-0019
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Meunier Elctrns.	317-635-3511
KS	Overland Park, Olive Elctrns.	913-362-1923
MD	Beltsville, P.S.I.	800-333-5292
MD	Columbia, Sager Elec. Supp.	410-995-4900
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Westborough, In-Stock Products Co.	800-225-3018
MI	Grand Rapids, S. F. Elctrns.	616-459-0216
MI	Livonia, RS Elctrns.	313-525-1155
MN	Minneapolis, Berquist	612-835-2322
MN	Roseville, Parts I	612-633-8079
MO	Kansas City, Walters Indl. Elctrns.	816-531-7015
MO	Maryland Hts., Olive Elctrns.	314-997-7709
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Salem, Sager Elctrl. Supp.	603-898-1348
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
NY	Buffalo, Summit Distr.	716-887-2899
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Sager Elec. Supp.	516-348-1300
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
NY	Rochester, Summit Distr.	716-334-8110
NC	Raleigh, Sager Elec. Supp.	919-850-9550
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Roberts Elctrns.	216-238-1711
OH	Columbus, Hughes-Peters	614-294-5351
OK	Tulsa, Radio Inc.	918-587-9123
OR	Portland, Radar Elec.	503-232-3404

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PA	Exton, VSH Elctrns.	215-363-2250
PA	Mars, Sager Elec. Supp.	412-772-2233
PA	Philadelphia, Sager Elec. Supp.	215-464-4336
TX	Dallas, Force Elctrns.	214-247-9955
TX	Ft. Worth, Allied Elctrns.	800-433-5700
TX	Ft. Worth, Tandy Natl. Pts.	800-322-3690
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
TX	Richardson, Off-the-Shelf Comps.	214-247-0052
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Burnaby, BC, Intek Elctrns.	604-294-8100
Can	Kingston, Ont., Elctrn. Packaging Sys.	613-384-1142
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Vancouver, BC, Future Elctrns.	604-294-1166

PADS SOFTWARE, INC., 119 Russell St., Littleton, MA 01460, Tel: 508-486-9521, FAX: 508-486-8217; Empl.: 46; *Sls. Mgr.:* Donna Andersson, Telesls. Mgr.; *Dist. Mgr.:* Sandra Jarry, Dir. of Sls., N.A.

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, FAX: 206-329-1615; FSC No.: 13624; Empl.: 96; *Sls. Mgr.:* John Sagvold, Steve Evans

PAKTRON, See ITW Paktron

PAKTRONICS CONTROLS, INC., P.O. Box 185669, Ft. Worth, TX 76181, Tel: 817-284-5241, FAX: 817-284-1712; Empl.: 30; *Sls. Mgr.:* Arthur B. Vega

PALOMAR ENGINEERS, Box 462222, Escondido, CA 92046, Tel: 619-747-3343, FAX: 619-747-3346; Empl.: 9

PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999, FAX: 414-637-2303; FSC No.: K 8-67203; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02154-3497, Tel: 617-899-2719, TELEX: 6817337, TWX: 951006, FAX: 617-899-1552; Empl.: 200; *Sls. Mgr.:* Bob Mel

PANASONIC FACTORY AUTOMATION CO., Matsushita Elect. Corp. of America, 9377 W. Grand Ave., Franklin Park, IL 60131, Tel: 708-288-4471, FAX: 708-288-4430

Panasonic
Industrial Company

FAX: 201-392-4782

PANASONIC INDUSTRIAL CO., Battery Sales GP, Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 .... **D•1457**

Local Sales Offices & Reps

CA	Glendale, Halbar Assocs. Inc.	818-906-3941
CA	San Diego, Tauber & Assocs.	619-274-7242
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555

Local Distributors

AL	Huntsville, Resistacap Inc.	205-883-4270
AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	San Diego, Tauber Elctrns. Inc.	619-274-7242
CA	San Jose, Rose Elec. Distrbg. Co.	408-943-0440
CA	Santa Clara, Cypress Elctrns. Inc.	408-980-2500
CA	Van Nuys, NESCO	818-781-0505
CO	Littleton, AVT	303-798-1958
FL	St. Petersburg, Micro Precision	813-854-2861
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Morton Grove, Power Pak Inc.	708-966-6000
IL	Palatine, Ohm Elctrns.	708-359-5500
MD	Beltsville, Mark Elctrns.	301-792-0072
MA	Canton, Impact Sls. Co. Inc.	508-668-8200
MI	Danvers, Generation Elctrns. Inc.	508-683-1177
MA	Sutton, Engrd. Assemblies, Inc.	508-865-0722
MI	Brighton, Applied Power Inc.	313-227-3604
MN	Thief River Falls, Digi-Key	800-344-4539
MN	Minneapolis, Stark Elctrns. Supp. Inc.	612-332-1325
NJ	Clifton, Engineered Assem.	201-288-4477
NC	Raleigh, Engrd. Assemblies Inc.	919-790-9700
OH	Columbus, Hughes-Peters	614-294-5351
OH	Columbus, Promark Elctrns. Inc.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Dallas, Computer Comps. Corp.	214-239-0271
TX	Dallas, Norvell Elctrns. Inc.	214-233-0020
TX	Fort Worth, Allied Elctrns.	817-595-3500
WI	Fond Du Lac, Fedco Elctrns., Inc.	414-922-6490
WI	Mequon, Taylor Elec. Co.	414-241-4321

PANASONIC INDUSTRIAL COMPANY, Custom Peripheral Dept., Two Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-6313, FAX: 201-348-7849; *Dist. Mgr.:* Edmund Silvia Jr., Prod. Mgr.

PANASONIC INDUSTRIAL CO., 1616 McCandless Dr., Milpitas, CA 95035, Tel: 408-946-7200, FAX: 408-946-3753

PANASONIC INDL. CO. STANDARD COMPS. SECTOR, Matsushita Elec. Corp. of America, Two Panasonic Way Panazip: 7H-4, Secaucus, NJ 07094, Tel: 201-392-4818, FAX: 201-392-6263; FSC No.: 54473; Empl.: 60; *Sls. Mgr.:* Hank Miyai; *Dist. Mgr.:* Dick Robert

PANAVISE PRODUCTS, INC., 1485 Southern Way, Sparks, NV 89431, Tel: 702-353-2900, FAX: 702-353-2929; Empl.: 35; *Sls. Mgr.:* Mark Thorsell; *Dist. Mgr.:* Mark Thorsell

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 800-777-3300, FAX: 708-532-1811; FSC No.: ;06383; Empl.: 2000

PANEL
COMPONENTS
CORPORATION

FAX: 800-645-5360

PANEL COMPONENTS CORP., 100 Interpower Ave., Oskaloosa, IA 52577, Tel: 515-673-0097; Empl.: 30 ..... **A•2443; B•1376-1377; C•1426-1438, 1793-1801; D•2291**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg. Inc.	205-536-9775
AZ	Phoenix, C.T. Carlberg & Assoc.	602-468-0750
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
CO	Englewood, Omega Ltd.	303-762-1921
FL	Altamonte Springs, DHR Mktg. Inc.	407-331-1199
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Northbrook, Raines & Assocs.	708-498-0890
IN	Indianapolis, Rockford Controls	317-846-7415
IA	Marion, M-S-B Assocs., Inc.	319-377-6261
KS	Roeland Park, M-S-B Assocs., Inc.	913-432-2131
MD	Frederick, Glasscock Assoc.	301-694-5048
MA	Scituate, Olsen Tech. Sls.	617-545-5101
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Louis, M-S-B Assocs., Inc.	314-946-5577
NJ	Kenvil, CFE/Gray	201-927-6662
NM	Albuquerque, C.T. Carlberg & Assoc.	505-899-2155
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Medina, Rockford Controls	216-725-3705
OR	McMinnville, Electro-Design	503-472-0481
PA	Philadelphia, Eastern Sci. Mktg.	215-368-4570
PA	Pittsburg, Rockford Controls Ohio	412-331-0306
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TN	Nashville, DHR Mktg.	615-331-2745
TX	Lewisville, Jim Hughes Co.	214-221-1536
VA	Ashland, Glasscock Assoc.	804-798-2125
WA	Redmond, Electro-Design	206-867-9300
EXP	Burnaby, B.C., Darmac Agencies, Ltd.	604-520-7121
Can	Ottawa, Ont., Ellam & Assoc.	613-727-3892

PANELTEC, 3307 Edward Ave., Santa Clara, CA 95054, Tel: 408-496-1175, FAX: 408-970-1277; Empl.: 105; *Sls. Mgr.:* Daniel Johnston

PAN INTERNATIONAL (USA), INC., 9477 E. Archibald Ave., Rancho Cucamonga, CA 91730, Tel: 909-945-1365, FAX: 909-989-9935; Empl.: 24; *Sls. Mgr.:* Barry Park; *Dist. Mgr.:* Barry Park, Natl. Sls. Mgr.

PAN-MAGNETICS, See Tamura Corp. of America

PAPST
PAPST MECHATRONIC CORPORATION

FAX: 401-849-4640

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-8810; Empl.: 30 .... **C•1633-1637**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Phoenix, O'Donnell Assocs. SW	602-944-9542
CA	Dana Point, Papst Mechatronic Corp.	714-661-1447
CA	Los Gatos, Luscombe Engrg. Co of San Francisco	408-370-2020
CA	Montrose, Luscombe Engrg. Co. of So. Calif.	818-249-9000
CA	Mountain View, Papst Mechatronic Corp.	415-903-9311
CA	San Diego, Luscombe Engrg. Co. of So. Calif.	619-689-0018
CO	Englewood, Quorum 3	303-799-8100
CT	Meriden, Delta Conn	203-634-8558
FL	Altamonte Springs, Over & Over, Inc.	407-332-1222
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Arlington Heights, Brainard-Nielsen Mktg.	708-437-2700
IL	Arlington Heights, Papst Mechatronic Corp.	708-981-1404
IL	Arlington Hgts., Brainard-Nielsen Mktg.	708-437-2700
IA	Marion, MSB Assocs. Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MA	Framingham, Papst Mechatronic Corp.	508-875-8986
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NJ	Kenvil, C.F.E. Gray Assocs., Inc.	201-927-6662
NM	Albuquerque, Reptronix, Ltd.	505-292-1718
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NY	Yaphank, C.F.E. Gray Assocs., Inc.	516-924-2471
NC	Charlotte, Over & Over, Inc.	704-542-9111
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Venture Elctrns.	503-624-0617
PA	Knoxville, Trinkle Sls., Inc.	215-922-2080
RI	Newport, Papst Mechatronic Corp. Hq.	401-849-8810
TX	Dallas, JYSCO/Comps., Inc. (except El Paso)	214-349-1650
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Manitowoc, Brainard-Nielsen Mktg.	414-682-1201

PARADIGM TECHNOLOGY, INC., 71 Vista Montana, San Jose, CA 95134, Tel: 408-954-0500, FAX: 408-954-8913

PARAGON ELECTRIC CO., INC., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, TELEX: 26-3450, FAX: 414-793-3736; Empl.: 500; *Sls. Mgr.:* Don Karman

PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222, FAX: 818-281-5867; FSC No.: 59465 .... **A•2444**

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112-1290, Tel: 800-272-7537, 800-C-PARKER, TELEX: 980636; Empl.: 26,669

PARKER HANNIFIN CORPORATION, Compumotor Division, 5500 Business Park Drive, Rohnert Park, CA 94928, Tel: 707-584-7558, FAX: 707-584-8015

PARKER HANNIFIN CORP., Daedal Div., P.O. Box 500, Sandy Hill Road, Harrison City, PA 15636, Tel: 412-744-4451, FAX: 412-744-7626; *Sls. Mgr.:* R. Mitchell; *Dist. Mgr.:* R. Mitchell

PARKER HANNIFIN CORP., Hose Products Division, 30240 Lakeland Blvd., Wickliffe, OH 44092, Tel: 216-943-5700, FAX: 216-943-7088

PARKER HANNIFIN CORPORATION, Hydraulic Valve Division, 520 Ternes Ave., Elyria, OH 44036-2026, Tel: 216-366-5200, FAX: 216-366-5253

PARKER HANNIFIN CORP., Instrumentation Connectors Div., 9400 S. Memorial Pkwy., Huntsville, AL 35802, Tel: 205-881-2040, FAX: 205-881-5730

PARKER HANNIFIN CORP., Parflex Div., 1300 N. Freedom Street, Ravenna, OH 44266, Tel: 216-296-2871, FAX: 216-296-8433

PARKER HANNIFIN CORP., Pneumatic Division, 8676 E M-89, Richland, MI 49083, Tel: 616-629-5000, FAX: 616-629-5385

PARKER HANNIFIN CORP., Refrigerating Specialties Division, 2445 South 25th Ave., Broadview, IL 60153, Tel: 708-681-6300, FAX: 708-681-6306

PARKER HANNIFIN CORPORATION, Rotary Actuator Division, 135 Quadral Dr., Wadsworth, OH 44281-0450, Tel: 216-336-3511, TELEX: 216-334-3335

PARKER HANNIFIN CORP., Schrader Bellows Division, 257 Huddleston Avenue, Cuyahoga Falls, OH 44221, Tel: 216-923-5202, FAX: 1-800-426-3259

PARKER HANNIFIN CORPORATION, Seal Grp., 18321 Jamboree Rd., Irvine, CA 92715, Tel: 714-833-3000, FAX: 714-851-2127

PARKER HANNIFIN CORP., Tube Fittings, 3885 Gateway Blvd., Columbus, OH 43228, Tel: 614-279-7070, FAX: 614-279-7685

PARLEX CORPORATION, 145 Milk St., Methuen, MA 01844, Tel: 508-685-4341, FAX: 508-685-8809; FSC No.: 18377; Empl.: 375; *Sls. Mgr.:* Robert D. Cyr

SINCE 1922

FAX: 718-774-0583

PAR METAL PRODUCTS, INC., Par Industrial Complex, 1246 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI ATTN:PAR; FSC No.: 3449;3469; Empl.: 100; *Sls. Mgr.:* J. Troiano .... **C•1069**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* S. Wurzer

PARSYTEC INC., Bldg. 9, Unit60, 245 W. Roosevelt Rd., West Chicago, IL 60185, Tel: 708-293-9500, FAX: 708-293-9525; Empl.: 7; *Sls. Mgr.:* Reinhard Rinn

PARVEX SERVO SYSTEMS, GEC Alsthom International, Inc., 4 Skyline Dr., Hawthorne, NY 10532, Tel: 914-345-5150, FAX: 914-345-5295

PASO SOUND PRODUCTS, 14 First St., Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 18; *Sls. Mgr.:* Ken O'Brien

PASS & SEYMOUR CANADA, INC., Legrand, 448 North Rivermede Rd., Concord, Ont L4K 3M9, Tel: 416-738-9195, FAX: 416-738-9721; Empl.: 40; *Sls. Mgr.:* Dennis Conard

PASS & SEYMOUR/LEGRAND, Pass & Seymour/Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232, FAX: 315-468-6305; Empl.: 1700; *Sls. Mgr.:* Sergio Palluci, Sls. Mgr./Kristin Northrop, Prod. Mgr.

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920, FAX: 714-261-7451; FSC No.: 53919; *Sls. Mgr.:* Elayne Wilson

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 45; *Sls. Mgr.:* F. Spunzo

PAVE TECHNOLOGY CO., INC., 2751 Thunderhawk Ct., Dayton, OH 45414-3445, Tel: 513-890-1100, FAX: 513-890-5165; Empl.: 35

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452, FAX: 304-757-7305; Empl.: 40; *Sls. Mgr.:* R. B. Vogelbach

PCA ELECTRONICS, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Nand Aggarwal ..... **A•1572-1575, 1668-1671; D•1854-1856**

Local Sales Offices & Reps

AL	Huntsville, Southeast Tech. Grp.	205-534-2376
AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Mission Viejo, Ramsey & Assocs.	714-380-7757
CA	San Diego, Ramsey & Assocs.	619-451-8865
CA	San Jose, Arnold Techn. Sls.	408-954-0400
FL	Clearwater, Sunland Assocs.	813-536-2955
FL	Goldenrod, Sunland Assocs.	305-365-9533
FL	Lauderhill, Sunland Assoc.	305-561-1303
GA	Lawrenceyille, Southeast Tech. Grp.	404-979-2055
IL	Elk Grove, W.G. Brouillette	708-290-1313
MA	Sudbury, KSA of New England	508-443-5881
MN	Bloomington, Bill Deming and Assocs.	612-888-5000
MS	Meridan, Southeast Tech. Grp.	601-485-7055
NC	Zebulon, Southeast Tech. Grp.	919-269-5589
OH	Beavercreek, Electro-Com	513-427-2696
OH	Mansfield, Electro-Com	419-756-5846
OR	Beaverton, Elctrn. Comp. Sls.	503-245-2342
PA	Exton, Linear Sls.	215-524-8080
TX	Richardson, Blackburn Assocs.	214-238-8181
UT	Salt Lake City, Luscombe Engrg.	801-268-3434
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Sherman Oaks, DLDI-Delay Lines Distrs.	818-986-9455
MA	Sudbury, ASK Elctrns.	508-443-5881
PA	Exton, VSH Elctrns.	215-363-2250

P.C. BOARDS, INC., 210 West Main, Chanute, KS 66720, Tel: 316-431-0406, FAX: 316-431-2013; Empl.: 73; *Sls. Mgr.:* Greg Bilyeu

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371, FAX: 716-684-0987; Empl.: 210

PCD, 2 Technology Dr., Peabody, MA 01960, Tel: 508-532-8800, FAX: 508-532-6800; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

Local Sales Offices & Reps

AL	Huntsville, REP, Inc.	205-881-9270
AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	San Diego, Qualtronics, Inc.	619-695-0118
CA	San Jose, Kottmeier Assocs., Inc.	408-371-8700
CA	Woodland Hills, Precision Connector Designs, Inc.	818-884-7171
FL	Tampa, APM Assocs.	813-886-2457
GA	Tucker, REP, Inc.	404-938-4358
IL	Elk Grove Vlg., Control Sls.	708-595-2110
MA	Sharon, S & Y Elctrns., Inc.	617-784-6437
MN	Minneapolis, Electro-Tech Assocs., Inc.	612-853-0242
MO	St. Louis, Harris Hanson	314-432-3611
NC	Morrisville, REP, Inc.	919-469-9997
OH	Miamisburg, Elctrn. Comps., Inc.	513-866-3340
PA	Harrisburg, All-Tech Mktg., Inc.	717-540-1204
PA	West Chester, All-Tech Mktg., Inc.	215-344-0134
TN	Jefferson City, REP, Inc.	615-475-9012
TX	Irving, AID Elctrns.	214-790-4761
WI	Brookfield, Control Sls.	414-797-9500

P C EXPRESS, INC., 15103 U.S. Hwy. 19, Hudson, FL 34667, Tel: 813-863-6114; Empl.: 15

PCI LTD., 1530 Parkmoor Ave.-Ste. A, San Jose, CA 95128, Tel: 408-282-0200, FAX: 408-282-0216; Empl.: 2500; *Sls. Mgr.:* Mike Clarke; *Dist. Mgr.:* Jane Campbell

PCK ELASTOMERICS, INC., See Elastomeric Technologies, Inc.

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 15; *Sls. Mgr.:* Stanley L. Goldstein .... **A•2445-2453**

PDS TECHNOLOGIES, See Power-Pac

PEARL TECHNOLOGY, 2988-A Scott Blvd., Santa Clara, CA 95054, Tel: 408-996-9823, FAX: 408-253-2287

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 16; *Sls. Mgr.:* Stacey Evensen .... **A•2454**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550, FAX: 215-639-3545; Empl.: 30; *Sls. Mgr.:* Joanne Fields

THE PEDRO COMPANIES, 104 E. 10th St., St. Paul, MN 55101, Tel: 612-224-9491, FAX: 612-224-8674; Empl.: 1000; *Sls. Mgr.:* Douglas Bieniek

PENBERTHY, INC., 320 Locust St., Prophetstown, IL 61277, Tel: 815-537-2311, TWX: 257-339 PMCO PRWN, FAX: 815-537-5764; Empl.: 160

PENN ENGINEERING & MANUFACTURING CORP., 5190 Old Easton Rd. PO Box 1000, Danboro, PA 18916, Tel: 215-766-8853, 800-237-4736, FAX: 215-766-0143; FSC No.: CAGE 46384; Empl.: 950; *Sls. Mgr.:* John E. O'Brien; *Dist. Mgr.:* Ed Soorikian

PENN KEYSTONE CORP., 30 N. Plains Ind. Ste.13, Wallingford, CT 06492, Tel: 203-294-0537, FAX: 203-294-0361; FSC No.: 03034; *Sls. Mgr.:* Robert Ginter

PENN-TRAN CORP.,SUB. OF SPECTRUM ELCTRNS. INC., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, FAX: 814-355-1524; FSC No.: 50783; Empl.: 80; *Sls. Mgr.:* Jeffrey Krauss **A•1260-1261; D•1857**

Local Sales Offices & Reps

CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Pasadena, A-F Sls. Engrg., Inc.	909-599-4412
MA	Medfield, Nortech	508-359-6063
MN	Minneapolis, International Sls. Co.	612-831-8423
NC	Raleigh, Arthur Harris	919-460-8660
OR	Portland, Intertech Sls.	503-775-7885
PA	Glenside, Koebert Assocs., Inc.	215-887-2310
TX	Dallas, Seaton Corp.	214-980-9860

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 310-393-1497, FAX: 310-393-6040; *Dist. Mgr.:* Rose Riedel Prod. Mgr.

Penny+Giles

FAX: 508-226-5208

PENNY & GILES CONTROLS, INC., 163 Pleasant St., Attleboro, MA 02703, Tel: 508-226-3008; Empl.: 10; *Sls. Mgr.:* Dean T. Bushy **A•2115**

PENNY & GILES DATA SYSTEMS, INC., 1250 Northmeadow Pkwy., Ste. 114, Roswell, GA 30076, Tel: 404-740-0415, FAX: 404-740-0420

PENNY TECHNOLOGIES, INC., 78 Kingsland Ave., Greenpoint, NY 11222, Tel: 718-782-4149, FAX: 718-963-2930; Empl.: 54; *Sls. Mgr.:* Jack Russell

PENRIL DATACOMM NETWORKS, 1300 Quince Orchard Blvd., Gaithersburg, MD 20878, Tel: 301-921-8600, FAX: 301-921-8376; Empl.: 240

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, 800-PENSTOCK, FAX: 408-730-4782; Empl.: 60; *Sls. Mgr.:* Ken Wadors; *Dist. Mgr.:* Ken Wadors

Local Distributors

CA	Penstock Southern CA	1-800-PENSTOCK
CA	Sunnyvale, Penstock, Inc.	408-730-0300
CO	Penstock Rocky Mtn. Desert States	1-800-PENSTOCK
DE	Penstock Mid-Atlantic	1-800-PENSTOCK
FL	Penstock Florida	1-800-PENSTOCK
GA	Penstock South	1-800-PENSTOCK
IL	Penstock Midwest	1-800-PENSTOCK
MA	Penstock New England	1-800-PENSTOCK
NJ	Penstock East	1-800-PENSTOCK
TX	Penstock Texas	1-800-PENSTOCK
WA	Penstock Northwest	1-800-PENSTOCK
Can	Penstock Canada	1-800-736-7862

PENTA LABORATORIES, INC., 21113 Superior St., Chatsworth, CA 91311, Tel: 818-882-3872, 800-421-4213, TELEX: 95-4295 798, FAX: 818-882-3368; Empl.: 50; *Sls. Mgr.:* Richard Sanett

PENTICA SYSTEMS, INC., 19A Crosby Dr., Bedford, MA 01730, Tel: 617-275-4419, FAX: 617-275-6514; FSC No.: 04-2978461; Empl.: 6; *Sls. Mgr.:* Pete Kurpis

PERCON, INC., 1720 Willow Creek Circle, Ste. 530, Eugene, OR 97402-9153, Tel: 1-800-8-PERCON, 503-344-1189, FAX: 503-344-1399; Empl.: 32; *Sls. Mgr.:* Sls. Dept.; *Dist. Mgr.:* Doug Wilson, Dir. Mktg./Sls.

PERFECT GEAR & INSTRUMENT, Designatronics, Inc., 2101 Jericho Tpke, Box 5416, New Hyde Park, NY 11042-5416, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., See Magnetic Shield Corp.

PERFORMANCE CONTROLS, INC., 433 Caredean Drive, Horsham, PA 19044, Tel: 215-675-6500, TELEX: 88-1478, FAX: 215-674-8714; FSC No.: 61773; Empl.: 40

PERFORMANCE ELECTRONIC PACKAGING SERVICES, 6354-B Corte Del Abeto, Carlsbad, CA 92009, Tel: 619-931-7824

PERFORMANCE MOTION DEVICES, 11 Carriage Dr., Chelmsford, MA 01824, Tel: 508-256-1913, FAX: 508-256-0206; Empl.: 6; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

PERFORMANCE SEMICONDUTOR CORP., 610 E. Weddell Dr., Sunnyvale, CA 94089, Tel: 408-734-8200

PERIPHERAL RESOURCES, 9911 W. Pico Blvd., Ste. B-215, Los Angeles, CA 90035, Tel: 310-552-3888, 800-533-2297, FAX: 310-552-2806; Empl.: 11; *Sls. Mgr.:* Bil Dwyer

PERIPHERALS, 1363 Logan Ave., Costa Mesa, CA 92626, Tel: 714-540-4925, 800-468-6888, FAX: 714-540-2026; Empl.: 20; *Sls. Mgr.:* Sandra Weller

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543, 213-849-6454, FAX: 818-566-4232; Empl.: 6; *Sls. Mgr.:* J. Ross

PERMA POWER ELCTRNS., 5601 W. Howard Ave., Niles, IL 60714, Tel: 312-763-0763, FAX: 312-763-8330; Empl.: 80/100; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844, FAX: 617-734-0844; Empl.: 14; *Sls. Mgr.:* N. Geskos

PERX,INC., 525 Tamal Plaza, Corte Madera, CA 94925, Tel: 415-927-0155, FAX: 415-927-0159; Empl.: 5

PETER PARTS & ASSOCS., 82 E. Main St., Webster, NY 14580, Tel: 716-265-2540, FAX: 716-265-2542; *Sls. Mgr.:* Peter Parts

PFC, See Southern Elctrns. Co. Inc.

P,G. ELECTRONICS LTD., 800 Arrow Rd., 8, Weston, Ont., Canada M9M2Z8, Tel: 416-741-7682, FAX: 416-741-9927; FSC No.: 38243

PHASETRONICS INC./MOTORTRONICS INC., 13214-38th St. North, Clearwater, FL 34622, Tel: 813-573-1900, FAX: 813-573-1803; Empl.: 400; *Sls. Mgr.:* Karen Alberts

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-458-4444, 800-255-CLIC (2542), FAX: 219-422-1667; Empl.: 1,000; *Sls. Mgr.:* D.R. Disque, Mktg. VP

PHENIX TECHNOLOGIES, Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-746-8118, FAX: 301-895-5570; Empl.: 45; *Sls. Mgr.:* Bill Robeson

PHILADELPHIA INSULATED WIRE CO. INC., General Cable Corporation, 4 Tesseneer Drive., Highland Heights, KY 40176, Tel: 606-572-8306, 800-257-8357, FAX: 800-547-8249; Empl.: 140; *Sls. Mgr.:* Michael F. Wells

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS CIRCUIT ASSEMBLIES, 3602 W. Waters Avenue, Tampa, FL 33614-2797, Tel: 813-933-5113, TELEX: 3727509, FAX: 813-932-1373; *Sls. Mgr.:* Keith Weil

Philips Components
Discrete Products Division
A North American Philips Company

FAX: 407-881-3300

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, A North American Philips Company, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228; *Dist. Mgr.:* Jess Hall **A•1144-1148, 2010-2012, 2150-2170; B•1015, 1336-1338, 1888-1889; D•1403**

Local Sales Offices & Reps

AL	Huntsville, Over & Over Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Santa Clara, Technlg. Sls. Inc.	408-727-7200
CA	Signal Hill, Harper & Strong, Inc.	310-424-3030
CA	Sunnyvale, Philips Comps.	408-991-2294
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Over & Over, Inc.	407-339-5073
FL	Ft. Lauderdale, Over & Over, Inc.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Libertyville, GMR Sls., Inc.	708-367-8440
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Fort Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IN	Kokomo, Philips Comps.	317-456-1615
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Overland Pk., Lorenz Sls. Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6010
MN	Minneapolis, Electric Comp. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Englewood Cliffs, ED Glass Assocs.	201-592-0200
NJ	Parsippany, Philips Comps.	201-455-1507
NY	East Rochester, Empire Tech. Assoc., Inc.	716-381-8500
NY	Edwell, Empire Tech. Assocs., Inc.	607-754-8756
NY	Skaneateles, Empire Tech. Assoc., Inc.	315-685-5703
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
NC	Raleigh, Philips Comps.	919-782-3334
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6096
TN	Greenville, Philips Comps.	615-639-0251
TX	Austin, Philips Comps.	512-331-8828
TX	Houston, Philips Comps.	713-272-8086
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	New Berlin, Philips Comps.	414-785-6509
PR	Caparra Hgts., M. Anderson Co. Inc.	809-793-6544
Can	Scarborough, Ont., Philips Comps.	416-292-5161

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 1033 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-247-0486,914-246-0487; FSC No.: 02114; *Sls. Mgr.:* B. Grindle

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 1440 W. Indiantown Rd., Jupiter, FL 33458, Tel: 407-744-4200, FAX: 407-863-1811; *Sls. Mgr.:* Bill Winther **A•1144, 1147-1148; B•1015**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445; *Sls. Mgr.:* Bill Cvirko **A•1145-1146**

DC Aluminum Electrolytic Capacitors(Computer Grade, Radial)Indl. & Consumer AC Motor Starts, Film Capacitors (Film/Foil, Metallized) Tantalum Capacitors (Foil) Film Trimmer Capacitors

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, FAX: 817-325-1052; *Sls. Mgr.:* Richard Swingen **A•2010-2012; B•1888-1889**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., Professional Components Grp., 100 Providence Pike, Slatersville, RI 02876, Tel: 401-762-3800, FAX: 401-767-4493; FSC No.: 73445; *Dist. Mgr.:* Jeff Brooke-Stewart **A•2150-2170**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV,, Discrete Semiconductor Group, 100 Providence Pike, Slatersville, RI 02876-2078, Tel: 401-762-3800, FAX: 401-767-4493 **A•2150-2170; B•1336-1338**

PhilipsECG
A North American Philips Company

FAX: 717-323-4691

PHILIPS ECG, North American Philips Co., 1025 Westminster Dr., Williamsport, PA 17701, Tel: 717-323-4691; *Sls. Mgr.:* L.R. Brophy, Gen. Mgr. Mktg.; *Dist. Mgr.:* E. H. Frost **A•2172-2173**

Local Sales Offices & Reps

CA	Byron, Philips ECG	510-634-9879
CA	Gardena, Bidwell Schwartz Assoc.	213-770-0300
FL	Ft. Lauderdale, Hawkins Frederickson Assoc.	305-321-6702

FL	Maitland, Hawkins Frederickson Assoc.	407-831-2474
GA	Atlanta, Millar Elctrns.	404-634-3350
MA	Woburn, Philips ECG	617-932-4748
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MO	Kansas City, Philips ECG	816-741-4019
NY	Seneca Falls, Philips ECG	315-568-5875
NC	Raleigh, Millar Elec., Inc.	919-828-8840
OH	Dayton, Philips ECG	513-436-0066
PA	Emporium, JSH Sls. Co.	814-486-1311
TX	Richardson, Philips ECG	214-231-8274
Can	Dorval, Que., ECG Canada Inc.	514-685-5800

PHILIPS SEMICONDUCTORS, Philips Electroincs, 811 E. Arques Ave., P.O. Box 3409, Sunnyvale, CA 94088-3409, Tel: 408-991-2000, FAX: 408-991-2311; FSC No.: 1CH66; Empl.: 20,000; *Sls. Mgr.:* Jim Feijoo; *Dist. Mgr.:* Vinnie Bonanno

Philips Technologies
A Philips Electronics North America Company
PHILIPS
FAX: 203-271-6522

PHILIPS TECHNOLOGIES, North American Philips Corporation, 7 McKee Place, Cheshire, CT 06410, Tel: 203-271-6525; Empl.: 4000; *Sls. Mgr.:* R.F. Kamm

PHILIPS TECHNOLOGIES, Airpax Mechatronics Group, 604 West Johnson Ave., Cheshire, CT 06410, Tel: 203-271-6000, FAX: 203-271-6400; Empl.: 350; *Sls. Mgr.:* Ron Barbieri

PHILIPS TECHNOLOGIES, Airpax Protector Group, 807 Woods Road, Cambridge, MD 21613, Tel: 410-228-4600, FAX: 410-228-8910; FSC No.: 81541; Empl.: 1100; *Sls. Mgr.:* S. Monagham (CBS)/C. Tinley (MCPS) .... **B•1378**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	San Jose, Philips Technlgs.	408-453-5129
CO	Littleton, Lange Sls.	303-795-3600
GA	Lawrenceville, BCI	404-962-6826
ID	Boise, Lange Sls., Inc.	208-323-0713
IL	Lake Zurich, Somers-Stanton, Inc.	708-438-2999
IN	Indianapolis, Philips Technlgs.	317-573-9911
IA	Cedar Rapids, Rep Assocs.	319-373-0152
MA	Westborough, Philips Technlgs.	508-366-7313
MI	Farmington Hills, Philips Technlgs.	313-553-6030
MN	Eagan, Philips Technlgs.	612-683-9007
NY	Rochester, Philips Technlgs.	716-654-7470
NY	Syosset, Philips Technlgs.	516-364-1217
OH	Dayton, Baehr, Greenleaf	513-439-0724
OH	Westlake, Baehr, Greenleaf	216-892-1770
OR	Beaverton, Philips Technlgs.	503-641-6130
PA	Pittsburgh, Russell F. Clark	412-242-9500
TX	Dallas, Philips Technlgs.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

PHILIPS TECHNOLOGIES, Airpax Protector Group, Husky Park, Frederick, MD 21701, Tel: 301-663-5141, FAX: 301-698-0624; Empl.: 600; *Sls. Mgr.:* Fred Dietzel .... **B•1891**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	San Jose, Philips Technlgs.	408-453-5129
CO	Littleton, Lange Sls.	303-795-3600
GA	Lawrenceville, B.C.I.	404-962-6826
ID	Boise, Lange Sls., Inc.	208-323-0713
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Philips Technlgs.	317-573-9911
IA	Cedar Rapids, Rep Assocs., Inc.	319-373-0152
MA	Westborough, Philips Technlgs.	508-366-7313
MI	Farmington Hills, Philips Technlgs.	313-553-6030
MN	Eagan, Philips Technlgs.	612-683-9007
NY	Rochester, Philips Technlgs.	716-654-7470
NY	Syosset, Philips Technlgs.	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OR	Beaverton, Philips Technlgs.	503-641-6130
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Philips Technlgs.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

PHILIPS TECHNOLOGIES, Airpax Instruments, 150 Knotter Drive, Cheshire, CT 06410, Tel: 203-271-6000, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 200; *Sls. Mgr.:* Ron Cimino .... **D•1168**

Local Sales Offices & Reps

AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	San Jose, Philips Technlgs.	408-453-5129
CO	Littleton, Lange Sls., Inc.	303-795-3600
ID	Boise, Lange Sls, Inc.	208-323-0713
IL	Lake Zurich, Somers-Stanton Inc.	708-438-2999
IN	Indianapolis, Philips Technlgs.	317-573-9911
IA	Cedar Rapids, Rep Assocs.	319-373-0152
MA	Westborough, Philips Technlgs.	508-366-7313
MI	Farmington Hills, Philips Technlgs.	313-553-6030
MN	Eagan, Philips Technlgs.	612-683-9007
NY	Rochester, Philips Technlgs.	716-654-7470
NY	Syosset, Philips Technlgs.	516-364-1217
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf, & Assocs.	216-892-1770
OR	Beaverton, Philips Technlgs.	503-641-6130
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088
TX	Dallas, Philips Technlgs.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

AL	Birmingham, Dwight D. Prouty	205-988-8110
AL	Mobile, Dwight D. Prouty	205-476-5056
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Santa Clara, MANCO	408-496-6611
CO	Denver, Q.E.D., Inc.	303-825-5011
CT	Milford, Motors & Drives, Inc.	203-877-6509
FL	Ft. Lauderdale, Indl. Instrs.	305-971-0209
FL	Tampa, Wacco Inc.	813-621-6441
GA	Marietta, Control Equip. Co.	404-427-8776
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Countryside, Chicago Chain & Transmission	708-482-9000
IN	Mishawaka, Power Comps. of Midwest	219-256-6630
IA	Cedar Rapids, Van Meter Co.	319-366-5301
IA	Des Moines, Kim Controls	515-274-9194
KY	Louisville, Automatic Controls	502-426-4666
LA	Baton Rouge, D & W Sys. Sls.	504-753-0992
LA	Kenner, D & W. Sys. Sls.	504-466-1692
MA	Hingham, Hingham Bay Corp.	617-740-1900
MI	Detroit, Automatic Controls	315-533-8890
MN	Minneapolis, Kim Controls	612-780-2991
MO	Fenton, Hi-Tech Elec.	314-343-6060
NH	Manchester, Industrial Control Sys.	603-625-2900
NY	Amherst, N.E. Controls of Buffalo	716-691-0081
NY	Clifton Park, N.E. Controls of Buffalo	518-371-4413
NY	New Hyde Park, I/O Corp.	516-355-0130
NY	Thompson Ridge, Vespo Mktg.	914-361-2800
NC	Charlotte, McGuire & Crawford	704-366-3454
OH	Brunswick, Automatic Controls	216-273-1117
OH	Cleves, ATR Distrs.	513-353-1800
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Ft. Washington, I/O Corp.	215-641-1870
PA	Pittsburgh, Friday Engrg.	412-341-1444
PA	Pittsburgh, Gilson Engrg. Sls.	412-369-0100
TX	Dallas, Automatic Sys.	214-688-1810
TX	Houston, The Haltom Co.	713-782-5625
VA	Richmond, Process Specialties	804-794-2511
VA	Salem, Process Specialties	703-563-0707
WA	Richland, Radar Elec, Co., Inc.	509-943-8336
WA	Seattle, Radar Elec, Co., Inc.	206-282-2511
WA	Spokane, Radar Elec, Co., Inc.	509-747-3053
WV	Charleston, Gilson Engrg Sls.	304-342-0012
WI	New Berlin, Electric Sales & Engrg.	414-782-2400
Can	Ontario, Leonard Elec., Ltd.	416-829-1200
Can	Vancouver, Southwell Controls, Ltd.	604-980-3688

PHILIPS TECHNOLOGIES, Automotive Electronics Group, Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-271-6000, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 800; *Sls. Mgr.:* Jim Richford

PHILIPS TECHNOLOGIES, Philips Key Modules Group, 2001 Gateway Place, Ste. 650 West, San Jose, CA 95110, Tel: 408-453-7373, FAX: 408-453 6444; Empl.: 10; *Sls. Mgr.:* Arend Verweij

PHILMORE MANUFACTURING, 2240 15th St. P.O. Box 6386, Rockford, IL 61125-1386, Tel: 815-229-7773, FAX: 815-229-7785; Empl.: 18

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 910-831-3286, FAX: 405-524-4254; Empl.: 40; *Sls. Mgr.:* Robert P. Gelernter

PHOENIX CONTACT INC., P.O. Box 4100, Harrisburg, PA 17111, Tel: 717-944-1300, FAX: 717-944-1625; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford

PHOENIX MICROSYSTEMS, 991 Discovery Dr., Huntsville, AL 35806, Tel: 205-922-1200, TELEX: 752592, FAX: 205-837-1256; Empl.: 100

PHOENIX MICROWAVE, 100 Emlen Way, Telford, PA 18969, Tel: 215-723-6011, FAX: 215-723-6015; Empl.: 53; *Sls. Mgr.:* Joseph Diesso, VP Sls. & Mktg.

PHOENIX WIRE, INC., 100 Teflon Ave., S. Hero, VT 05486, Tel: 802-372-4561; Empl.: 25; *Sls. Mgr.:* Ohmer Corbin; *Dist. Mgr.:* Ohmer Corbin .... **C•1802**

PHONON CORPORATION, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070, Tel: 203-651-0211, TELEX: 294705, FAX: 203-651-8618; FSC No.: 6Y858; Empl.: 20

PHOTON, INC., 1115 Space Park Dr., Santa Clara, CA 95054-3432, Tel: 408-492-9449, FAX: 408-492-9659; *Sls. Mgr.:* J. M. Darchuk

PHOTO RESEARCH:KOLLMORGEN, 9330 DeSoto Ave./PO Box 2192, Chatsworth, CA 91313-2192, Tel: 818-341-5151, FAX: 818-341-7070; FSC No.: 92434; Empl.: 66; *Sls. Mgr.:* M. L. Woolsey

PHYSICS INTERNATIONAL CO., Olin Defense Systems Grp., 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 360

PIC DESIGN, Remington Technologies, Inc., P.O. Box 1004, Middlebury, CT 06762, Tel: 203-758-8272, TWX: 910-997-0989, FAX: 203-758-8271; FSC No.: 00141; Empl.: 100; *Sls. Mgr.:* Gary Hampton

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PICO ELECTRONICS, INC., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, Tel: 914-699-5514, 800-431-1064; FSC No.: 31669; *Sls. Mgr.:* Joe Sweeney .. **A•1263-1273, 2455-2505; D•1859-1873, 2137-2185**

Local Sales Offices & Reps

CA	Santa Clara, Fisher Assocs.	408-733-7350
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665/1264
WA	Seattle, W. Spaulding Co.	206-282-9173

PICONICS, INCORPORATED, 26 Cummings Road, Tyngsboro, MA 01879, Tel: 508-649-7501, FAX: 508-649-9643; FSC No.: 26618; Empl.: 48; *Sls. Mgr.:* Virgilius Di Biase .... **A•1274-1275, 2013**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Tempe, Semper-Fi Sls.	602-730-9553
CA	Cupertino, Alpha Inds., Inc.	408-446-5333
CA	N. Hollywood, Jewett Co.	818-789-8103
CA	North, Alpha Ind., Inc.	408-446-5628
CO	Parker, Mikro Sls. Co.	303-841-4131
FL	Lighthouse Point, R.C. Simon & Co.	305-941-2757
IL	No. IL & WI, R.H.I. Sls.	708-888-0099
IN	Huntington, Rixan Assoc.	513-278-1233
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Chelmsford, Advanced Tech. Mktg.	508-458-0200
MN	Minneapolis, Peterson Sls. Assocs.	612-835-5281
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NY	Rochester, J.G. Welch	716-244-1100
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Cincinnati, Rixan Assoc.	513-278-1233
OH	Dayton, Rixan	513-222-0011
OK	Bethany, El-Tec Sls.	405-789-5911
PA	Bedford, NJ Koebert Assocs.	215-576-1329
PA	Glenside, Koebert Assocs. Inc.	215-887-2310
TX	Ft. Worth, El-Tec Sls.	817-268-2896
VA	Alexandria, Koebert	703-461-3655
WA	Belleview, Call Factory	508-649-7501
WV	Inwood, Koebert & Assocs., Inc.	304-229-8401

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[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

PICOSECOND ATE INC., P.O. Box 1080, Beaverton, OR 97075, Tel: 503-641-3295, FAX: 503-646-3778; Empl.: 2

Local Sales Offices & Reps

OR	Beaverton, picosecond ATE Inc.	503-641-3295

PICOSECOND PULSE LABS, INC., P.O. Box 44, Boulder, CO 80306, Tel: 303-443-1249, FAX: 303-447-2236; Empl.: 7; *Sls. Mgr.:* J.R. Andrews; *Dist. Mgr.:* J.R. Andrews

PIEZO CRYSTAL CO., 100 K St., Box 619 , Carlisle, PA 17013, Tel: 717-249-2151, FAX: 717-249-7861; FSC No.: 74306; Empl.: 250; *Sls. Mgr.:* Glenn R. Kurzenknabe

PIEZO ELECTRIC PRODUCTS, INC., 212 Durham Ave., Metuchen, NJ 08840, Tel: 908-548-2800, FAX: 908-548-3625; Empl.: 75; *Sls. Mgr.:* M.R. Scarillo

PIEZO KINETICS INC., P.O. Box 756, Pine and Mill Streets, Bellefonte, PA 16823, Tel: 814-355-1593, FAX: 814-355-4342; FSC No.: 5Y690; Empl.: 28; *Sls. Mgr.:* Harry D. Shirey

PIEZO TECHNOLOGY INC., 2525 Shader Rd., Orlando, FL 32804, Tel: 407-298-2000, FAX: 407-293-2979; FSC No.: 25120; *Sls. Mgr.:* Paul Dechen

PIHER INTERNATIONAL CORP., NACESA, 903 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-390-6680, 800-323-6693, FAX: 708-390-9866; FSC No.: 54869; Empl.: 13; *Sls. Mgr.:* Kimberly Mack, Sls. Supp. Mgr.

PILLAR INDUSTRIES

FAX: 818-358-0398

PILLAR INDUSTRIES, INC., 1780 Evergreen Street, Duarte, CA 91010, Tel: 818-358-1337; Empl.: 3 .... **D•1874-1877**

Local Sales Offices & Reps

CA	Los Angeles, Power Partner, Inc.	310-215-0800
CA	Oxnard, Power Partner	805-659-5356
CA	Santa Clara, Foresight	408-980-9700
WA	Lynnwood, Blair Hirsh	206-775-8151

PIND TESTERS INC., 13805 Alton Parkway, Ste. B, Irvine, CA 92718, Tel: 714-457-1090, FAX: 714-457-1378; FSC No.: 66; Empl.: 15; *Sls. Mgr.:* C. Ditgen

PINE INSTRUMENT CO., 101 Industrial Dr., Grove City, PA 16127, Tel: 412-458-6391, FAX: 412-458-4648; Empl.: 60

PIONEER COMPONENTS, 2352 E. 66th St., Brooklyn, NY 11234, Tel: 718-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

PIONEER MAGNETICS, 1745 Berkeley St., Santa Monica, CA 90404, Tel: 310-829-6751, FAX: 310-453-3929; FSC No.: 08676; Empl.: 310; *Sls. Mgr.:* Michael B. MacKrell .... **D•1879-1881**

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech Assocs.	205-881-9298
AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Signal Hill, Thorson Co.	310-595-0361
CO	Commerce City, Williams Assocs.	303-289-5647
FL	West Palm Beach, Pen-Tech Assocs.	407-640-0800
GA	Roswell, Pen-Tech Assocs.	404-642-4110
IL	Arlington Hgts., Hill Sales	708-255-4400
MD	Columbia, Stein Instrmn.	301-596-3748
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Lee's Summit, Omni Tech. Sls.	816-578-4221
NJ	Glen Gardner, Daner-Hayes Inc.	201-537-4534
NM	Albuquerque, Williams Assocs.	505-255-1368
NY	Vestal, D. H. Technlgs.	716-359-4652
NC	Greensboro, Pen-Tech Assocs.	919-852-6000
OH	Dublin, KRW Sls. Inc.	614-885-2598
OH	Westlake, KRW Sales	216-871-7521
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, Kruvand	214-437-3355
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Redmond, Halbar-RTS	206-882-0990

PIONEER RESEARCH, INC., 1745 Berkeley St., Santa Monica, CA 90404, Tel: 310-829-6751, FAX: 310-453-3929; Empl.: 450; *Sls. Mgr.:* F. Heath

PIRELLI CABLE CORP., See Specialty Cable Corp.

PITTMAN®

FAX: 215-256-1338

PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, Tel: 215-256-6601; FSC No.: 98938; Empl.: 180 .... **B•1304-1305**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Leucadia, Halbar Assocs.	619-942-4075
CA	San Mateo, Halbar North, Inc.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Englewood, Integrated Motion Sys.	303-792-5516
CT	Bristol, M. L. Assocs., Inc.	203-589-2856
FL	Fort Lauderdale, Motion Controls, Inc.	305-434-4197
GA	Suwanee, Overton Assocs. Inc.	404-497-0166
IL	Mount Prospect, K-W Assocs.	708-253-6680
IN	Elkhart, Shaum Mfg., Inc.	219-264-0771
MA	Wayland, M. L. Assocs.	508-358-5540
NY	Glen Head, Marcus Sls. Assocs., Inc.	516-671-6820
NY	Rochester, Application Spec.	716-586-6226
NC	Raleigh, Overton Assocs. Inc.	919-469-5190
OH	Cleveland, Servo-Mark	216-871-2353
OK	Edmond, Motion Reps, Inc.	405-340-8100
OR	Tigard, Halbar-RTS, Inc.	503-624-5741
PA	Exton, Kiley Elect. Co., Inc.	215-363-8550
SC	Walhalla, Overton Assocs. Inc.	803-638-7101
TN	New Tazewell, Overton Assocs. Inc.	615-626-6009
TX	Austin, Motion Reps, Inc.	512-288-5758
TX	Carrollton, Motion Reps Inc.	214-492-0106
TX	Denton, Motion Reps, Inc.	817-382-4159
TX	Houston, Motion Reps, Inc.	713-981-8700
WA	Redmond, Halbar-RTS, Inc.	206-882-0990
Can	Woodbridge, Ont., Electomate Indl. Sls. Ltd.	416-850-7447

PIXELOGIC INC., 1200 N.E. Keyes Rd., Vancouver, WA 98684, Tel: 206-253-5033, FAX: 206-253-5033; Empl.: 5

PIXELWORKS, INC., 7 Park Ave., Hudson, NH 03051, Tel: 603-880-1322, FAX: 603-880-6558; Empl.: 15; *Sls. Mgr.:* Michael Jannery; *Dist. Mgr.:* A. Straume

PLAINVIEW BATTERIES, INC., 23 Newtown Rd., Plainview, NY 11803, Tel: 800-642-2354, FAX: 516-249-2876; *Sls. Mgr.:* B. Erde .... **D•1459-1461**

PLAINVIEW ELECTRONICS, See Plainview Battieries, Inc.

PLANAR SYSTEMS, INC., 1400 N.W. Compton Dr., Beaverton, OR 97006-1992, Tel: 503-690-1100, FAX: 503-690-1244; FSC No.: 5Z179; Empl.: 121; *Sls. Mgr.:* Gary Baughn

PLANT SPECIALTIES, INC., P.O. Box 110537, Carrollton, TX 75011-0537, Tel: 214-245-9673, FAX: 214-245-9673; *Sls. Mgr.:* J. E. Bryer

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-489-2229, FAX: 312-489-0496; FSC No.: 99120; Empl.: 60; *Sls. Mgr.:* Thomas J. Brown; *Dist. Mgr.:* Thomas J. Brown

PLASTICORP, 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 310-539-9530, FAX: 310-539-8325; Empl.: 120; *Sls. Mgr.:* Thomas Salken

PLASTIC SYSTEMS INC., 261 Cedar Hill St., Marlboro, MA 01752-3004, Tel: 508-485-7390, FAX: 508-480-0257; *Sls. Mgr.:* Jim Novak; *Dist. Mgr.:* Jim Novak

PLASTIMATIC, INC., 11 Danco Rd., Putnam, CT 06260, Tel: 203-928-7911, FAX: 201-575-8748; Empl.: 85; *Sls. Mgr.:* Christopher Brooks

PLASTRON CORP., 429 S. Evergreen St., Bensenville, IL 60106, Tel: 708-595-2212, FAX: 708-595-2599; Empl. 245; *Sls. Mgr.:* Ian Graham

PLATO PRODUCTS, INC., 18731 Railroad St., Industry CA 91748, Tel: 818-965-8044, 800-423-4510, FAX: 818 965-8960; FSC No.: 32399; Empl.: 75; *Sls. Mgr.:* Walte Schaub

Local Distributors

AL	Muscle Shoals, Jones Elctrns.	205-383-124
AZ	Phoenix, Scottsdale Tool & Supply	602-273-737

CA	Fullerton, Bertech	714-526-3700
CA	Poway, Wassco	619-679-8787
CA	Sunnyvale, COM-KYL	408-734-9660
CO	Denver, Solder Tec	303-623-5000
FL	Clearwater, Your Production Cupb'd	813-447-2581
FL	Winter Pk., Deanco, Inc.	407-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Chicago, E M F	312-889-8323
MD	Gaithersburg, Deanco	301-948-5444
MA	N. Andover, Contact East	508-682-2000
MI	Bloomfield Hills, Murray Percival Co.	313-333-1700
MN	Minneapolis, Warner Indl. Supp.	612-378-7300
NJ	Fairfield, Deanco, Inc.	201-575-7960
NY	Ithaca, Deanco, Inc.	607-257-4444
NY	W. Babylon, Irv Morse Sls.	516-491-7800
NC	Raleigh, Cameron & Barkley	919-834-6010
OR	Portland, Gen. Tool & Supp.	503-226-3411
TX	Dallas, Briggs-Weaver	214-631-3600
TX	McAllen, McAllen Bolt & Screw, Inc.	512-687-8596
TX	Pflugerville, Briggs-Weaver	512-244-3343
UT	Salt Lake City, Techn. Devices	801-972-5935
WA	Seattle, Gen. Tool & Supp.	206-762-1500
PR	E.M.F.	800-621-0080
Can	Edmonton, Alb., Cardinal Indl. Elctrns.	403-483-6266
Can	Montreal, Que., Adtool Corp.	514-482-2548

PLESSEY ELECTRIC SYSTEMS CORP., See GEC-Marconi

PLETRONICS, INC., 19015 36th Ave. West, Ste. H, Lynnwood, WA 98036, Tel: 206-776-1880, FAX: 206-776-2760; Empl.: 11; *Sls. Mgr.:* Les Podgorny; *Dist. Mgr.:* Les Podgorny .... **A•1449-1455**

Local Sales Offices & Reps

AL	Huntsville, Strategic Mktg.	205-464-0490
AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	Mission Viejo, Jay Mktg. Assocs.	714-768-7519
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CT	N. Haven, Radix	203-239-3611
FL	St. Petersburg, QXI	813-894-4556
IL	Downers Grove, Golten Assocs.	708-512-0093
MA	Randolph, Bengal	617-961-4120
MI	Farmington, Bergin Assoc.	313-471-7940
MN	St. Paul, Countryman	612-645-9151
NJ	Springfield, Radix	201-467-4970
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Raleigh, Strategic Mktg.	919-847-7972
OH	Centerville, Omega	513-434-5507
OH	Cleveland, Omega Sls.	216-360-9400
OR	Oregon City, Halbar PNW, Inc.	503-656-3714
TN	Nashville, Strategic Mktg.	615-883-7882
TX	Austin, Sage Mktg.	512-335-0300
TX	Dallas, Sage Mktg.	512-335-0300
WA	Redmond, Halbar	206-882-0990
Can	Mississauga, Ont., Intellatech	416-629-0082

Local Distributors

AZ	Phoenix, Arizona Comps	602-269-5655
AZ	Scottsdale, Kent	602-998-0399
CA	El Segundo, Force	213-772-1324
CA	Milpitas, Kent	408-262-5300
CA	San Diego, Kent Elctrns.	619-453-7133
CA	Santa Clara, Force	408-748-1324
CA	Sunnyvale, Capsco	408-734-3020
CA	Sunnyvale, Target	408-733-0384
CA	Torrance, All American	800-831-8300
CA	Torrance, Kent Elctrns.	310-320-2700
CA	Yoriba Linda, Target Elctrns.	714-692-1630
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Largo, Kent	813-545-0057
GA	Norcross, Century Elctrns.	404-729-2522
FL	Sunrise, All American	800-432-6838
IL	Woodridge, Golten Assocs.	708-985-5100
MD	Beltsville, PSI	301-937-4960
MD	Columbia, Kent	301-720-6200
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Chelmsford, Kent	508-250-9666
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wakefield, All American	617-246-2300
MA	Wilmington, North Star	508-657-5155
MA	Worcester, Coghlin	508-791-7861
MN	Eden Prairie, All American	612-944-2151
MN	Fridley, Voyager	612-571-7766
MN	St. Paul, Kent	612-642-2868
NJ	Edison, Dove Elctrns.	908-738-0321
NY	East Setauket, Dove Elctrns.	516-689-7733
NY	Mt. Vernon, All American	800-926-6668
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Century Elctrns.	919-596-2220
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Twinsburg, Schuster Elctrns.	216-425-8134
PA	Norristown, Century Elctrns.	215-631-5404
TX	Austin, Kent Elctrns.	512-834-1900
TX	Carrollton, North Star	800-882-6418
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, All American	214-231-5300
TX	Richardson, Kent Elctrns.	214-669-2600
WA	Redmond, Capsco	206-869-7400
WA	Redmond, Kent Elctrns.	206-883-7200
WA	Redmond, Priebe	206-881-2363
Can	Mississauga, Ont., Intellatech	416-629-0082

PLITRON MANUFACTURING, INC., 250 Wildcat Rd., Downsview, Ont., CAN M3J 2N5, Tel: 416-667-9914, FAX: 416-667-8928; Empl.: 42; *Sls. Mgr.:* Brad Jolly .... **A•2506-2507**

Local Sales Offices & Reps

AZ	Phoenix, Saguaro Sls.	602-870-9242
CA	Burbank, Darco	818-504-2425
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
IL	Schaumberg, McNulty & Assocs.	708-980-9868
MO	St. Louis, Harris Hanson Co.	314-432-3611
NJ	Edison, R.E. Breuer Co. Inc.	908-561-6161
NC	Raleigh, Eastern Elctrns.	919-876-7591
OR	Mc Minnville, Electro-Design	503-472-0481
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
WA	Redmond, Electro-Design	206-867-9300
Can	Toronto, Plitron	416-667-9914

PLUMMER PRECISION OPTICS, 601 Montgomery Ave., Pennsburg, PA 18073, Tel: 215-679-6272, FAX: 215-679-2277; Empl.: 180; *Sls. Mgr.:* Lynanne Schaeffer

PMC/BETA LTD. PARTNERSHIP, 4 Tech Circle, Natick, MA 01760, Tel: 617-237-6920, FAX: 508-651-9762; Empl.: 25; *Sls. Mgr.:* Jack Newton

PMI MOTION TECHNOLOGIES, Kollmorgen Corporation, 49 Mall Dr., Commack, NY 11725-5703, Tel: 516-864-1000, FAX: 516-864-2084; Empl.: 175; *Sls. Mgr.:* Peter Dougherty

PMT DIVISION, A Subsidiary of Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19053, Tel: 215-355-6900, FAX: 215-355-2937; Empl.: 125; *Sls. Mgr.:* James Snyder

POCO SLS., Porter Co., 8925 Fullbright St., Chatsworth, CA 91311, Tel: 818-700-8727, FAX: 818-700-8453; FSC No.: 69-1603; Empl.: 8

POINT 4 DATA CORP., 15442 Del Amo Ave., Tustin, CA 92680, Tel: 714-259-0777, FAX: 714-259-0921; Empl.: 50; *Sls. Mgr.:* Mr. Ted Cooper; *Dist. Mgr.:* Mr. Ted Cooper

POLARA ENGINEERING INC., 4115 W. Artesia Ave., Fullerton, CA 92633, Tel: 714-521-0900, TELEX: 688489, FAX: 714-522-8001; Empl.: 62 .... **A•1576**

POLAROID CORP., 119 Windsor St. 2-B, Cambridge, MA 02139, Tel: 800-225-1618, FAX: 617-577-3213; Empl.: 8,000; *Sls. Mgr.:* Jack O'Brien

POLESTAR PLASTICS, INC., 3110 Research Dr., State College, PA 16801, Tel: 814-238-2400, FAX: 814-238-2634; *Sls. Mgr.:* Edward J. Uberti

POLE/ZERO CORPORATION, 5530 Union Centre Dr., West Chester, OH 45069, Tel: 513-870-9060, FAX: 513-870-9064; *Sls. Mgr.:* Joseph J. Janning, Vice Pres.

POLYCASE PRODS., ECP Corp., 4726 Superior Ave, Cleveland, OH 44103, Tel: 216-391-0444, 800-248-1233, FAX: 216-391-2891; Empl.: 22 .... **C•1070**

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Torrance, Allied Elctrns.	213-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Pompano Beach, Allied Elctrns.	305-978-3008
GA	Norcross, Allied Elctrns.	414-446-8595
IL	Des Plaines, Allied Elctrns.	312-803-1040
IN	Indianapolis, Allied Elctrns.	317-875-0448
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
MI	Livonia, Allied Elctrns.	313-462-0190
MN	Eden Prairie, Allied Elctrns.	612-829-7554
NJ	Fairfield, Allied Elctrns.	201-227-8776
NJ	Mt. Laurel, Allied Elctrns.	609-234-7769
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Worthington, Allied Elctrns.	614-785-1270
PA	Pittsburgh, Allied Elctrns.	412-367-4124
TX	Fort Worth, Allied Elctrns.	1-800-433-5700
TX	Fort Worth, Allied Elctrns.	817-336-5401
WA	Seattle, Allied Elctrns.	206-547-2827
WI	New Berlin, Allied Elctrns.	414-796-1280

POLYFET RF DEVICES, 1090 Lawrence Dr., Newbury Park, CA 91320, Tel: 805-498-4552, FAX: 805-498-2230; Empl.: 9; *Sls. Mgr.:* Ed Greenbaum

POLYFLON COMPANY, Crane Co., 35 River Street, New Rochelle, NY 10801, Tel: 914-636-7222, FAX: 914-633-3664; Empl.: 32; *Sls. Mgr.:* Joseph A. Seminoro

POLYGENEX INTERNATIONAL INC., P.O. Box 1487, Cary, NC 27512-1487, Tel: 919-380-8100, FAX: 919-380-8115; *Sls. Mgr.:* J.D. McGarry

POLYPHASE INSTRUMENT, 175 Commerce Dr., Ft. Washington, PA 19034, Tel: 215-643-6950, FAX: 1-215-643-5237; FSC No.: 98330; Empl.: 160; *Sls. Mgr.:* Paul Stevens

POLYPHASER CORPORATION, 2225 Park Place, P.O. Box 9000, Minden, NV 89423-9000, Tel: 702-782-2511, 800-325-7170, TELEX: 272718 PolyPhaser, FAX: 702-782-4476; FSC No.: 61114; Empl.: 65; *Sls. Mgr.:* James J. Renwick; *Dist. Mgr.:* James J. Renwick .... **B•1379**

Local Sales Offices & Reps

CO	Aurora, Electro-Tek Sls., Inc.	303-343-8020, FAX:303-343-8018
FL	Ft. Lauderdale, Mac Com, Inc.	305-772-3025, FAX:305-772-1919
KS	Lenexa, Maury E. Bettis Co.	913-541-9552, FAX:913-541-9566
MN	Stillwater, Ned Gordon & Assoc., Inc.	612-430-1572,FAX:612-430-0027
NV	Minden, PolyPhaser Corp.	702-782-2511
NH	Manchester, Assocd. Sys.	603-472-2297, FAX:603-472-3464
NJ	Somerset, PMC Assoc.	908-563-0366
NC	Black Mountain, PolyPhaser Corp.	704-669-4700, FAX:704-669-0470
TX	Rowlett, Horizon Comm. Sls. Co.	214-475-1179, FAX:214-475-1293
WA	Kirkland, Manon Engrg.	206-827-7449,FX, 206-827-7099
WI	Hartland, Elctrn. Prods., Inc.	414-367-2929, FAX:414-367-8302

Local Distributors

CA	Hayward, Talley Elctrns.	510-783-2111, FAX:510-783-2118
CO	Aurora, Electro-Comm Distrs.	303-343-8937, FAX:303-343-8019
FL	Melbourne, Technical Equip. Dist., Inc.	407-259-2711,FAX:407-242-3109
GA	Norcross, Alltel Supp., Inc.	404-448-5210, FAX:404-446-0427
HI	Honolulu, Honolulu Elctrns.	808-949-5564, FAX:808-949-1209
IL	Joliet, Primus Elctrns. Corp.	815-436-8945, FAX:800-767-7605
IL	Mundelein, Harger Lightning Protection	708-362-4848,FAX:708-362-3519
KS	Lenexa, Sante Fe Distrbg., Inc.	913-492-8288, FAX:913-894-2136
MD	Sparks, Tessco	410-472-7000,FAX:410-472-7575
MN	St. Paul, Pulstar Dist., Inc.	612-645-3411, FAX:612-645-3511
NV	Minden, PolyPhaser Corp.	702-782-2511, FAX:702-782-4476
NJ	Clarksboro, W.R. Block & Assocs.	609-423-2255, FAX:609-423-0891
OH	Cincinnati, Cartwright Comms. Co.	513-489-1755, FAX:513-489-1449
TX	Rowlett, Horizon Comm. Sls. Co.	214-475-1179, FAX:214-475-1293
WA	Bellevue, Arpac, Ltd.	206-453-2132, FAX:206-453-1558
EXP	Minden, PolyPhaser Corp.	702-782-2511, FAX:702-782-4476
Can	Aurora, Ont., Sinclabs, Inc.	416-841-0624, FAX:416-841-6255

POLY-PLANAR INC., 1800 Mearns Rd., Unit J - P.O. Box 2578, Warminster, PA 18974, Tel: 215-675-7805, FAX: 215-675-7920; Empl.: 12

POLYPLY INC./CONDUCTIVES SYSTEMS, INC., Rd. No. 1, Route 5 South, Amsterdam, NY 12010, Tel: 518-843-3900, FAX: 518-843-5829; *Sls. Mgr.:* W.G. Bruce

POLYSWITCH PRODUCTS, See Raychem Corporation

POLYTRON DEVICES, INC

FAX: 201-345-1264

POLYTRON DEVICES, INC., Box 398 - River St. Sta., Paterson, NJ 07544, Tel: 201-345-5885; Empl.: 26 .... **D•1882-1884, 2292-2296**

Local Sales Offices & Reps

CA	San Jose, P & M Elctrns.	408-287-0402
GA	Duluth, Stelmack	404-441-7927
MA	Shrewsburg, Advanced Comp. Grp.	508-845-2023
NC	Raleigh, Stelmack Power Specialists	919-881-0677
OH	Dayton, Technical Dvcs.	513-890-6811
OR	Oregon, Power Factors & Assoc., Inc.	503-657-6969
PA	Collegeville, HB Sys.	215-489-3256
PA	Pittsburgh, KT Mktg.	412-367-1011

Local Distributors

AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
GA	Norcross, Applied Power	404-263-0421
MA	Wellesley Hills, Target Elctrns., Inc.	617-235-1079
MI	Brighton, Applied Power	313-227-3684
MN	Fridley, Voyager Elctrns.	612-571-7766
NM	New Mexico, J. Smith & Assocs., Inc.	505-345-6501

POLYTRONIX, INC., 805 Alpha Dr., Richardson, TX 75081, Tel: 214-238-7045, FAX: 214-644-0805; Empl.: 65 .... **B•1106**

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POMFRET RESEARCH OPTICS, P. O. Box 1265, Orange, VA 22960, Tel: 703-854-4350, FAX: 703-854-6726; Empl.: 5

PORTASOL, Oglesby and Botler Ltd., 7422 Carmel Executive Park, Charlotte, NC 28226, Tel: 704-543-6239, FAX: 704-543-6839; Empl.: 100; *Sls. Mgr.:* Tom Carbott; *Dist. Mgr.:* Tom Carbott

PORTESCAP U.S., INC., 36 Central Ave., Hauppauge, NY 11788, Tel: 516-234-3900, FAX: 516-234-3986; Empl.: 16

POSITRONIC INDUSTRIES, INC., 423 N. Campbell St., P.O. Box 8247, Springfield, MO 65801, Tel: 417-866-2322, TELEX: 436445, FAX: 417-866-4115; FSC No.: 28198; Empl.: 500

POTRANS INTERNATIONAL INC., Potrans Electrical Corp., Ltd., 17935 Sky Park Circle No. H, Irvine, CA 92714, Tel: 714-975-1222, TELEX: 244319, FAX: 714-975-1390; Empl.: 300; *Sls. Mgr.:* Jason Mc Kinstry

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FAX: 812-386-2072

POTTER & BRUMFIELD, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, Tel: 812-386-1000, TELEX: 27-8451; Empl.: 3000; *Sls. Mgr.:* Don Patton; *Dist. Mgr.:* Sherry Colborn .... **B•1380-1381, 1577-1590**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, C.T. Carlberg & Assocs.	602-468-0750
CA	Los Altos, Recht Assocs.	415-964-6321
CA	Newport Beach, Jones & McGeoy Sls., Inc.	714-724-8080
CA	San Diego, CERCO	619-693-7500
CO	Littleton, Simpson Assocs.	303-794-8381
CT	Wallingford, John E. Boeing Co.	203-265-1318
FL	Apopka, Cartwright & Bean	407-889-9100
FL	Deerfield Beach, Cartwright & Bean	305-429-3400
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Fort Wayne, R. O. Whitesell & Assocs.	219-489-0588
IN	Indianapolis, R. O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IN	Princeton, Potter & Brumfield-N & E U.S.	812-386-2007
IN	Princeton, Potter & Brumfield-S & W	812-386-2211
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Village, R.W. Kunz & Assocs.	913-648-3535
KS	Wichita, R.W. Kunz & Assocs.	316-686-3436
KY	Versailles, R. O. Whitesell & Assocs.	606-873-1182
LA	Covington, Cartwright & Bean	504-892-1780
MD	Burtonsville, Mechtronics Sls., Inc.	301-421-4200
MA	Chelmsford, John E. Boeing Co.	508-256-5800
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
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POWER INTEGRITY CORP., 1834 Pembroke Rd., Greensboro, NC 27408, Tel: 910-379-9773, 800-237-6260, FAX: 910-379-1301; *Sls. Mgr.:* James T. Fesmire

POWERLINE, INC., 1360 S. Clarkon St., Denver, CO 80210, Tel: 303-698-7883, FAX: 303-777-7573; Empl.: 9; *Sls. Mgr.:* Matt Breneman

POWER MAGNE-TECH CORPORATION, 441 High Street, Perth Amboy, NJ 08861, Tel: 908-826-4700, FAX: 908-826-4706; Empl.: 65; *Sls. Mgr.:* Arthur Zuckerman; *Dist. Mgr.:* Arthur Zuckerman

POWERMARK, See Square D Co. Power Protection Sys.

POWER/MATE CORPORATION, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, FAX: 619-296-8039 (sls); Empl.: 175

POWER MEASUREMENT LTD., 6703 Rajpur Place, Victoria, BC, Canada V8X 3X1, Tel: 604-652-5118, FAX: 604-652-0411; Empl.: 50; *Sls. Mgr.:* Bradford Forth, Mktg. Mgr.

POWERNETICS LTD., Clarence St. Loughborough, Leics, ENG LE11 1DX, Tel: 0509 214153, TELEX: 34306, FAX: 0509 262460; Empl.: 66; *Sls. Mgr.:* Margaret A. Foggon, Export Sls. Mgr.

Power-one

D.C. Power Supplies

FAX: 805-388-0476

POWER-ONE, INC., 740 Calle Plano, Camarillo, CA 93012, Tel: 805-987-8741; FSC No.: 54407; Empl.: 320; *Dist. Mgr.:* Julius Hirsch,V.P. Sls. .... **D•1886-1895**

Local Sales Offices & Reps

AL	Huntsville, M-Squared, Inc.	205-830-0498
AZ	MESA, Sys. Sls. of AZ	602-464-9989
CA	Escondido, Eagle Tech. Sls.	619-743-6550
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CA	Woodland Hills, Varigon, Inc.	818-594-5080
CO	Englewood, Quorum 3	303-799-8100
CT	Hamden, Datcom	203-288-7005
FL	Boca Raton, Electrocraft	407-394-9686
FL	Largo, Electrocraft	813-544-1766
FL	Longwood, Electrocraft	407-682-7832
GA	Norcross, M-Squared,Inc.	404-447-6124
IL	Chicago, M. Gottlieb & Assocs.	312-775-1151
IN	Indianapolis, Rathsburg Assoc. Inc.	313-489-1500
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Baltimore, Eastern Comps. Sls.	410-788-7050
MA	Waltham, Datcom, Inc.	617-891-4600
MI	Farmington Hills, Rathsburg Assocs., Inc.	313-489-1500
MN	Edina, G.P. Sls., Inc.	613-831-2362
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NM	Albuquerque, Sys. Sls. of AZ	505-889-2901
NY	E.Syracuse, Nycom, Inc.	315-437-8343
NY	Fairport, Nycom, Inc.	716-425-5120
NY	Great Neck, Trionic Assocs.	516-466-2300
NC	Cary, M-Squared, Inc.	919-467-6319
NC	Raleigh, M-Squared, Inc.	919-851-0010
OH	Columbus, Rathsburg Assocs. Inc.	614-457-2242
OR	Beaverton, Pacific Mktg. Specialist	503-641-9373
PA	Norristown, Eastern Comp. Sls.	215-270-9530
VA	Redmond, Pacific Mktg. Specialist	206-882-3144
WI	Milwaukee, M. Gottlieb & Assocs.	414-546-4466

Local Distributors

AL	Huntsville, Pioneer Elctrns.-Tech.	205-837-9300
AL	Huntsville, RS Elctrns.	205-721-9999
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Bell Inds.	602-966-7800
AR	Ft. Smith, Carlton-Bates	501-646-8201
AR	Little Rock, Carlton-Bates	501-562-9100
AR	Pine Bluff, Carlton-Bates	501-535-1354
AR	Springdale, Carlton-Bates	501-756-5012
CA	Agoura, Bell Inds.	818-879-9494
CA	Carlsbad, FLW	619-434-5251
CA	Costa Mesa, FLW	714-751-7512
CA	Cypress, Bell Inds.	714-895-7801
CA	Del Mar, Compumech Elctrns.	619-792-7800
CA	Milpitas, Compumech Elctrns.	408-945-9395, 1-800-553-8558
CA	Oxnard, FLW	805-984-0167
CA	Rocklin, Bell Inds.	916-652-0418
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Sterling Elctrn.	619-560-8948
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	Sunnyvale, Bell Inds.	408-734-8875
CA	Tustin, Capstone Elctrns.	714-587-0638
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Bell Inds.	303-691-2460
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Shelton, Pioneer Elctrns.-Stand.	203-929-5600
CT	Wallingford, Bell Inds.	203-269-6801
CT	Wallingford, Greene-Shaw Co.	203-265-3333
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Altamonte Springs, Bell Inds.	407-339-0078
FL	Altamonte Springs, Pioneer Elctrns.-Tech.	407-834-9090
FL	Deerfield Bch, Pioneer Elctrns.-Tech.	305-428-8877
FL	Maintland, Elctrn. Equip.	407-539-0888
FL	Maitland/Pompano Bch., Elctrn. Equip.	305-960-1200
FL	Miami, Elctrn. Equip. Co.	305-526-6000
FL	Tampa, Elctrn. Equip.	813-988-0810
GA	Duluth, Pioneer Elctrns.-Tech.	404-623-1003
GA	Norcross, Bell Inds.	404-446-7167
GA	Norcross, RS Elctrns.	404-242-0520
ID	Boise, Pioneer Elctrns.-Tech.	208-336-2227
IL	Addison, Pioneer Elctrns.	312-495-9680
IL	Arlington Hts., C.W. Elctrns.	708-439-9880
IL	Bensonville, Voyager Elctrns.	312-860-1300
IL	Elk Grove Village, Bell Inds.	312-640-1910
IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Northbrook, Classic Comps.	708-272-9650
IL	Schaumburg, Sterling	708-303-9900
IN	Ft. Wayne, Bell Inds.	219-422-4300
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Pioneer Elctrns.	317-573-0880
IN	Indianapolis, RS Elctrns.	317-253-9065
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Lenexa, RS Elctrns.	913-362-1923
KS	Lenexa, Sterling Elctrns.	913-492-5406
LA	Shreveport, Carlton-Bates	318-636-9975
LA	Westwego, Sterling Elctrns.	504-436-1481
MD	Columbia, Bell Inds.	410-290-5100
MD	Columbia, Sterling Elctrns.	301-290-3800
MD	Gaithersburg, Pioneer Elctrns.-Tech.	301-921-0660
MA	Andover, Bell Inds.	508-474-8880
MA	Binghamton, Pioneer Elctrns.	617-748-8211
MA	Lexington, Pioneer Elctrns.	617-861-9200
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Grand Rapids, Pioneer	616-698-1800
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, Pioneer Elctrns.	313-525-1800
MI	Livonia, RS Elect.	313-525-1155
MN	Eden Priarie, Pioneer	612-944-3355
MN	Fridley, Voyager	612-571-7766
MN	Minneapolis, Sterling	612-831-2666
MO	Maryland Heights, RS Elctrns.	314-997-7709
MO	Springfield, Carlton-Bates	417-862-1699
MO	St. Louis, Pioneer	314-432-4350
NE	Lincoln, Scott Elctrns.	402-466-8221
NE	Omaha, Scott Elctrns.	402-734-6750
NJ	Edison, Sterling Elctrns.	908-417-1000
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Fairfield, Pioneer Elctrns.	201-575-3510
NJ	Marlton, Capstone Elctrns.	609-596-7500
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Binghamton, Pioneer Elctrns.	607-722-9300
NY	Buffalo, Zeller Elctrns.	716-873-1300
NY	Fairport, Pioneer Elctrns.	716-381-7070
NY	Hauppauge, RS Elctrns.	516-231-6372
NY	Rochester, CAM/RPC Elctrns., Inc.	716-427-9999
NY	Rochester, Zeller Elctrns.	716-254-8840
NY	Woodbury, Pioneer Elctrns.	516-921-8700
NC	Morrisville, Pioneer Elctrns.-Tech.	919-460-1530
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Sterling Elctrns.	919-790-8634
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Cleveland, Pioneer Elctrns.	216-587-3600
OH	Dayton, Bell Inds.	513-435-5922
OH	Dayton, Bell Inds. (Military)	513-434-8231
OH	Dayton, Pioneer Elctrns.	513-236-9900
OH	Maumee, RS Elctrns.	419-893-0721
OH	Solon, CAM/RPC/First Connection	216-248-6181
OH	Solon, Sterling Elctrns.	216-248-1122
OK	Oklahoma City, Carlton-Bates	405-681-4446
OK	Tulsa, Carlton-Bates	918-250-1626
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Beaverton, Bell Inds.	503-644-3444
OR	Portland, Radar Elec.	503-232-3404
PA	Horsham, Pioneer Elctrns.-Tech.	215-674-4000
PA	Pittsburgh, CAM/RPC Elctrns.	412-963-6202
PA	Pittsburgh, Pioneer Elctrns.	412-782-2300
PA	Trevose, Bell Inds.	215-953-2899
TN	Jackson, Carlton-Bates	901-664-2714
TN	Memphis, Carlton-Bates	901-365-3539
TN	Nashville, Carlton-Bates	615-885-3232

TX	Austin, Carlton-Bates	512-837-9098
TX	Austin, Norcom, Inc.	512-451-2757
TX	Austin, Pioneer Elctrns.	512-835-4000
TX	Austin, Sterling	512-836-1341
TX	Carrollton, Capstone Elctrns.	214-380-9049, 1-800-388-6757
TX	Carrollton, Sterling Elctrns.	214-243-1600
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Dallas, Pioneer Elctrns.	214-386-7300
TX	Ft. Worth, Carlton-Bates	817-293-5588
TX	Houston, Norcom, Inc.	713-778-0392
TX	Houston, Pioneer Elctrns.	713-495-4700
TX	Houston, Sterling Elctrns.	713-623-6600
TX	Richardson, Bell Inds.	214-690-0468
TX	San Antonio, Carlton-Bates	512-805-8300
TX	Texarkana, Carlton-Bates	214-792-6923
UT	Midvale, Bell Inds.	801-561-9691
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Redmond, Bell Inds.	206-881-2140
WA	Richardson, Radar Elec.	509-747-3053
WA	Richland, Radar Elec.	509-943-8836
WA	Seattle, Radar Electric	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Brookfield, Pioneer Elctrns.	414-784-3480
WI	New Berlin, Classic Comps.	414-786-5300
WI	Waukesha, Bell Inds.	414-547-8879
EXP	CA, Los Angeles, Hanex, Inc.	213-556-3807

POWER-PAK, INC., 6216 Oakton St., Morton Grove, IL 60053, Tel: 708-966-6000, FAX: 708-966-6009; Empl.: 35; *Sls. Mgr.:* Robert Villari

POWER PRODUCTS DIV., COMPUTER PRODS./POWER PRODS., See Computer Prods. Inc., Fremont, CA.

POWER SOLUTIONS INC., 4699 N. Federal Hwy., Pompano Bch., FL 33064, Tel: 305-943-4110, FAX: 305-943-6068

POWER-SONIC, Box 5242, 3106 Spring St., Redwood City, CA 94063, Tel: 415-364-5001, FAX: 415-366-3662; Empl.: 50; *Sls. Mgr.:* Carl E. Fischetti; *Dist. Mgr.:* Carl E. Fischetti .... **D•1464**

Local Sales Offices & Reps

CA	Redwood City, Andrew Ryan	415-364-5001
CO	Denver, Richard Moody	303-893-3771
FL	Tampa, SRT Mktg.	813-884-4805
IL	Chicago, Rendell Sls. Co.	312-539-1820
KY	Lexington, Donald Keil	606-272-6960
MA	Norwood, Assocd. Power Prods.	617-769-7516
MI	Chelsea, Sean T Sls.	313-475-2021
MS	Jackson, Doby Assocs.	601-981-1138
NJ	Northvale, John Hart	201-767-9654
MN	Bloomington, J.L.K. Tech. Sls.	612-884-0009
OH	Willoughby, Nationwide Comps.	216-946-3226
TX	Dallas, The Power Connection	214-401-3490

Local Distributors

AL	Birmingham, Forbes Distrbg.	205-251-4104
AK	Anchorage, Frigid North	907-561-4633
AZ	Phoenix, Lynntronics	602-841-3900
AR	Little Rock, Carlton Bates	501-562-9100
CA	Costa Mesa, Battery Specialties	800-352-3706
CO	Denver, Cargo Battery	303-296-8763
CT	Waterbury, Jasco Batteries	203-597-9220
DE	National Distr., Allied Elctrns.	800-433-5700
FL	Altamonte Springs, TNR Tech.	800-346-0601
GA	Decatur, Emergency Lighting Srvc.	404-981-2288
HI	Honolulu, I.C. Supp.	808-839-1966
ID	Boise, Kimball Elctrns.	208-232-2201
IL	National Distr., Allied Elctrns.	800-433-5700
IN	Evansville, Hutch & Sons	812-425-7201
IA	Des Moines, Radio Trade Supp.	515-288-7237
KS	Kansas City, North Supply	913-791-7000
KY	Louisville, P.I. Burks	502-589-3960
LA	New Orleans, Southern Radio Supp.	800-447-0444
ME	National Distr., Allied Elctrns.	800-433-5700
MD	Aberdeen, Harco Elctrns.	301-838-7990
MA	Billerica, Mayer Elctrns.	401-724-7100
MI	Livonia, R.S. Elctrns.	313-525-1155
MN	Minneapolis, Burns Sls.	800-728-4761
MO	Kansas City, Elctrn. Supp.	816-931-3383
NE	National Distr., Allied Elctrns.	800-433-5700
NV	Las Vegas, Kiesub	702-733-0024
NH	National Distr., Allied Elctrns.	800-433-5700
NJ	Randolph, Mouser Elctrns.	201-328-3322
NM	Albuquerque, Betatron	505-821-1122
NY	Ridgewood, J.A. McDermott Corp.	718-456-3606
NC	Winston Salem, Kirkman Elctrns.	919-722-9131
ND	National Distr., Allied Elctrns.	800-433-5700
OH	Millbury, Dynalite	419-837-6837
OK	Oklahoma City, Radio Supp.	405-232-6127
OR	Beaverton, Micro Power	503-626-7086
PA	National Distr., Allied Elctrns.	800-433-5700
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TN	Memphis, Carlton Bates	901-365-3539
TX	Ft. Worth, Allied Elctrns.	800-433-5700
VA	Chesapeake, Battery Outlet	804-545-4442
WA	Redmond, Energy Sls.	206-883-2343
Can	Fort Erie, The Battery Co.	800-695-9482

POWER STAR, INC., P.O. Box 18701, Irvine, CA 92713, Tel: 714-261-5377, 800-854-9420, FAX: 714-261-5381; Empl.: 11

POWER SUPPLY CONCEPTS INC., 840 Jupiter Park Dr., Units 103-104, Jupiter, FL 33458-8947, Tel: 407-746-1800, FAX: 407-746-1805 .... **D•1896-1897**

power SWITCH Corp.

FAX: 201-478-8201

POWER SWITCH CORPORATION, 17 Vreeland St., Lodi, NJ 07644, Tel: 201-478-5788; Empl.: 33; *Sls. Mgr.:* Ken Schnitzer .... **D•1899-1905**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-9909
AZ	Tempe, Gassner & Clack	602-968-9037
CA	Camarillo, The Tricamo Co.	805-388-0039
CO	Franktown, MRC	303-660-8750
FL	Palm Bay, VM2 Mktg.	407-984-1918
GA	Atlanta, Benchmark Tech. Sls.	404-446-1711
IL	Wood Dale, BNI	708-595-9210
IN	Indianapolis, Wilson Tech Sls. Inc.	317-872-2513
IA	Cedar Rapids, Midtec Assoc., Inc.	319-395-0028
KS	Lenexa, Midtec Assoc., Inc.	913-541-0505
MA	Tyngsboro, CompTech	508-649-3030
MI	Clarkson, Bradcor Elctrns.	313-625-7644
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, Midtec Assoc., Inc.	314-275-8666
NJ	Haddonfield, M & S Assoc.	609-429-7055
NY	Endwell, Micheal Foldes, Inc.	607-786-4962
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OH	Cleveland, Bradcor Elctrns.	216-671-1200
OH	Dayton, Bradcor Elctrns.	216-671-1200
TX	Dallas, Tycom	214-960-7368
WA	Edmonds, Power Sources Unltd.	206-743-6641
WI	Brookville, BNI	414-781-4775
Can	Mississauga, Andy Baumen Assoc.,Ltd.	416-828-2600

POWER SYSTEMS, INC., 45 Griffin Rd., South, Bloomfield, CT 06002, Tel: 203-726-1300, FAX: 203-726-1495; FSC No.: 50463; Empl.: 310; *Sls. Mgr.:* Kerry D. Smith

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

POWER SYS. GRP., Rantec Div., Emerson Elec. Co., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Fred Silver

POWERTEC INDUSTRIAL CORP., 3958 Airway Drive, Rock Hill, SC 29732, Tel: 803-328-1888, FAX: 803-328-1870; Empl.: 110; *Sls. Mgr.:* Ed Lee; *Dist. Mgr.:* Dale Norman

POWERTEC POWER SUPPLIES, INC., DIV. OF ASTEC AMERICA, See Astec America

POWERTECH, INC., Fair Lawn Ave., Fair Lawn, NJ 07410, Tel: 201-791-5050, TELEX: 353970; FSC No.: 32953; Empl.: 49

POWER TECHNOLOGY, INC., P.O. Box 191117, Little Rock, AR 72219-1117, Tel: 501-568-1995, FAX: 501-568-1994; Empl.: 85; *Sls. Mgr.:* John Webb

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, FAX: 408-738-4326; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio .... **D•1907**

Local Sales Offices & Reps

AL	Huntsville, TEQSPEC	205-883-6699
AZ	Phoenix, Jayson Co., Inc.	602-867-1964
CA	Los Alamitos, Power Specialists	213-594-9418
CA	San Diego, Power Specialists	619-726-4799
CO	Louisville, SDW	303-665-8089
CT	Guilford, HG Assocs.	203-453-5424
FL	Palm Harbor, TEQSPEC	813-942-6006
GA	Snellville, TEQSPEC	404-972-7955
IL	Arlington Hgts., Comtel Midwest Co.	708-392-4040
IN	Indianapolis, Comtel Midwest Co.	317-253-1681
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MA	Stow, HG Assocs.	508-897-3190
MI	Framington Hill, Carter, McCormic & Pierce	313-477-7700
MN	Wayzata, Comtel Midwest Co.	612-476-1551
MO	Manchester, Comtel Midwest Co.	314-227-7220
NM	Albuquerque, SDW	505-883-3668
NY	Great Neck, RTI	516-829-3770
NC	Winston-Salem, TEQSPEC	919-765-5553
OH	Parma, Carter, McCormic & Pierce	216-398-0400
OK	Tulsa, Acudata	918-743-1875
PA	Pittsburgh, Carter, McCormic & Pierce	412-826-3800
TX	Austin, Acudata	512-478-1018
TX	Houston, Acudata	713-580-2451
TX	Plano, Acudata	214-424-3567
VT	Graniteville, HG Assocs.	802-476-4223
VA	Fairfax, SCI-REP	703-385-0600
WA	Bellevue, A. J. Smith Co.	206-746-6770
WI	New Berlin, Comtel Midwest Co.	414-544-6042
Can	N. Vancouver, BC, Jerome & Francis	604-986-1286
Can	Rexdale, Ont., Interfax	416-674-8970

POWERTREND, INC., 515 E. Pershing Blvd., Ste. 1001, Cheyenne, WY 82001, Tel: 307-635-9221, FAX: 307-635-8116; *Sls. Mgr.:* W. Rumsey

POWER TRENDS, INC., 1101 N. Raddant Rd., Batavia, IL 60510, Tel: 708-406-0900, FAX: 708-406-0901; Empl.: 45; *Sls. Mgr.:* Don Matthiesen

All Locations call Hamilton/Avnet 800-442-6458

Powertron

FAX: 516-883-7155

POWERTRON CORPORATION, Industrial Test Equipment Co., Inc., 21 Yennicock Ave., Port Wash., NY 11050, Tel: 516-883-1700; Empl.: 6; *Sls. Mgr.:* Barbara Assa .... **D•1012, 2268-2271**

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, TELEX: 572-444

POWERTRONIX

FAX: 415-345-7240

POWERTRONIX CORP., 703 Cayman Ln., Foster City, CA 94404, Tel: 415-345-6800; Empl.: 94; *Sls. Mgr.:* Carl A. Svensson .... **A•2509-2511**

Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns.	602-996-5909
AR	Little Rock, Doby Assocs.	501-221-0326
CA	Foster City, Powertronix Corp.	415-345-6800
CA	Mission Viejo, Champa Assocs.	714-581-3459
CA	Sherman Oaks, Champa Assocs.	818-769-9456
CO	Littleton, Taylor Mktg.	303-850-0207
FL	Delray Beach, Phelps Assocs.	407-276-7591
IL	Arlington Hgts., MJ Petersen & Assocs.	708-577-8200
MD	Baltimore, Chesapeake Indl.	410-653-0476
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
NV	Las Vegas, Chaparral Nevada	702-433-5486
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NJ	Wayne, Apogee Mktg.	201-305-3735
NM	Albuquerque, Chaparral Elctrns.	505-271-2266
NY	Hauppauge, Sticom	516-366-4221
NY	Rochester, H.C. Johnson Agencies	716-586-0777
OH	Mainville, G.A. Barnett and Co.	513-677-0922
PA	Glenshaw, Hollern Sls. Inc.	412-487-1246
PA	Plymouth Meeting, CMS Sls. & Mktg.	215-834-6840
TN	Collierville, Doby Assocs.	901-854-5482
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9590

THE ELECTRONIC SYSTEM POWER SPECIALISTS

FAX: 708-816-8988

POWERVAR, INC., 28457 N. Ballard Dr., Ste. C, Lake Forest, IL 60045, Tel: 708-816-8585, 800-369-7179; *Sls. Mgr.:* Tom Gornick; *Dist. Mgr.:* Tom Gornick .... **D•2297-2299**

Local Sales Offices & Reps

AZ	Glendale, Desert Canyon Sls.	602-938-1804, FAX:602-938-5026
CA	Concord, Competent Tech. Scvs.	510-827-9501, FAX:510-676-2904
CA	Inglewood, Ezra Mintz Assocs., Inc.	310-677-6790, FAX:310-677-7160
CA	Los Alamitos, Power Dynamics Co., Inc.	714-527-6567,FAX:714-827-7832
CA	Redondo Bch., Intelligent Power Solution	310-798-1946,FAX:310-379-1077
CA	Santa Ana, Powervar West	714-544-9940
CA	Santa Barbara, Powercom	805-963-4864, FAX:805-962-0104
CA	Woodside, Radical Two	415-363-0267, FAX:415-364-9504
CO	Boulder, Carebase Technlgs., Inc.	303-444-9399, FAX:303-444-6467
FL	Boca Raton, Business Svc. Mgt., Inc.	407-750-6802,FAX:407-750-9823
HI	Waipahu, Computer Power Specialists, Inc.	808-676-3700,FAX:808-676-5700
IL	Barrington, Integrated Power Solutions	708-991-9424,FAX:708-991-9425
IN	Zionsville, Elctrl. Powwer Protection Specs.	317-873-5027,FAX:317-873-4047
IA	Honeycreek, Integrated Elctrl. Svcs.	712-545-9394, FAX:712-545-3572
IA	Urbandale, Precision Power Sys.	515-276-4312, FAX:515-276-5058
MN	Edina, Dytec	612-831-7169,FAX:612-831-5114
MN	Lakeville, MESA Distbn.	612-469-1991, FAX:612-469-2273
MN	Minneapolis, T.G. Power Sys.	612-781-2722, FAX:612-781-7545
NY	N. Syracuse, Lachut Elctrl. Sls.	315-458-6486, FAX:315-458-6147
PA	Feasterville, Spectrum Power Prods.	215-357-6562,FAX:215-357-5871
TX	Dickinson, Power Unltd.	713-337-6804, FAX:713-337-5504
WA	Redmond, AC Power Technlg.	206-868-3632, FAX:206-868-3730
WA	Seattle, Quality Power Sys.	206-524-7016, FAX:206-524-7016
Can	Bedford, NS, Powervar Canada	902-835-0497, FAX:902-835-4530
Can	Vancouver, BC, Fisher Power Corp.	604-684-7383, FAX:604-684-0401

POWR-UPS CORP., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-5700, 1-800-333-POWR, FAX: 516-345-3106; Empl.: 50; *Sls. Mgr.:* Veronica Harney

PPC PRODUCTS CORPORATION, 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 407-848-9606, TWX: 510-952-7611; FSC No.: 33178; Empl.: 75; *Sls. Mgr.:* Kathy Anderson

FAX: 919-781-4980

PPD, INC., 6001 Resco Ct, Raleigh, NC 27613, Tel: 919-781-3955; Empl.: 25 .... **A•1150-1155; B•1383**

Local Sales Offices & Reps

NC	Raleigh, Godwin Assocs.	919-878-8000

PPM, INC., 23500 Mercantile Rd., Unit I, Cleveland, OH 44122, Tel: 1-800-899-4776; FSC No.: 29504; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher .... **D•1315**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CA	Camarillo, Brevco	805-491-2943
CO	Colorado Springs, J. Smith & Assocs.	719-597-5343
MI	Ferndale, Tiby Co.	313-547-3550
NM	Albuquerque, J. Smith & Assocs.	505-345-6501
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822

PRACTICAL AUTOMATION, INC., 2 Research Dr., Shelton, CT 06484, Tel: 203-929-5381, FAX: 203-929-9941; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, FAX: 215-757-8025; FSC No.: 60197; Empl.: 50; *Sls. Mgr.:* Paul F. Ruo

PRECI-DIP, See Mill-Max Mfg. Corp.

PRECISE SENSORS, INC., 235 West Chestnut Ave., Monrovia, CA 91016, Tel: 818-358-4578, FAX: 818-358-3546; Empl.: 35

PRECISION COMPONENTS, INC., 400 W. Davy Ln., Wilmington, IL 60481, Tel: 708-543-6448, FAX: 708-543-6484

PRECISION CONTROL MANUFACTURING, INC., 1509-B Queen Anne Ave. N., Seattle, WA 98109, Tel: 206-281-9380; FSC No.: 64782; Empl.: 5; *Sls. Mgr.:* Steve L. Deters .... **A•2116**

Local Sales Offices & Reps

WA	Seattle, Precision Control Mfg., Inc.	206-281-9380

Local Distributors

CA	Granada Hills, Lion Elctrn., Inc.	818-363-0993

PRECISION DIGITAL CORP., 15 Mercer Road, Natick, MA 01760, Tel: 508-655-7300, FAX: 508-655-8990; *Sls. Mgr.:* Jeffrey Peters

PRECISION ELECTRONIC HARDWARE, INC., 987 Woodtick Road, Waterbury, CT 01703, Tel: 203-754-0779, FAX: 203-755-7996; Empl.: 25; *Sls. Mgr.:* Jeffrey A. Balko

PRECISION ELECTRONICS, 9101 King Ave., Franklin Park, IL 60131, Tel: 708-678-5350, FAX: 708-678-0511; Empl.: 25; *Sls. Mgr.:* Jeff Franzen

PRECISION ELECTRONICS INC., One DiFomas Ct., Copiague, NY 11726, Tel: 516-842-4900, FAX: 516-842-4904 .... **A•2526**

PRECISION ELECTRO-OPTICS, INC., 30 Commerce St., Box 1039, Chatham, NJ 07928, Tel: 201-635-8811, FAX: 201-635-0437; FSC No.: OG1WB-Cage Code; Empl.: 8; *Sls. Mgr.:* Jim Ingram

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 708-766-0340, FAX: 708-766-0495; Empl.: 135; *Sls. Mgr.:* Richard Ziehm

FAX: 219-253-6570

PRECISION FABRICATION TECHNOLOGIES, INC., State Road 16 W., Monon, IN 47959, Tel: 1-800-558-7297, 219-253-6666; Empl.: 100; *Sls. Mgr.:* Joseph Rogers; *Dist. Mgr.:* Duane Nagel .... **C•1073-1079**

Local Sales Offices & Reps

AL	Mobile, Allied Elctrns.	800-433-5700
AZ	Phoenix, Allied Elctrns.	800-433-5700
AZ	Phoenix, TeQni-Rep. Assoc.	602-242-9449
CA	Saratoga, Edward King & Assocs.	408-741-0434
CA	Sun Valley, TeQni-Rep. Assoc.	818-768-4223
CO	Englewood, Techtel Mktg.	303-721-9626
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Orlando, Aurora-Schmitt Assoc.	800-232-9005
IL	Cary, Bob Burns & Assocs.	708-516-3322
IL	Monee, C.R. Co.	708-534-7940
MA	Burlington, FJS Assocs.	617-273-5959
MI	Livonia, Amtech Rep.	313-474-8300
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Hauppauge, Schmitt Mktg. Corp.	516-434-1313
OH	Rocky Hill, Oak Hill Mktg., Inc.	216-333-0000
OR	Portland, Caruso & Co.	503-246-5439
TX	Austin, S.W. Mktg. Assoc.	512-255-8010
TX	Dallas, S.W. Mktg. Assocs.	214-341-8631
TX	Houston, S.W. Mktg. Assocs.	713-537-8166
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Colgate, Rep One & Assocs.	414-628-4016
WI	Madison, Rep One & Assoc.	608-246-8889

Local Distributors

AL	Birmingham, ACK Radio Supply	205-322-0588
AL	Huntsville, Allied Elctrns.	800-433-5700
AL	Huntsville, Marshall Inds.	205-881-9235
AL	Mobile, Allied Elctrns.	800-433-5700
AZ	Phoenix, Allied Elctrns.	800-433-5700
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Tucson, Elctrn. City	602-622-1173
CA	Calabasas, Marshall Inds.	818-878-7021
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Chatsworth, Allied Elctrns.	800-433-5700
CA	Chatsworth, ITC Elctrns.	818-700-0900
CA	Costa Mesa, Marvac Elctrns.	714-540-3280
CA	El Toro, R-Vac Elctrns.	714-586-1210
CA	Fremont, Allied Elctrns.	800-433-5700
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawaiian Gardens, Dow Radio	213-421-3781
CA	Irvine, Allied Elctrns.	800-433-5700
CA	Irvine, Marshall Inds.	714-458-5394
CA	Los Angeles, ITC Elctrns.	213-388-0621
CA	Los Angeles, Pacific Radio	213-462-1393
CA	Milpitas, Marshall Inds.	408-942-4700
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	North Hollywood, Sandy's Elctrns.	818-983-2550
CA	Oxnard, Dow Radio	805-486-6353
CA	Oxnard, ITC Elctrns.	805-983-4115
CA	Pamona, DOW-Radio	818-966-8461
CA	Pasadena, DOW-Radio	818-793-1195
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Rocklin, Allied Elctrns.	800-433-5700
CA	Sacramento, Allied Elctrns.	800-433-5700
CA	Sacramento, Zack Elctrns.	916-369-1786
CA	San Diego, Allied Elctrns.	800-433-5700
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrns.	408-943-0255
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Santa Clara, Context Engrg.	408-748-8676
CA	South San Francisco, Allied Elctrns.	800-433-5700
CA	Thousand Oaks, Pace Elctrns.	805-379-9631
CO	Denver, Gateway Elctrns.	303-458-5444
CO	Englewood, Allied Elctrns.	800-433-5700
CO	Thornton, Marshall Inds.	303-451-8444
CT	Bridgeport, Park Dists.	203-366-7200
CT	Cheshire, Allied Elctrns.	800-433-5700
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Casselbery, Allied Elctrns.	800-433-5700
FL	Fort Lauderdale, Marshall Inds.	305-977-4880
FL	Jacksonville, Allied Elctrns.	800-433-5700
FL	Largo, Allied Elctrns.	800-433-5700
FL	Miami Lakes, Allied Elctrns.	800-433-5700
FL	Pompano Beach, Allied Elctrns.	800-433-5700
FL	St. Petersburg, Marshall Inds.	813-573-1399
GA	Atlanta, Allied Elctrns.	800-433-5700
GA	Atlanta, ACK Radio	404-351-6340
GA	Duluth, Allied Elctrns.	800-433-5700
GA	Norcross, Marshall Inds.	404-923-5750
ID	Boise, Radar Elc.	208-336-2227
IL	Berwin, B-B & W Inc.	708-749-1710
IL	Champaign, Klaus Radio	217-356-1896
IL	LaSalle, Klaus Radio	815-223-7400
IL	Libertyville, Allied Elctrns.	800-433-5700
IL	Mt. Prospect, Tri-State Elctrns.	708-255-0600
IL	Niles, Joseph Elctrns.	708-297-4240
IL	Oak Forest, Allied Elctrns.	800-433-5700
IL	Peoria, Klaus Radio	309-691-4840
IL	Quincy, Klaus Radio	217-223-7560
IL	Schaumburg, Marshall Inds.	708-490-0755
IL	Wood Dale, Allied Elctrns.	800-433-5700
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Evansville, Ohio Valley Sound	812-425-6173
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Allied Elctrns.	800-433-5700
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, Marshall Inds.	317-297-0483
IN	Indianapolis, PEI-Genesis	317-879-0700
IN	Terre Haute, Ohio Valley Sound	812-235-6025
IA	Des Moines, Allied Elctrns.	800-433-5700
KS	Lenexa, Allied Elctrns.	800-433-5700
KS	Lenexa, Marshall Inds.	913-492-3121
KY	Louisville, Allied Elctrns.	800-433-5700
KY	Owensboro, Ohio Valley Sound	502-683-6727
LA	Metairie, Allied Elctrns.	800-433-5700
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Columbia, Allied Elctrns.	800-433-5700
MD	Gaithersburg, Capitol Radio	301-840-5700
MD	Silver Spring, Marshall Inds.	301-622-1411
MA	Billerica, Allied Elctrns.	800-433-5700
MA	Northboro, Papi Supp.	508-393-8564
MA	Norwood, Allied Elctrns.	800-433-5700
MA	Wilmington, Marshall Inds.	508-658-0810
MI	Grand Rapids, Allied Elctrns.	800-433-5700
MI	Grand Rapids, S F Elctrn. Supp.	616-459-0216
MI	Livonia, LWC Distributors	313-464-7700
MI	Livonia, Marshall Inds.	313-525-5850
MI	Plymouth, Allied Elctrns.	800-433-5700
MN	Bloomington, Allied Elctrns.	800-433-5700

MN	Minneapolis, Tortec Corp.	612-866-3662
MN	Plymouth, Marshall Inds.	612-559-2255
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Earth City, Allied Elctrns.	800-433-5700
NE	Omaha, Allied Elctrns.	800-433-5700
NH	Nashua, Allied Elctrns.	800-433-5700
NJ	Edison, Allied Elctrns.	800-433-5700
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Lodi, Nidisco	201-773-1771
NJ	Moorestown, Allied Elctrns.	800-433-5700
NJ	Mount Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Allied Elctrns.	800-433-5700
NJ	Pine Brook, Allied Elctrns.	800-433-5700
NM	Albuquerque, Bestech	505-298-0034
NM	Albuquerque, TMA, Inc.	505-345-8921
NY	Endicott, Marshall Inds.	607-785-2345
NY	Fairport, Allied Elctrns.	800-433-5700
NY	Hauppauge, Broadline Elctrns.	516-273-2695
NY	Hauppauge, Marshall Inds.	516-273-1515
NY	Lagrangeville, Allied Elctrns.	800-433-5700
NY	Liverpool, WEI Inc.	315-652-8111
NY	Mineola, Allied Elctrns.	800-433-5700
NY	New York City, Audiotechniques	212-586-5989
NY	Rochester, Marshall Inds.	716-235-7620
NY	Syracuse, Allied Elctrns.	800-433-5700
NC	Charlotte, United Elctrn. Supp.	704-372-2650
NC	Raleigh, Allied Elctrns.	800-433-5700
NC	Raleigh, Marshall Inds.	919-878-9882
OH	Beachwood, Allied Elctrns.	800-433-5700
OH	Cincinnati, Allied Elctrns.	800-433-5700
OH	Columbus, Marshall Inds.	614-891-7580
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, Consolidated Elctrns.	513-435-5662
OH	Dayton, Marshall Inds.	513-898-4480
OH	Solon, Marshall Inds.	216-248-1788
OH	Worthington, Allied Elctrns.	800-433-5700
OK	Tulsa, Allied Elctrns.	800-433-5700
OR	Beaverton, Marshall Inds.	503-644-5050
OR	Portland, Allied Elctrns.	800-433-5700
OR	Portland, Radar Elec.	503-232-8353
PA	Bethlehem, P.A. Peters	215-861-4850
PA	Camp Hill, Allied Elctrns.	800-433-5700
PA	Pittsburgh, Allied Elctrns.	800-433-5700
PA	Pittsburgh, Marshall Inds.	412-788-0441
RI	Cranston, Jabbour Elctrns.	401-944-2570
RI	Pawtucket, Jabbour Elctrns.	401-728-4600
SC	Greenville, Allied Elctrns.	800-433-5700
TN	Memphis, Allied Elctrns.	800-433-5700
TX	Austin, Allied Elctrns.	800-433-5700
TX	Austin, Altex Elctrns.	512-832-9131
TX	Austin, Marshall Inds.	512-837-1991
TX	Brownsville, Marshall Inds.	512-542-4589
TX	Carrollton, Marshall Inds.	214-233-5200
TX	Dallas, Allied Elctrns.	800-433-5700
TX	El Paso, Allied Elctrns.	800-433-5700
TX	El Paso, Marshall Inds.	915-593-0706
TX	Fort Worth, Allied Elctrns.	800-433-5700
TX	Houston, Allied Elctrns.	800-433-5700
TX	Houston, Marshall Inds.	713-467-1666
TX	Humble, Allied Ectrns.	800-433-5700
TX	Midland, GDL Elctrns.	915-687-3876
TX	San Antonio, Altex Elctrns.	512-828-0503
UT	Salt Lake City, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Marshall Inds.	801-973-2288
VA	Alexandria, Arcade Elctrns.	703-256-4610
VA	Richmond, Norfolk Wire	804-355-1100
VA	Springfield, Allied Elctrns.	800-433-5700
VA	Virginia Beach, Allied Elctrns.	800-433-5700
VA	Virginia Beach, Norfolk Wire	804-449-1100
WA	Bothell, Marshall Inds.	206-486-5747
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Allied Elctrns.	800-433-5700
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WA	Tacoma, Allied Elctrns.	800-433-5700
WI	Madison, Satterfield Elctrns.	608-222-3400
WI	Milwaukee, Ind. Elctrns.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Allied Elctrns.	800-433-5700
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	Waukesha, Marshall Inds.	414-797-8400
Can	Ontario, Marshall Inds.	416-458-8046
Can	Quebec, Marshall Ind.	514-694-8142

PRECISION FILTERS, INC.
CONDITIONERS•SWITCHES•DATA ACQUISITION•SYSTEMS

FAX: 607-277-4466

PRECISION FILTERS, INC., 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 80; *Sls. Mgr.:* D. F. Chandler .... **A•1616, 1673-1675; D•1018, 1200-1202**

Local Sales Offices & Reps

AZ	Tempe, Hannah-Hill	602-431-1772
CA	Chatsworth, Technologies West	818-700-6426
IL	Matteson, Instrumentation Sls. Inc.	708-720-0705
CA	San Jose, Dugan Technlgs.	408-268-1766
CO	Denver, Hannah-Hill, Inc.	303-252-1154
FL	Orlando, Microspec	407-898-3504
GA	Lilburn, Microspec	404-921-3840
IL	Matteson, Instrumentation Sales. Inc.	708-720-0705
KS	Merriam, TECREP Corp.	913-262-9500
IN	Indianapolis, RDP Corp.	317-243-8788
MD	W. Friendship, Gans & Pugh Assocs.	410-442-2189
MA	Boston, Ellis Assocs.	617-585-6750
MI	St. Louis, TECREP Corp.	314-454-9110
MI	Farmington Hills, RDP Corp.	313-471-0685
NH	Manchester, Ellis Assocs.	603-623-0185
NM	Albequerque, Hannah-Hill, Inc.	505-268-0950
NY	Amherst, Reliable Measurement	716-862-9484
NY	Port Chester, Radiation Elctrns.	914-937-2300
OH	Dayton, RDP Corp.	513-253-6175
OH	Richfield, RDP Corp.	216-659-3138
OK	Tulsa, Abcor, Inc.	918-279-1468
PA	North Wales, Gans & Pugh Associates, Inc.	215-699-6655
PA	Pittsburg, RDP Corp.	412-487-2217
SC	Rock Hill, Microspec	803-366-3015
TN	Nashville, Microspec	615-383-4064
TX	Houston, ABCOR, Inc.	713-486-9251
UT	Salt Lake City, Hannah-Hill, Inc.	801-943-9918
VA	Herndon, Gans & Pugh Assocs.	703-709-0305
WA	Bellevue, Syntek	206-462-7700

PRECISION GRAPHICS INC., 59 La Grange St., Raritan, NJ 08869, Tel: 908-707-8880, FAX: 908-707-8884; Empl.: 39; *Sls. Mgr.:* David K. Weissman

Local Sales Offices & Reps

NJ	West Orange, Rizzo Assocs.	201-731-0974
OH	Twinsburg, Protocol Sls.	216-425-2569
PA	New Hope & Norristown, Intek, Inc.	215-723-0433

PRECISION IMAGE CORPORATION, 501 Chesapeake Dr., Redwood City, CA 94063, Tel: 415-366-8900, 1-800-338-3377, FAX: 415-366-2149; Empl.: 70; *Sls. Mgr.:* Mr. Rene Carillo; *Dist. Mgr.:* Mr. Rene Carillo

PRECISION INTERCONNECT, Subsidiary of AMP Incorporated, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400; FSC No.: 60381; Empl.: 500; *Sls. Mgr.:* Alex Guletsky

PRECISION LAMP, INC., 720 Portal St., Cotati, CA 94931, Tel: 707-792-0333, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 80

PRECISION MECHANISMS, 50 Bond St., Westbury, NY 11590, Tel: 516-ED3-5955, FAX: 516-333-5956; FSC No.: 08127; Empl.: 19; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01960, Tel: 508-532-5500, FAX: 508-532-9403; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert A. Degnan

PRECISION MICROCONTROL, 8122 Engineer Rd., San Diego, CA 92111, Tel: 619-565-1500, FAX: 619-565-1511; *Sls. Mgr.:* Ian M. Clark

PRECISION PAPER TUBE CO., 1033 South Noel Ave, Wheeling, IL 60090, Tel: 708-537-4250, FAX: 708-537-5777; Empl.: 250

PRECISION PRODUCTS GROUP, INC., 4903 E. State St., Rockford, IL 61108, Tel: 815-395-2155, FAX: 815-395-2151; Empl.: 500; *Sls. Mgr.:* Douglas W. Franklin

PRECISION PROTOTYPES, INC., 255 Midland Ave., Garfield, NJ 07026, Tel: 201-546-6737, FAX: 201-546-8872; *Sls. Mgr.:* Rick Caporino

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131; Empl.: 65; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline .... **A•2014-2015**

Local Sales Offices & Reps

AZ	Tempe, Advanced Comp. S/S AZ	602-731-9711
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Seal Beach, Texel	310-596-9411
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Melbourne, Phoenix Comps.	407-723-4414
GA	Duluth, Dixie Tech. Mktg.	404-381-5592
IL	Arlington Heights, Russell Elctrn. Sale	708-394-5560
IN	Greenwood, Valentine & Associates	317-888-2260
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MD	Baltimore, Advanced Tech. Sls.	301-323-3140
MA	Lexington, Jesco, Inc.	617-863-1598
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
NJ	Ridgewood, Ballou Inc.	201-444-6990
OH	Kettering, K.B. Smith Inc.	513-299-0033
TX	Dallas, Kay Todd Assocs.	214-458-8833
WA	Edmonds, ACDC	206-745-5445

PRC

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647-1421, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid .... **A•2016-2017**

PRECISION SPECIALTIES, INC., 8740 Shirley Ave., Northridge, CA 91324, Tel: 818-349-9774, FAX: 818-349-4367; FSC No.: 66785; Empl.: 10

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128, FAX: 415-856-1638

PRECISION THIN METAL (LP), 112 Mary Ann Road, Beaver Dam, WI 53916, Tel: 414-885-9000, FAX: 414-885-5078; Empl.: 12; *Sls. Mgr.:* Philip F. Lauf

PRECISION TUBE, 287 Wissahickon Ave., N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PRECISION TUBE CO., Coaxitube Div., 245 Naylor Mill Rd., Salisbury, MD 21801, Tel: 410-546-3911, FAX: 410-546-3913; FSC No.: OBV02; Empl.: 18; *Sls. Mgr.:* Douglas McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, 1-800-553-6374, FAX: 413-562-7275; Empl.: 160; *Sls. Mgr.:* Andree Buscemi

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 708-438-4000, FAX: 708-438-5522; FSC No.: 36-3193682; Empl.: 10; *Sls. Mgr.:* Pat Jones; *Dist. Mgr.:* Bob Van Orden

PREMA PRECISION ELECTRONICS, INC., 4650 Arrow Hwy. Suite E-5, Montclair, CA 91763, Tel: 714-621-7292, FAX: 714-625-2098

PM Premier Magnetics Inc.

FAX: 714-362-4212

PREMIER MAGNETICS INC., 27111 Aliso Creek Rd., Ste. 175, Aliso Viejo, CA 92656, Tel: 714-362-4211; Empl.: 10; *Sls. Mgr.:* Jim Earley .... **A•2508**

Local Sales Offices & Reps

CA	Northern CA, Silicon Valley Sls.	408-432-1967
FL	Tampa, APM Assocs.	813-886-2457
GA	B.T. Funderburk, Inc.	404-963-9495
MD	Artco Assocs.	410-638-1134
MA	Advanced Comp. Grp.	508-845-2023
NJ	Unirep	908-940-1851
NJ	W. Milford, Dynamic Sls. Assoc.	201-728-1044
NJ	West Milford, Dynamic Sls. Assoc.	201-728-1044
NC	B.T. Funderburk, Inc.	919-846-2373
OR	Northwest Comp. Sls.	503-620-3285
WA	Kirkland, Northwest Comp. Sls.	206-828-2104

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 718-993-9200, FAX: 718-993-9211; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza .... **C•1080**

Local Sales Offices & Reps

CA	Campbell, Shur Sls.	408-374-5577
CA	Fontana, Premier Metal	714-829-3089
CO	Denver, AKI Enterprises	303-338-4488
CT	East Haven, Eagle Assocs.	203-467-6542
GA	Marietta, Adams & Assocs.	404-973-0853
IL	Carmel, Current Elctrns.	317-844-1770
IL	St. Charles, May Assocs.	708-293-0062
KS	Kansas City, Delltron Co.	816-436-6445
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Anoka, Tech. Solutions	612-785-9303
MO	Florissant, Delltron Co.	314-839-0033
NY	New Hyde Park, Harris & Aldrich Sls.	516-488-2622
NY	Rochester, MicroTech Mktg.	716-426-0806
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greenboro, Adams & Assocs.	919-272-6838
OH	Dayton, Thompson & Assocs.	513-435-7733
PA	Penndel, Delta Mktg.	215-353-6639
TX	Richardson, Spectra Sls. Corp.	214-234-3600
WA	Redmond, Scientific Dvcs	206-885-0004
EXP	FL, Ft. Lauderdale, GM Intl.	305-434-6617

Local Distributors

AZ	Phoenix, Dalis Elctrns.	602-275-2885
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrns.	408-943-0255
ID	Boise, Radar Elec.	208-336-2227
IL	Skokie, Anixter	708-677-2600
LA	Baton Rouge, Menard Elctrns.	504-355-0323
MI	Ann Arbor, Purchase Radio Supp.	313-668-8696
MO	St. Louis, Gateway Elctrn. Supp.	314-427-6116
NJ	Cranford, Garden State Indl. Elec.	201-272-6400
NJ	Englewood, Datanet	201-569-2353
NY	Buffalo, Summit Distrs.	716-884-3450
NY.	Great Neck, Avon Datacom	516-466-1690
NY	Hauppauge, Broadline Elec. Dist.	516-231-4100
NY	LIC, H. L. Dalis Inc.	212-361-1100
NY	New York, Audio Techniques	212-586-5989
NY	Portchester, Wise Comps.	914-939-8600
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Warren, Rem Elctrns.	216-248-1636
OR	Portland, Radar Elec.	503-232-3404
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	West Chester, West Chester Elec. Supp.	215-696-7500
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, FAX: 914-939-9239; FSC No.: 15870; Empl.: 43; *Sls. Mgr.:* Mel Radner

PREM®

FAX: 815-385-8578

PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700; FSC No.: 20462; Empl.: 180; *Sls. Mgr.:* D. Hertel .... **A•1277-1281, 2512-2525**

PRES-AIR-TROL CORP., 1009 Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625, FAX: 914-698-9456; Empl.: 25; *Sls. Mgr.:* Gilbert Bassin .... **B•1800**

PRESCO, INC., 8 Lunar Drive, Woodbridge, CT 06525, Tel: 203-397-8722, FAX: 203-389-1129; Empl.: 8

PRESIDIO COMPONENTS, INC., 7169 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, FAX: 619-578-6225; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd., Addison, IL 60101, Tel: 708-628-2255, FAX: 708-628-8025; Empl.: 25; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-5002, FAX: 201-751-9653; FSC No.: 52193; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 98; *Sls. Mgr.:* J. S. Yakshe

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME TECHNOLOGY

FAX: 203-481-8937

PRIME TECHNOLOGY, INC., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 60; *Sls. Mgr.:* James L. Jamieson, Mktg. VP

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* H. Ikoma; *Dist. Mgr.:* S. Mizutani

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 908-687-1750, FAX: 908-687-1755; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, 2549 U.S. Highway 1, North Brunswick, NJ 08902, Tel: 908-297-4448, FAX: 908-297-5641; Empl.: 29; *Sls. Mgr.:* H.R. Center; *Dist. Mgr.:* H.R. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-1500, FAX: 215-355-7766; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

PRINTER PRODUCTS, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 100; *Sls. Mgr.:* Joe Grimaldi; *Dist. Mgr.:* Bruce Burgess

PRINT PRODUCTS INTL., 8931 Brookville Rd., Silver Spring, MD 20910, Tel: 301-587-7824, 800-638-2020, FAX: 800-545-0058; Empl.: 6; *Sls. Mgr.:* Scott MacDonald; *Dist. Mgr.:* Scott MacDonald

PBS
PRO BATTERY SPECIALISTS

FAX: 404-449-5457

PRO BATTERY, INC., 3941 Oakcliff Indl. Ct., Atlanta, GA 30340, Tel: 800-451-7171; Empl.: 35; *Sls. Mgr.:* Neal A. Zucker .... **B•1178; D•1465**

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-772-1519, FAX: 619-560-7354; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; *Sls. Mgr.:* Frank J. Ardezzone

PROCESS & ANALYTICAL INSTRUMENTS DIV., A Subsidiary of Ametek Inc., 150 Freeport Rd., Pittsburgh, PA 15238, Tel: 412-828-9040, FAX: 412-828-0399; Empl.: 110; *Sls. Mgr.:* Jerry Barth

PRO-COMM, INC., 1105 Industrial Pkwy., Brick, NJ 08724, Tel: 908-206-0660, FAX: 908-458-1919; FSC No.: OUTX6; Empl.: 10; *Sls. Mgr.:* Robert L. Sepulveda

PRO COM TECHNOLOGY INC., 29 Newton Rd., Plainview, NY 11803, Tel: 516-293-4443, 800-762-3785, FAX: 516-293-4456; FSC No.: 0K887; Empl.: 11; *Sls. Mgr.:* Alan Spiegel

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 130; *Sls. Mgr.:* Dan Johnson

PRODIGIT ELECTRONICS, 69 Moreland Rd., Simi Valley, CA 93065, Tel: 805-527-0888; Empl.: 100; *Sls. Mgr.:* Daniel Erb

PRODUCTION AUTOMATION, INC., 2558 Seaboard Ave., San Jose, CA 95131-1026, Tel: 408-894-9064, FAX: 408-894-9083; Empl.: 4; *Sls. Mgr.:* Bill Minnick; *Dist. Mgr.:* Bill Minnick

PRODUCTRONICS INC., 7616 Disalle Blvd., Fort Wayne, IN 46825, Tel: 219-489-8201, FAX: 219-489-6573; Empl.: 4; *Sls. Mgr.:* Bernard James

PRODUCTS ENGRG. CORP., 503 S. Vincent Ave., Azusa, CA 91702-5131, Tel: 818-969-5879, TELEX: 910-587-1559, FAX: 818-969-9381; FSC No.: CAGE 3S621; Empl.: 30; *Sls. Mgr.:* Richard Mitchell

PRODUCTS FOR RESEARCH, 88 Holten St., Danvers, MA 01923, Tel: 508-774-3250, FAX: 617-245-1628; Empl.: 16

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998, FAX: 714-474-1340; FSC No.: 1Z295; Empl.: 85; *Sls. Mgr.:* Diane Weston .... **C•1673**

PROFESSIONAL ENGINEERING SYSTEMS, 425 Parkway Dr., Erie, PA 16511-1051, Tel: 814-453-5452

PROGRAMMABLE DEVICES, INC., 205 Main St., North Reading, MA 01864, Tel: 508-664-6447, FAX: 508-664-9977; Empl.: 10

PTS
FREQUENCY SYNTHESIZERS

FAX: 508-486-4495

PROGRAMMED TEST SOURCES, 9 Beaver Brook Road, P.O. Box 517, Littleton, MA 01460, Tel: 508-486-3008; FSC No.: 66381; Empl.: 30 .... **D•1316**

PROJECTIONS UNLIMITED, 14831 Myford Rd., Tustin, CA 92680, Tel: 714-544-2700, FAX: 714-544-8711; *Sls. Mgr.:* Robert C. Gau

PROJECTOR RECORDER BELT CORP., Route 3 Highway 59 P.O. Box 176, Whitewater, WI 53190, Tel: 1-800-533-9654, FAX: 1-800-635-8101; Empl.: 30; *Sls. Mgr.:* Ed Wetzel; *Dist. Mgr.:* Nancy Smith

PROJECT PRO, 1710 Enterprise Pkwy., Twinsburg, OH 44087, Tel: 216-425-8888

PROJECT RESOURCES INC., 16 Kendrick Rd., Wareham, MA 02571, Tel: 508-295-7444, FAX: 508-295-7497; FSC No.: OEF11; Empl.: 18; *Sls. Mgr.:* T.R.Egan

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, FAX: 513-890-4911; Empl.: 61; *Sls. Mgr.:* Greg Kimpton .... **D•1057**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CA	Irvine, Cal Rep Inc.	
CA	San Jose, Comtech Mktg.	408-249-3330
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Lakeland, Munday Sls. Co.	813-858-5606
GA	Alpharetta, R.A. Sls.	404-442-6749
IL	Woodridge, Golten Assocs. Inc.	708-985-5100
IN	Indianapolis, The J. C. Hofstetter Co.	317-897-7914
IA	Cedar Rapids, Thomas Dowell	319-393-7920
KS	Overland Park, Thomas L. Dowell	913-722-4242
MA	Westwood, Sturdy Corp.	617-326-8300
MN	Edina, G.P. Sls.	612-831-2362
MO	St. Louis, Thomas L. Dowell	314-849-4234
NH	Derry, Sturdy Corp.	603-434-8440
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Bohemia, Optimum Metro Sls., Inc.	516-244-5744
NY	Penn Yan, Ecco New York	315-536-5033
NC	New Bern, R A Sales	919-244-2672
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Hillsboro, Doran Sls., Assoc.	503-640-4500
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Valley Forge, Providence Mktg.	215-935-3300
SC	Easley, R A Sales	803-859-1859
TN	Rutherford, R.A. Sls.	901-665-6301
TX	Austin, Kruvand Assocs. Inc	512-219-9443
TX	Dallas, Kruvand Assoc.	214-437-3355

WA	Bothell, Doran Sls. Assocs., Inc.	206-488-1200
Can	Islington, Ont., D.T. Shaw Co., Ltd.	416-231-3494
Can	Montreal, Que., D.T. Shaw Co. Ltd.	514-332-1163

Local Distributors

AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
AR	Pine Bluff, Carlton Bates	501-535-1354
AR	Springdale, Carlton Bates	501-756-5012
CA	Milpitas, Kent Elctrns.	408-262-5300
CA	San Jose, Speakers Unlimited	408-453-5698
CA	Torrance, Kent Elctrns.	310-320-2700
CO	Commerce City, Waco Elctrns.	303-289-4743
CT	Newtown, Target Elctrns.	203-426-4403
FL	Clearwater, Atlantic Elctrns.	813-531-5900
FL	Lakeland, A-A Elec.	813-665-6941
FL	Lakeland, Atlantic Elctrns.	813-687-0200
FL	West Palm Beach, Atlantic Elctrns.	407-686-8553
GA	Lawrenceville, A-A Elec.	404-822-4960
IL	Bensenville, Voyager Elctrns. Corp.	708-860-1300
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
LA	Shreveport, Carlton Bates	318-636-9975
MD	Gaithersburg, Axis Elctrns.	800-368-2815
MA	Hingham, Hingham Bay	617-740-1900
MA	Westwood, Target Elctrns.	617-329-2700
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
MO	Springfield, Carlton-Bates Co.	417-862-1699
MO	St. Louis, Beckwith Elctrns.	314-343-6463
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NY	Rochester, Ray Baker Elctrns.	716-586-9164
OH	Dayton, Electro Supp.	513-299-5020
OK	Oklahoma City, Carlton Bates	405-681-4446
OK	Tulsa, Carlton Bates	918-250-1626
OR	Beaverton, Kent Elctrns.	503-626-8300
PA	Levittown, Aim Elctrns.	215-946-3900
PA	McKean, Advacom	814-476-7774
TN	Jackson, Carlton Bates	901-664-2714
TN	Memphis, Carlton Bates	901-365-3539
TN	Nashville, Carlton Bates	615-885-3232
TX	Austin, Carlton-Bates Co.	512-837-9098
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Dallas, Off The Shelf Comps.	214-247-0052
TX	Ft. Worth, Carlton Bates	817-293-5558
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Off the Shelf Comps.	214-238-0808
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	San Antonio, Carlton Bates	512-805-8300
TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Texarkana, Carlton Bates	903-792-6923
WA	Redmond, Kent Elctrns.	206-883-7200
WI	Milwaukee, Electronic Expeditors	414-228-8100
Can	Willowdale, Ont., Electro Sonic	416-494-1555

PRO-LOG CORP., 2555 Garden Road, Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 120; *Sls. Mgr.:* Pat Laughlin; *Dist. Mgr.:* Pat Laughlin

PROLOGIC SYSTEMS, 557-P Burbank St., Broomfield, CO 80020, Tel: 303-460-0103, FAX: 303-469-5565; Empl.: 6

PROMAC, United Exporters Company, 1095 Market St., Ste. 701, San Francisco, CA 94013-1630, Tel: 415-255-9393, FAX: 415-255-9392; *Sls. Mgr.:* Brian Tench

PROMAX-JOHNTON ELECTRONIC CORP., 1555-B McGaw Ave., Irvine, CA 92714, Tel: 714-975-1245, FAX: 714-975-1202; Empl.: 12; *Sls. Mgr.:* Kathy De Yeso; *Dist. Mgr.:* Kathy De Yeso

PROTEK DEVICES, 2001 W. Tenth Pl., Tempe, AZ 85281, Tel: 602-968-6060, FAX: 602-921-3760; Empl.: 50

PROTO SYSTEMS, 625 Sims Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, 800-331-1797, FAX: 404-442-9751; FSC No.: 7U 718; Empl.: 155; *Sls. Mgr.:* Keith Koehle

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094, FAX: 513-874-2252; FSC No.: 60813; Empl.: 45; *Sls. Mgr.:* Ron Nabors

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, FAX: 609-298-8235; FSC No.: 05853; Empl.: 30; *Sls. Mgr.:* C. W. Harrison

PTS CORPORATION, Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 350; *Sls. Mgr.:* Jeff Hamilton; *Dist. Mgr.:* David Melwid

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, TELEX: 23-0398, FAX: 313-388-9171; Empl.: 21; *Sls. Mgr.:* J. Schultz

Z-LINE®

FAX: 714-641-9062

PULIZZI ENGINEERING, INC., 3260 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; FSC No.: 70513; Empl.: 28 **D•2300-2304**

Local Sales Offices & Reps

CA	Anaheim, Alpha Elctrn. Sls.	714-665-6580
CA	Garden Grove, Elctrn. Packaging Solutions	714-638-4455
CA	Los Gatos, Norwest Elctrns.	408-395-1190
CA	Santa Ana, Pulizzi Engrg., Inc.	714-540-4229
CO	Golden, J.F. Hurlbut Co.	303-279-7796
FL	Oldsmar, Temco Sls. Inc.	813-855-7566
IL	Bensenville, E.S.I.	708-766-3667
MD	Columbia, L.G. White & Co., Inc.	410-290-8880
MA	Stow, H.G. Assocs.	508-897-3190
MN	St. Paul, Heyda-Hanks Assocs.	612-484-8531
NY	Babylon, The Jette Grp.	516-669-6788
NY	Fayetteville, Martin P. Andrews	315-637-5291
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
OR	Beaverton, Temper Tech. Mktg.	503-292-8201
TX	Dallas, Kruvand Assocs.	214-437-3355
PA	Valley Forge, J.E. Cuesta & Co.	215-935-0400

PULNIX AMERICA, INC., 770 Lucerne Dr., Sunnyvale, CA 94086, Tel: 408-733-1560, FAX: 408-737-2966; Empl.: 80; *Sls. Mgr.:* Richard Hofmeister

PULSE ENGINEERING, INC., 12220 World Trade Dr., San Diego, CA 92128, Tel: 619-674-8100, FAX: 619-674-8262; Empl.: 3000; *Sls. Mgr.:* Dan Jackson; *Dist. Mgr.:* Rich Backman

PULSE INSTRUMENTS CO., 1234 Francisco, Torrance, CA 90502, Tel: 310-515-5330, FAX: 310-515-0068; Empl.: 30; *Sls. Mgr.:* Ron Perry

PUREDATA, 180 West Beaver Creek Rd., Richmond Hill, Ont., Canada L4B 1B4, Tel: 416-731-6444, FAX: 416-731-7017; Empl.: 150; *Sls. Mgr.:* Alex Kosarow, VP of Sls.; *Dist. Mgr.:* Sal Cataldo, US Sls.

PUROLATOR PRODUCTS, INC., Formerly Facet Enterprises, 3 Miracle Mile, P.O. Box 1502, Elmira, NY 14902, Tel: 607-737-8011, TELEX: 6854130, FAX: 607-737-8335; FSC No.: 72850; Empl.: 300

PYCO, INC., 600 E. Lincoln Hwy., Penndel, PA 19047, Tel: 215-757-3704, FAX: 215-757-3780; Empl.: 48; *Sls. Mgr.:* John Savage

PYLE INDUSTRIES, INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200, FAX: 219-356-2830; Empl.: 375; *Sls. Mgr.:* Tom Pyle; *Dist. Mgr.:* Mark Pyle, Natl. Sls. Mgr.

PYLE-NATIONAL, 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300 x210, TELEX: 25251, TWX: 910-221-0335, FAX: 312-342-0872; FSC No.: 49367; Empl.: 400

PYLON CO., See Augat/Pylon Corp., Inc.

PYLON ELECTRONICS INC., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, FAX: 514-636-1970; Empl.: 50; *Sls. Mgr.:* J. Guay

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535, FAX: 206-365-0402; *Sls. Mgr.:* Bill Kurtz

PYROFERRIC INTERNATIONAL, INC., P. O. Box 159, Toledo, IL 62468-0159, Tel: 217-849-3300, FAX: 217-849-2544; Empl.: 50; *Sls. Mgr.:* S. John Horner

PYROFILM RESISTOR CO., See KDI/Triangle Electronics

Q-CARD, INC., 2 Chellis Ct., Owings Mills, MD 21117-1634, Tel: 410-581-0112; *Sls. Mgr.:* Larry Nickel

QMI/NIEC, 12900 Rolling Oaks Rd., Twin Oaks, CA 93518, Tel: 805-867-2555, FAX: 805-867-2698; *Sls. Mgr.:* Mitchell M. Cohen; *Dist. Mgr.:* Eric A. Wesoff, W. Reg. Mgr. **A•2176-2177**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-830-4030
CA	Laguna Hills, 4-Star Elctrn. Comp. Sls.	714-583-9781
CO	Denver, Alliance Elctrns. Colorado	303-433-1648
CT	Orange, Isdale Assocs.	203-389-8583
FL	Boca Raton, Tech Sls. Specialists, Inc.	407-391-3718
GA	Roswell, EMA, Inc.	404-992-7240
IL	Glendale Hgts., Synergistic Sls., Inc.	708-858-8686
MI	Troy, C.B. Jenson & Assocs., Inc.	313-643-0506
MN	Prior Lake, Gleason Assoc., Inc.	612-447-7020
NJ	No. Fairfield, Metro Logic Corp.	201-575-5585
NJ	So. Medford, CEF Assocs.	609-953-8945
NC	Raleigh, EMA, Inc.	919-846-6888
OR	Rocky River, Oak Hill Mktg., Inc.	216-333-0000
TX	Dallas, Electra Reps., Inc.	214-248-3852

QMS CIRCUITS, INC., QMS, 40 Hill Ave., Ft. Walton Bch., FL 32548, Tel: 904-244-6191, FAX: 904-244-0270; FSC No.: 65977; Empl.: 66; *Sls. Mgr.:* Jim Kimmitt

QPS INC., 95 Stiles Rd., Salem, NH 03079, Tel: 603-893-5100, FAX: 603-890-6675; FSC No.: OR9M8

QSI CORPORATION, 2212 So. W. Temple No. 46, Salt Lake City, UT 84115, Tel: 801-466-8770, FAX: 801-466-8792; Empl.: 10; *Sls. Mgr.:* Gerri Mackey **D•1105**

Local Sales Offices & Reps

CT	Orange, Isdale Assocs.	203-389-8583
FL	Altamonte Springs, Machine Controls	407-788-6607

Q-TECH CORP., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, Tel: 310-836-7900, FAX: 310-836-2157; FSC No.: 51774; Empl.: 121; *Sls. Mgr.:* Howard Phillips **A•1456-1459**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Hermosa Beach, Quattro Sls. Assoc., Inc.	310-372-4221
CA	Moorpark, Quattro Sls. Assoc., Inc.	805-523-2978
CA	San Diego, Quattro Sls. Assoc., Inc.	619-581-3093
CA	San Jose, Blue Elctrn. Sls.	408-345-0260
CA	San Juan Capistrano, Quattro Sls. Assoc., Inc.	714-735-4510
CO	Aurora, Pipers Sls. Co.	303-340-0216
CO	Parker, Howard Assoc.	303-841-5755
CT	Canterbury, Deltech Sls. Assocs.	203-546-6322
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
IN	Fort Wayne, TX Sales Inc.	219-489-4447
IA	Cedar Rapids, WG Controls	319-373-1009
KS	Roeland Pk., Abrams & Assocs.	913-432-2303
MA	Littleton, Deltech Sls. Assocs.	508-486-8294
MN	Minneapolis, Torkelson Assocs.	612-835-2414
MO	St. Louis, Abrams & Assoc.	314-569-0447
NJ	Glen Gardner, F & M Tech. Sls.	908-537-7888
NJ	Paramus, Eltech Sls.	201-967-1309
NM	Albuquerque, Piper Sls. Co.	505-828-1300
TN	Winchester, C.J. Sls.	615-967-2156
TX	Houston, Texoma Technical Sales, Inc.	713-462-1432
TX	Richardson, Texoma Tech.	214-238-8127
Can	Don Mills, Ont., R.D. Assoc.	416-444-0959

QUAD DESIGN TECHNOLOGY, INC., 1385 Del Norte Road, Camarillo, CA 93010, Tel: 805-988-8250, FAX: 805-988-8259; Empl.: 20; *Sls. Mgr.:* Ron Lee; *Dist. Mgr.:* Jack Weaver

QUADTECH, INC., Formerly GenRad Instruments, 45 Main St., Bolton, MA 01740-1107, Tel: 800-253-1230, FAX: 508-779-0247; Empl.: 80; *Sls. Mgr.:* Bob White, VP Sls.

QUALITEC TECHNOLOGIES, INC., 43064 Christy St., Fremont, CA 94538, Tel: 510-498-1046, FAX: 510-498-5938; Empl.: 130; *Sls. Mgr.:* Kevin Daniels **D•1317**

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QUALITY COMPONENTS, INC., P.O. Box 113, St. Marys, PA 15857, Tel: 814-834-2817, FAX: 814-834-9141; Empl.: 95; *Sls. Mgr.:* Michael Renaud, Mktg. Mgr.

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls.	602-957-3570
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	San Diego, Van Gott & Assocs.	619-489-0893
CT	Southington, The Orion Grp.	203-621-8371
IL	Palatine, Vine Sls., Inc.	414-279-3871
MA	Peabody, The Orion Grp.	508-532-6266
WI	Milwaukee, Vine Sls.	414-279-3871

QUALITY MICROWAVE INTERCONNECTS, INC., 301 Ballardvale St., Wilmington, MA 01887, Tel: 508-988-9090, FAX: 508-988-9393; FSC No.: 64023; Empl.: 30; *Sls. Mgr.:* Paul M. Tusini

QUALITY POWER SYSTEMS, INC., 2400 S. Texas Ave., Pearland, TX 77581, Tel: 713-997-1700, 800-992-1701, FAX: 713-997-1907; Empl.: 20; *Sls. Mgr.:* Clarence Oliver

QUALITY RESEARCH COMPANY, North 11424 Judkins Lane, Spokane, WA 99207-9632, Tel: 509-924-6895; Empl.: 6; *Sls. Mgr.:* Jon Roath

QUALITY SEMICONDUCTOR, 851 Martin Ave., Santa Clara, CA 95050, Tel: 408-450-8080, FAX: 408-496-0773

QUALITY TECHNOLOGIES, 610 N. Mary Ave., Sunnyvale, CA 94086, Tel: 408-720-1440, TELEX: 6731382, FAX: 408-720-0848; Empl.: 2000; *Sls. Mgr.:* Bob Taber; *Dist. Mgr.:* James Kahn

Qti
Quality Thermistor, Inc

FAX: 208-376-4754

QUALITY THERMISTOR, 2147 Centurion Pl., Boise, ID 83709, Tel: 208-377-3373; FSC No.: 56866; Empl.: 30; *Sls. Mgr.:* John Mahoney; *Dist. Mgr.:* Todd Ketlinski **B•1856, 1892-1893**

Local Sales Offices & Reps

EXP	Oradell, NJ, Sylvan Ginsbury Ltd.	201-261-3200

QUALOGY INC., 109 Bonaventura Dr., San Jose, CA 95134, Tel: 408-434-5200, FAX: 408-434-5242; Empl.: 16; *Sls. Mgr.:* Mike Sills

QUALSTAR CORP., 9621 Irondale Ave., Chatsworth, CA 91311, Tel: 818-882-5822, FAX: 818-882-4081; Empl.: 50; *Sls. Mgr.:* W. J. Gervais

Qualtek ELECTRONICS CORPORATION

FAX: 216-951-7252

QUALTEK ELECTRONICS CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, TELEX: 985319; Empl.: 75; *Sls. Mgr.:* Laura Yano/Regional Sls. Mgr.; *Dist. Mgr.:* Pat Clark/Regional Sls. Mgr. **A•1600; C•1638-1639**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
CA	Los Gatos, Luscombe Engrg.	408-370-2020
CA	Montrose, Signal Entprs., Inc.	818-957-0640
CO	Golden, Cristec-Meade Co.	303-279-5070
FL	Tampa, Florida Comp. Sls.	813-873-3622
IN	Fishers, Connect 21	317-578-2121
IN	Valparaiso, Catalyst	219-477-4004
KS	Olathe, Rothkopf & Assocs.	913-829-8897
MA	Needham, Sturgeon Tech. Sls.	617-444-6603
MN	Minneapolis, RK Sls. Assocs. Inc.	612-571-1001
MO	St. Louis, Rothkopf & Assocs.	314-961-4485
NJ	Lawrenceville, DVS Co.	609-896-1112
NJ	Matawan, Ashtec	908-583-6903
NY	Mendon, Tech Mark Inc.	716-624-3840
NY	Port Washington, Ashtec	516-767-0336
OH	Rocky River, Oak Hill Mtkg.	216-333-0000
OH	Westerville, Oak Hill Mktg.	614-890-5150
OR	Portland, Caruso & Camelleri Assocs.	503-246-5439
TX	Dallas, SW Mktg. Assocs.	214-341-8631
VA	Charlottesville, DVS Co.	804-973-0303
WA	Bellevue, Caruso & Assocs.	206-455-8811
Can	Ontario, Millennium Mktg.	416-798-3044

Local Distributors

CA	Gardena, Cal Switch	714-538-9830
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CT	Hartford, Wes-Garde Comps.	203-527-7705
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Wheeling, Hawk Elctrns.	708-459-4030
MD	Beltsville, Petricko Sls.	301-937-4960
MA	Marlboro, Hardware Specialty	508-481-8622
MA	Marlboro, Now Elctrns.	508-460-0187
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Wyoming, North Coast	616-249-8910
MN	Roseville, Parts One	612-633-8079
MO	Maryland Hts., L-Comp	314-291-6200
NJ	Pennsauken, IMS Distbn.	609-662-1770
NY	Elmsford, Multimetrics	914-347-3666
OH	Highland Hgts., Major Electronix	216-442-6200
PA	Philadelphia, Sharp Elctrns.	215-969-3300
PA	Pittsburgh, CAM-RPC	412-963-6202
PA	York, ECI	717-846-5334
TX	Ft Worth, Allied Elctrns.	817-595-3500
TX	Ft. Worth, Tandy Elctrns.	817-870-5600
WA	Seattle, Radar Elec.	206-282-2511
WA	Vancouver, Interconnect Sls.	206-256-4085
Can	Markham, Carsten Elctrns.	416-477-7705
Can	Pickering, Ont., A.C. Simmonds & Sons	416-839-8041
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710

QUALTRONICS CORP., INC., Tollgate Rd., Palm, PA 18070-0468, Tel: 215-679-0900, FAX: 215-679-5927; FSC No.: 7Z968; Empl.: 22

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago, IL 60637, Tel: 312-488-5800, FAX: 312-488-6944; Empl.: 200; *Sls. Mgr.:* William G. Little; *Dist. Mgr.:* Greg Johns **D•1059**

Local Sales Offices & Reps

AZ	Mesa, Yocum Mktg.	602-834-3334
CA	Culver City, Westech Mktg.	310-842-8820
CA	Gardena, Bidwell-Schwartz Assocs.	213-770-0300
UT	Salt Lake City, Pro Tech Mktg.	801-943-8331
FL	Orlando, Cartwright & Bean of FL	407-422-4531
GA	Norcross, Cartwright & Bean of GA	404-368-0160
IL	Mt Prospect, The Dombrow Co.	312-253-3326
IL	Skokie, Specialized Mktg.	708-674-1111
IN	Carmel, Green-Wissler Sls.,Inc.	317-843-5785
KS	Prairie Village, R. W. Kunz & Assocs., Inc.	913-648-3535
MA	Chicopee, Repworks, Inc.	413-533-0845
MN	Edina, Mel Foster Techn. Sls. Inv.	612-941-9790
NJ	Rahway, R. E. Breuer CO.	201-388-5045
NY	Syracruse, The Lewis & Dunnigan Co., Inc.	315-446-5522
OH	Stow, J. W. Lehner Co.	216-686-1965
PA	Broomall, Lowery Assocs. Co.	215-356-5300
TN	Menphis, Cartwright & Bean of TN	901-362-8345
TX	Dallas, Dick Bellew Sls.	214-644-7881
WA	Seattle, Vector Manufacturers' Rep.	206-368-8400
EXP	Yonkers, NY, Roburn Agencies, Inc.	914-968-1016
Can	Waterloo, Ont., McBride Loudspeaker Source, Ltd.	519-884-3500
MI	Southfield, Robert Milsk Co.	313-354-3310

QUAN-TECH, Stansbury Industries Inc., P.O. Box 28, Rte. 206, Flanders, NJ 07836, Tel: 201-927-1766, FAX: 201-927-8242; FSC No.: 63921; *Sls. Mgr.:* Richard A. Stansbury

QUANTEX CORPORATION, 2 Research Ct., Rockville, MD 20850, Tel: 301-258-2701, 800-992-5149 (Sls. only), FAX: 301-258-9871; Empl.: 40; *Sls. Mgr.:* Ken Charbonneau

QUANTRONIX, Excel Technology, 45 Adams Ave., Hauppauge, NY 11788, Tel: 516-273-6900, TELEX: 685-2167, FAX: 516-273-6958; Empl.: 100; *Sls. Mgr.:* S. Tornegard

QUANTUM CHROMODYNAMICS, INC., 2401 208th Street Unit 9, Torrance, CA 90501, Tel: 310-320-5717, FAX: 310-320-5848; Empl.: 4; *Sls. Mgr.:* David L. Hills

QUANTUM DATA®

FAX: 708-888-2802

QUANTUM DATA INC., 2111 Big Timber Road, Elgin, IL 60123, Tel: 708-888-0450, TELEX: 206725; Empl.: 23; *Sls. Mgr.:* Bill Down **D•1318**

QUANTUM ELECTRONICS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-1132, FAX: 717-248-8680; Empl.: 20; *Sls. Mgr.:* Kit C. Kennedy

QUANTUM SCIENTIFIC INC., 433 Horner Ave, Unit 4, Toronto, Ont M8W 4Y4, Tel: 416-503-8555, 800-268-6000, FAX: 416-503-1322; Empl.: 14; *Sls. Mgr.:* Gary Aitchison

QUARTZITE PROCESSING, INC., 6 Holyoke St., Malden, MA 02148, Tel: 617-322-3611, FAX: 617-322-9623; Empl.: 11; *Sls. Mgr.:* D. Yanofsky

QUATECH INC., 662 Wolf Ledges Pkwy., Akron, OH 44311, Tel: 216-434-3154, TELEX: 5101012726, FAX: 216-434-1409; Empl.: 32; *Sls. Mgr.:* Michael Cenker; *Dist. Mgr.:* Michael Cenker

QUEST CONTROLS, INC., 208 9th St. Dr. West, Palmetto, FL 34221, Tel: 813-729-4799, FAX: 813-729-5480; Empl.: 32; *Sls. Mgr.:* Joe Hencoski

Q.V.S., INC., 20 North 15th St., East Orange, NJ 07017, Tel: 201-673-3996, FAX: 201-673-3997; FSC No.: 89820; Empl.: 45

RACAL-DANA INSTRS. INC., 4 Goodyear St., Irvine, CA 92718, Tel: 714-859-8999; FSC No.: 21793; Empl.: 230

RACAL-DATACOM, 1601 N. Harrison Parkway, Sunrise, FL 33323-2899, Tel: 305-846-1601, 1-800-RACAL-55, TWX: 510-955-4145, FAX: 305-846-4942; Empl.: 2400; *Sls. Mgr.:* Dan Latham; *Dist. Mgr.:* Bill Wilson

RACAL-GUARDATA, INC., 480 Spring Pk. Pl., Ste. 900, Herndon, VA 22070, Tel: 703-471-0892, FAX: 703-437-9333; FSC No.: 56496; Empl.: 29; *Sls. Mgr.:* Thomas Mitchell, VP; *Dist. Mgr.:* Thomas Mitchell, VP

Local Distributors

Can	Mississauga, Ont., Racal Guardata Canada	416-620-3431

RADIAL CONTROLS INC., 2555 E. 55th Place, Indianapolis, IN 46220, Tel: 317-255-2796; Empl.: 25; *Sls. Mgr.:* R. L. Newsom

RADIALL, INC., 150 Long Beach Blvd., Stratford, CT 06497, Tel: 203-386-1030, TELEX: 311796, FAX: 203-375-3808; Empl.: 40; *Sls. Mgr.:* Bill Pitcher; *Dist. Mgr.:* Peter Dionisio

RADIANT COMMUNICATIONS CORP., 5001 Hadley Rd. P.O. Box 867, South Plainfield, NJ 07080, Tel: 908-757-7444, TELEX: 908-757-8666; Empl.: 10; *Sls. Mgr.:* Gene Thaw

RADIOMETRICS MIDWEST CORP., 55 West 22nd Street, Ste. 106, Lombard, IL 60148, Tel: 708-932-7262, FAX: 708-932-7271; FSC No.: Cage Code 1Z075 SIC Code 8748 Ext. 0021; Empl.: 5

RADIO RESEARCH INSTRUMENT CO., INC., 584 North Main Street, Waterbury, CT 06704-3506, Tel: 203-753-5840, FAX: 203-754-2567; FSC No.: 57174; *Sls. Mgr.:* E. B. Doyle

RADIO TELEVISION PRODUCTS CORP., 2702 Washington Ave. N., Douglas, AZ 85607, Tel: 602-364-4438, FAX: 602-364-4430; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* W. J. McGaw

RADIX MICROELECTRONICS INC., 3445 C Chelton Lp, Colorado Springs, CO 80909, Tel: 719-597-1975, FAX: 719-597-1975; Empl.: 18

RADIX WIRE CO., 26260 Lakeland Blvd., Cleveland, OH 44132, Tel: 216-731-9191, FAX: 216-731-7082; Empl.: 90; *Sls. Mgr.:* Peter B. Thurstone; *Dist. Mgr.:* Doug Kerans, Dir. Sls./Mktg.

RADSTONE TECHNOLOGY, 20 Craig Rd., Montvale, NJ 07645, Tel: 201-391-2700, 800-368-2738, FAX: 201-391-2899; *Sls. Mgr.:* Larry Abzug

RAE COMPANY INC., 1345 Brookville Way, Ste. C, Indianapolis, IN 46239, Tel: 317-351-1774, FAX: 317-351-1781; FSC No.: 07356; Empl.: 50; *Sls. Mgr.:* Tim Fraze

RAF ELECTRONIC HARDWARE, 95 Silvermine Rd., Seymour, CT 06483, Tel: 203-888-2133, FAX: 203-888-9860; FSC No.: 55566; Empl.: 120; *Sls. Mgr.:* William R. Bailey, Jr.; *Dist. Mgr.:* Dave Granger/John Capece

RAG ELECTRONICS, INC., 21418 Parthenia St., Canoga Park, CA 91304, Tel: 818-998-6500, 800-732-3457, FAX: 818-407-5559

RAGEN DATA SYSTEMS, INC., Subsidiary of Meggit U.S.A., 3 Oval Dr., Central Islip, NY 11722, Tel: 516-234-3800, FAX: 516-348-0993; FSC No.: 13068; Empl.: 180; *Sls. Mgr.:* Roberta Marino

RAGEN SYSTEMS, INC., Ragen Corp., 1 Frederick Rd., Warren, NJ 07059, Tel: 908-561-4200, FAX: 908-561-1184; Empl.: 200; *Sls. Mgr.:* Richard Grawehr

RALTRON ELECTRONICS, 2315 N.W. 107th Ave., Miami, FL 33172, Tel: 305-593-6033, TELEX: 441588, FAX: 305-594-3973; Empl.: 40; *Sls. Mgr.:* Alexander Wolloch; *Dist. Mgr.:* Alexander Wolloch **A•1460-1462**

Local Sales Offices & Reps

AL	Madison, Lamons Sls.	205-461-7871, FAX:205-461-7978
AZ	Scottsdale, EDP & Assocs.	602-991-6119
CA	Anaheim, Raltron-California	714-974-2664, FAX:714-921-2960
CA	Los Angeles, Landa & Assocs.	213-879-0770, FAX:310-478-0190
CA	San Marcos, Falcon Sls. & Technlg.	619-591-0504, FAX:619-591-4241
CA	Santa Ana, Landa & Assocs.	714-543-7805
CA	Santa Clara, Linctronics	408-748-2970
CO	Broomfield, Summit West Mktg.	303-460-9600, FAX:303-460-9074
CT	Guilford, Data Mark	203-453-0575, FAX:203-453-5935
FL	Boca Raton, Tech. Sls. Specialists	407-391-3718, FAX:407-750-1178
FL	Clearwater, Tech. Sls. Specialists	813-535-3375, FAX:813-535-9142
GA	Atlanta, Lamons Sls.	404-242-2610, FAX:404-243-3705
ID	Boise, First Source	208-375-1561
IL	Highland Park, Bransky Sls.	708-433-2375, FAX:708-433-2377
IN	Fort Wayne, J & B Engrg. Sls.	219-483-2813
IA	Cedar Rapids, M.I.N.K. Assocs. Inc.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs. Inc.	913-341-8309, FAX:913-341-2605
KS	Wichita, M.I.N.K. Assocs. Inc.	316-838-0190, FAX:316-838-9503
MD	Baltimore, Chesapeake Ind. MK	410-653-0476
MA	Norwood, JMG Inc.	617-762-5333, FAX:617-769-8010
MN	Eden Prairie, Hanna-Lind	612-942-8554, FAX:612-942-8469
MN	Roseville, Parts '1'	612-633-8079
MO	Bridgeton, M.I.N.K. Assocs. Inc.	314-291-5454, FAX:314-291-8595
NY	Manhasset, WIN-COR	516-627-9474, FAX:516-627-2282
NY	Rochester, H.C. Johnson Agencies, Inc.	716-586-0777,FAX:716-586-6435
NC	Raleigh, Lamons Sls.	919-846-1652, FAX:919-870-7793
PA	Horsham, Nexus Technlg. Sls.	215-675-9600, FAX:215-675-9604
TN	Greenville, Lamons Sls.	615-638-4320, FAX:615-639-5160
TX	Austin, SW Mktg.	512-255-8010
TX	Dallas, SW Mktg.	214-341-8631
TX	El Paso, Alexander Entprs.	915-591-3142, FAX:915-591-3169
TX	Houston, SW Mktg.	713-699-4838
UT	Salt Lake City, Component Well	801-263-8131, FAX:801-263-8192
Can	Calgary, Alb., A.C. Simmonds & Sons Ltd. Sls.	403-256-1516,FAX:403-254-2660
Can	Lower Sackville, Nova Scotia, A.C. Simmonds & Sons Ltd. Sls.	902-865-1889,FAX:902-865-5120
Can	Pickering, Ont., A.C. Simmonds & Sons Ltd. Sls.	416-839-8041,FAX:416-839-2667
Can	Ville Lemdyne, A.C. Simmons & Sons Ltd. Sls.	514-466-5250,FAX:514-466-5252

Local Distributors

AL	Huntsville, Bell Inds.-Huntsville/HNT	205-837-1074,FAX:205-830-5598
AZ	Tempe, Bell Inds.-Sunnyvale/SUN	602-966-7800, FAX:602-967-6584
CA	Carlsbad, AEGIS Elctrn. Grp. Inc.	619-729-2026, FAX:619-729-9295
CA	Irvine, Kelex Elctrns.	714-863-1230, FAX:714-474-1231
CA	Los Angeles, Bell Inds.-Corporate	213-826-3975, FAX:310-826-1534
CA	San Jose, All American San Jose	408-943-1200, FAX:408-943-1393
CA	San Jose, Passive Technlg. Sls. Inc.	408-435-5566, FAX:408-435-3041
CA	Sunnyvale, Bell Inds.-Sunnyvale/SUN	408-734-8570,FAX:408-734-8875
CT	Wallingford, Utronics	203-265-2724, FAX:203-269-3618
FL	Altamonte Springs, Bell Inds-Ft. Lauderdale/LAU	305-421-1997,FAX:305-421-5705
FL	Boca Raton, N.R.C.	407-241-8600, FAX:407-241-3328
FL	Melbourne, Dove Elctrns.	407-242-6916
FL	Melbourne, Pridmore Corp.	407-727-2491, FAX:407-723-1213
FL	Miami, All American Miami	305-621-8282, FAX:305-620-7831
GA	Norcross, Bell Inds.-Atlanta/ATL	404-662-0923, FAX:404-449-6901
GA	Norcross, NRC-JARD Dixie Inc.	404-729-0411, FAX:404-448-2854
IL	Elk Grove Village, Bell Inds.-Chicago/CHI	708-640-1910,FAX:708-640-0474
IL	Morton Grove, Nedco Elctrns. Inc.	708-967-0500, FAX:708-967-0505
IL	Northbrook, Classic Comps. Supp. Inc.	312-272-9650
MA	Andover, Bell Inds.-Andover	508-474-8880, FAX:508-474-8902
MA	Billerica, Baldwin Comps.	508-667-6710, FAX:617-671-0034
MA	Chelmsford, Shelley-Ragon	508-250-9666, FAX:617-250-8119
MA	Newton, Greene-Shaw	617-969-8900
MA	Sudbury, ASK Elctrns.	508-443-3542, FAX:508-443-0483
MA	Winchester, Bell Inds.-Winchester/WIN	617-729-5800,FAX:617-729-6839
MN	Edina, All American MN	612-944-2151, FAX:612-944-9803
MN	Edina, Bell Inds.-Minneapolis/MIN	612-941-1493, FAX:612-941-2964
MN	Edina, Bergquist Co.	612-835-2322, FAX:612-835-4156
NH	Hudson, Bell Inds.-Hudson/HUD	617-273-4450, FAX:617-882-1275
NJ	West Berlin, G.C.I.	609-768-6767
NY	E. Setauket, Dove Elctrns.	800-232-9825
NY	E. Setauket, Dove Elctrns.	800-232-9825, FAX:516-689-7362
NY	Farmingdale, Bell Inds.-Long Island/LGI	516-752-9303,FAX:516-752-9226
NY	Ronkonkoma, All American L.I.	516-981-3935, FAX:516-981-3947
NY	Ronkonkoma, Baldwin Comps.	800-645-5608
NY	Stony Brook, Dove Elctrns.	516-689-7733, FAX:516-689-7362
PA	Exton, V.S.H. Elctrns.	215-363-2250
TX	Richardson, All American Dallas	214-231-5300, FAX:214-437-0353
TX	Richardson, Bell Inds.-Dallas/DAL	214-690-0466, FAX:214-690-0822
UT	Midvale, Bell Inds.-Salt Lake City/SLC	801-255-9611,FAX:801-255-2477
WI	Mequon, Taylor Elec.	414-241-4321
WI	New Berlin, Classic Comps. Supp. Inc.	414-786-5300
WI	Waukesha, Bell Inds.-Milwaukee/MLW	414-547-8879,FAX:414-547-6547
Can	Montreal, Ferro Technique-LTEE/Ltd.	514-341-3450,FAX:514-341-1866
Can	Montreal, Que., Elctrn. Whlsrs. Co. Ltd.	514-769-8861,FAX:514-769-9060
Can	Montreal, Que., Ferro Technique LTEE/Ltd.	514-341-3450,FAX:514-341-1866
Can	Ottawa, Ont., Wackid Radio	613-728-1821, FAX:613-722-3465
Can	St. Laurent, Que., ZEI	514-342-6211, FAX:514-342-4073

RAMCOM SYSTEMS, 3547 Voyager St. Ste. 103, Torrance, CA 90503, Tel: 310-214-8601; *Sls. Mgr.:* Ralph Tisdale

RAMTRON INTERNATIONAL CORPORATION, 1850 Ramtron Dr., Colo. Springs, CO 80921, Tel: 719-481-7000, 800-545-3726, FAX: 719-488-9095; Empl.: 135; *Sls. Mgr.:* Don Carrigan; *Dist. Mgr.:* John van Conant

RANK BRIMAR INC., 25358 Avenue Stanford, Valencia, CA 91355-1214, Tel: 805-295-5770, FAX: 805-295-5087; FSC No.: 60750; *Sls. Mgr.:* P.A. Nicholas

RANSCO INDUSTRIES, 1400 E. Statham Pkwy., Oxnard, CA 93033, Tel: 805-487-7777, FAX: 805-486-7024; Empl.: 140; *Sls. Mgr.:* Robert Briner

RANTEC MICROWAVE & ELECTRONICS, Esco Electronics, 24003 Ventura Blvd., Calabasas, CA 91302, Tel: 818-591-8189, FAX: 818-591-8489; FSC No.: 04971; Empl.: 500; *Sls. Mgr.:* Dennis Lavelle **D•1908-1911**

Local Sales Offices & Reps

CA	Los Altos, Caine & White	415-948-6533
FL	Orlando, Holmes & Assocs.	407-281-0067
NH	Pelham, Rantec	603-635-3503
TX	Dallas, Kemp Engrg.	214-931-7100
VA	Sterling, Beacon North	703-478-2480
WA	Bellevue, Caine & Sweet	206-462-2118

RANTEC MICROWAVE & ELCTRNS., INC., Subsidiary of Esco Electronics Corp., 1173 Los Olivos Ave., Los Osos, CA 93402, Tel: 805-528-5858, FAX: 805-528-8132; FSC No.: 60132; Empl.: 110; *Sls. Mgr.:* Francesca Peterson **D•1908-1911**

Local Sales Offices & Reps

GA	Marietta, Electro Comp Sls., Inc.	404-922-2344

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RAPIDSYN DIVISION, American Precison Industries, 3229 Roymar Rd., Oceanside, CA 92054, Tel: 619-439-7500, TELEX: 18-1196; FSC No.: 32423; Empl.: 50; *Sls. Mgr.:* Mike Turner

RAPID SYSTEMS INC., 433 N. 34th St., Seattle, WA 98103, Tel: 206-547-8311, FAX: 206-548-0322; FSC No.: 91-1197314; Empl.: 13; *Sls. Mgr.:* Laurie Maltman

RASTER GRAPHICS, INC., P. O. Box 5157, Bend, OR 97701, Tel: 503-388-2584, FAX: 503-389-8249

RATELCO, Power Systems, 1260 Mercer, Dept. EEM, Seattle, WA 98109-5589, Tel: 206-624-7770, FAX: 206-382-5447; FSC No.: 14259; Empl.: 200; *Sls. Mgr.:* D. Terpstra

RAULAND-ZENITH ELECTRONICS CORP., 2407 W. North Ave., Melrose Pk., IL 60160, Tel: 708-450-8992, TELEX: 72-1488, FAX: 708-450-8393; Empl.: 2300

Raychem

FAX: 1-800-227-4866

RAYCHEM CORPORATION, 300 Constitution Dr., Menlo Park, CA 94025, Tel: 415-361-3863, 800-2-RAYCHEM/ext. 6900; Empl.: 500; *Sls. Mgr.:* Rob Palmatier; *Dist. Mgr.:* Michele Small **A•2179; B•1384-1385, 1894-1895; D•1466**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Pleasanton, Moulthrop Sls., Inc.	415-463-0450
CA	San Diego, Wiley Co.	619-453-9018
CO	Englewood, Thorson Rocky Mtn., Inc.	303-773-6300
FL	Altamonte Springs, Semtronics	800-432-0200
GA	Atlanta, CSR Elctrns.	404-396-3720
IL	Itasca, Micro Sls., Inc.	708-285-1000
IN	Carmel, TMC	317-844-8462
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
KY	Louisville, TMC	502-893-1377
MA	Burlington, Bob Dean, Inc.	617-229-6800
MI	Southfield, Raychem Sls. Off.	313-350-0900
MN	St. Paul, Cahill-Schmitz-Cahill	612-646-7217
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Rockville, S-J Assocs.	516-536-4242
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Parma, S-J Assocs.	216-888-7004
OH	W. Carrollton, S-J Assocs.	513-438-1700
TX	Austin, B-P Sls.	512-346-9186
TX	Dallas, B-P Sls.	214-234-8438
TX	Houston, B-P Sls.	713-782-4144
TX	Richardson, B-P Sls.	214-234-8438
UT	Salt Lake City, Thorson Rocky Mtn., Inc.	801-942-1683
VA	Falls Church, S-J Assocs.	703-533-2233
WA	Bothell, Quadra Sls. Corp.	206-489-3428
Can	Calgary, Alb., Cana-Rep Grp., Inc.	403-255-0294
Can	E. Toronto, Ont., Cana-Rep Grp., Inc.	416-930-4621
Can	Montreal, Que., Cana-Rep Grp., Inc.	514-276-4477
Can	Ottawa, Ont., Cana-Rep Grp., Inc.	613-692-4682
Can	Vancouver, B.C., Cana-Rep Grp., Inc.	604-599-1232
Can	W. Toronto, Cana-Rep Grp., Inc.	416-338-3399

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Scottsdale, Insulectro	602-991-2370
AZ	Tempe, Acacia/Deanco	602-894-2874
CA	Costa Mesa, Insulectro	714-957-8093
CA	Gardena, Cal Switch	800-225-7924
CA	Irvine, Acacia/Deanco	714-660-0834

CA	Lake Forest, Insulectro	714-587-3200
CA	Mt. View, Insulectro	415-969-7010
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Cal Switch	619-231-6740
CA	San Diego, Insulation Supply	619-467-6890
CA	San Diego, Insulectro	714-587-3375
CA	San Jose, Insulation Supply	408-435-1244
CA	San Jose, Passive Technlg. Sls.	408-435-5566
CA	Santa Clara, Kent-Shelley Ragon	408-727-9810
CA	Torrance, Insulation Supply	310-320-9400
CO	Aurora, Insulectro	303-360-8612
CO	Commerce City, WACO Elctrns.	303-289-4743
CO	Lakewood, Acacia/Deanco	303-232-2882
CT	Wallingford, Sager Elctrns.	203-265-4600
CT	Yalesville, Schaal Assocs.	203-269-3889
CT	Yalesville, Schaal Assocs., Inc.	203-269-3889
FL	Orlando, Hammond Elctrns.	407-841-1010
FL	Winter Park, Deanco, Inc.	407-671-5100
GA	Marietta, Deanco, Inc.	404-429-0126
GA	Norcross, Hammond Elctrns.	404-449-1996
HI	Honolulu, Precision Radio	808-537-5291
IL	Elk Grove Village, Kent Elctrns.	708-364-1300
IL	Elk Grove Village, Stranco Prods., Inc.	708-952-9250
IL	Wheaton, MEGA Co., Inc.	708-665-6214
IN	Indianapolis, Custom Service Elctrns.	317-879-9119
IA	Cedar Rapids, Kent-Shelley Ragon	319-373-0525
KS	Wichita, MEGA Co., Inc.	316-636-5020
MD	Columbia, Sager Elctrns.	410-995-4900
MD	Gaithersburg, Deanco, Inc.	301-948-5444
MA	Burlington, Schaal Assocs., Inc.	617-272-7940
MA	Hingham, Sager Elctrns.	617-749-6700
MN	St. Paul, Kent-Shelley Ragon	612-642-2823
MO	Hazelwood, Kent-Shelley Ragon	314-895-1515
MO	Independence, Kent-Shelley Ragon	816-254-3410
MO	St. Peters, MEGA Co., Inc.	314-939-9129
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Fairfield, Deanco, Inc.	201-575-7960
NM	Albuquerque, WACO Elctrns.	505-255-1638
NY	Hauppauge, Deanco, Inc.	516-434-7100
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Ithaca, Deanco, Inc.	607-257-4444
NC	Raleigh, Deanco, Inc.	919-851-2065
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Highland Heights, Elctrns. Mktg. Corp.	216-442-3441
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Insulectro	503-626-4289
OR	Beaverton, Kent	503-626-8300
PA	Mars, Sager Elctrns.	412-772-2233
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Irving, Bunker Inds., Inc.	214-438-3300
UT	W. Valley City, Insulectro	801-972-9262
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WA	Redmond, Insulectro	206-885-3800
WA	Redmond, Kent Elctrns.	206-883-7200
PR	Puerto Rico, Hammond Elctrns.	407-841-1010
Can	Calgary, Alb., Martin Elctrn. Mfg. Corp.	403-258-3399
Can	Markham, Ont., Matrix Technlg., Ltd.	416-477-4442
Can	Scarborough, Ont., Paisley Prods. of Canada	416-751-3700
Can	Surrey, B.C., Martin Elctrn. Mfg. Corp.	604-590-1553
Can	Vancouver, B.C., E.B. Peerless, Ltd.	604-327-1181

RAYCON TECHNOLOGY, 1001 W. 17th St., Unit D, Costa Mesa, CA 92627, Tel: 714-646-7700, FAX: 714-646-6436; Empl.: 12

RAYOVAC CORPORATION, 601 Rayovac Drive, Madison, WI 53711-0960, Tel: 608-275-4692, TELEX: 190428, FAX: 608-275-4994; FSC No.: 6135; Empl.: 2000; *Sls. Mgr.:* Jeff Heberlein

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RAYTHEON COMPANY, Quincy Operation, 465 Centre St., Quincy, MA 02269, Tel: 617-479-5300; Empl.: 720; *Sls. Mgr.:* R. Scott Silva; *Dist. Mgr.:* R. Scott Silva **A•1713-1715, 1850-1851; B•1108-1109; D•2199-2201**

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AZ	Phoenix, Southwest Tech. Sls.	602-893-1209
CA	Los Angeles, Knight Co.	310-670-2833
CA	Mountain View, Thorson West	415-964-9300
CT	Hamden, Datcom	203-288-7005
FL	Largo, Electrocraft	813-544-1766
IL	Elk Grove, Oasis Sls.	708-640-1850
IN	Carmel, Technlg. Mktg.	317-844-8462
IN	Fort Wayne, Technlg. Mktg.	219-432-5553
IA	Cedar Rapids, Oasis Sls.	319-377-8738
KS	Olathe, G.M. Brown & Assoc.	913-829-3086
MA	Waltham, Datcom	617-891-4600
MN	Bloomington, Oasis Sls.	612-941-1917
MO	Florissant, G.M. Brown & Assoc.	314-839-3600
NJ	Mt. Laurel, S J Mid-Lantic	609-866-1234
NY	Huntington, CDB Entprs.	516-692-5200
OH	West Carrolton, S-J Ohio	513-438-1700
OR	Beaverton, Westmark Elctrns.	503-641-8780
TX	Richardson, Barry Sls.	214-234-0255
VA	Falls Church, S-J Chesapeake	703-533-2233
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Brookfield, Oasis Sls.	414-782-6660

RAYTHEON CO., Electronic Components Division, 190 Willow St., Waltham, MA 02254, Tel: 617-899-8400, TWX: 710-324-8400, FAX: 617-899-5451; *Sls. Mgr.:* L. Ron Lewis

RAYTHEON CO., Laser Products, 465 Centre St., Quincy, MA 02169, Tel: 617-479-5300, TELEX: 92-3455, TWX: 710-324-6568, FAX: 617-479-5300 (ext. 2359); Empl.: 1000; *Sls. Mgr.:* B. Werschler

RAYTHEON-LA JOLLA, PO Box 2472, La Jolla, CA 92038, Tel: 619-457-1000, FAX: 619-455-6314; FSC No.: 59621; Empl.: 170; *Sls. Mgr.:* John Stahl, Dir. Sls.

RAYTHEON SEMICONDUCTOR, 350 Ellis St., Mountain View, CA 94043, Tel: 408-522-7068, FAX: 408-522-7055; Empl.: 800; *Sls. Mgr.:* Les Welborn, Dir. World Wide Sls.; *Dist. Mgr.:* Olivia Ellison, Distr. Sls. Mgr.

RAYTHEON/TAG SEMICONDUCTORS LTD., 43 Third Ave., Burlington, MA 01803, Tel: 617-272-3704 (3705), FAX: 617-272-1280; Empl.: 7; *Sls. Mgr.:* R. Muller; *Dist. Mgr.:* Pat Mobilia

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Local Sales Offices & Reps

AZ	Scottsdale, Kaye C-R	602-948-8433
CA	Laguna Hills, 4-Star	714-583-9781
CO	Denver, Purdy Co.	303-790-2211
IL	Des Plaines, Electron Mktg.	708-298-2330
MA	Needham, Ray Perron Co.	617-449-6162
MI	Brighton, A/P Assoc.	313-229-6650
MN	Eden Prairie, Hanna Lind	612-942-8554
MO	Bridgton, AEM	314-298-9900
NJ	Leonia, Peter E. Schmitt	201-944-1096
NY	Rochester, Micro Tech	716-426-0806
OH	Cleveland, RK Comp. Sls.	216-642-9312
PA	Erdenheim, Omni Sls.	215-233-4600
PA	Freedom, RK Comp. Sls.	412-775-0747
TX	Dallas, Allied Comps.	214-238-0408
VA	Manassas, FBD	703-369-7212
WI	Colgate, Rep One	414-628-4016

Local Distributors

CA	Industry, Ital	818-968-8515
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Santa Clara, Comps. Ctr.	408-988-3751
CO	Littleton, Indelco	303-795-3431
CT	Wallingford, Midstate	800-243-1043
FL	Ft. Lauderdale, Brothers	305-561-6700
FL	Melbourne, Pridmore	407-723-1213
FL	W. Palm Beach, Atlantic Elctrns.	813-531-5900
IL	Lisle, Components, Inc.	708-852-7707
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Elkhart, Earlynn	219-862-2425
IN	Indianapolis, Meunier	317-635-3511
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Newton, Greene Shaw/Coghlin	617-969-8900
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Grand Rapids, Calder	616-698-7400
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Roseville, Parts One	612-633-8079
NH	Merrimack, Brevan Elctrns.	603-429-1900
NJ	E. Brunswick, Brohters Elctrns.	908-238-2200
NY	Mamaroneck, New Yorker	914-968-7600
NY	Rochester, Masline	716-546-5373
OH	Akron, Aesco Elctrns.	216-762-8811
PA	Exton, VSH Elctrns.	215-363-2250
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Allied Elctrns.	800-433-5700
WI	New Berlin, NEP	414-785-9100

R. C. ELECTRONICS INC., 6464 Hollister Ave, Goleta, CA 93117, Tel: 805-685-7770, FAX: 805-685-5853; Empl.: 20; *Sls. Mgr.:* Chao-Sun Pang; *Dist. Mgr.:* Chao-Sun Pang

RC ELECTRONICS, 43002 Christy St., Fremont, CA 94538-3164, Tel: 510-656-8490, FAX: 510-656-4759; *Sls. Mgr.:* Joe Butler

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 708-432-7915, FAX: 708-432-9181; Empl.: 20

RDF CORPORATION, 23 Elm Ave., P.O. Box 490, Hudson, NH 03051-0490, Tel: 603-882-5195,800-445-8367, FAX: 603-882-6925; FSC No.: 02009; Empl.: 97; *Sls. Mgr.:* Randal A. Gauthier; *Dist. Mgr.:* Irwin Bluestein

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AL	Madison, E-Squared Mktg.	205-464-0392
CA	Newport Bch., SPA Elctrn. Sls.	714-863-1193
CA	San Jose, Comtech Mktg.	408-249-3330
FL	Longwood, M & H Assocs.	407-332-7912
GA	Marietta, E-Squared Mktg.	404-565-2088
MD	Germantown, Bresson Assocs.	301-540-0110
MN	Minneapolis, OEM Elctrl. Sls., Inc.	612-884-7509
NY	Hicksville, J. Square Mktg., Inc.	516-935-3200
OH	Dayton, John Stephenson Assoc.	513-435-0745
OK	Tulsa, Nova Mktg.	918-660-5105
PA	Narberth, Bresson Assocs.	215-664-6460
TX	Austin, Nova Mktg.	512-343-2321
TX	Dallas, Nova Mktg.	214-265-4600
TX	Houston, Nova Mktg.	713-988-6082
UT	Salt Lake City, Comp. Sls., Inc.	801-561-5099
WA	Redmond, Elctrnc. Mktg. Grp., Inc.	206-882-0962

REACTEL, INC., 687-K Lofstrand Ln., Rockville, MD 20850, Tel: 301-279-5535, FAX: 301-340-7304; FSC No.: 60458; Empl.: 30; *Sls. Mgr.:* Manny Assurian

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RE AMERICA, 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617, FAX: 216-871-4303; Empl.: 25; *Sls. Mgr.:* P. A. Bosworth

RE-AN U.S.A, INC., Re-An Ltd. (UK), 16 Passail Ave., Fairfield, NJ 07004, Tel: 1-800-828-7266, FAX: 201-808-6517; *Sls. Mgr.:* Frank Riordan

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RECTRON, 13252 E. Temple Ave., Industry, CA 91746, Tel: 818-333-3802, FAX: 818-330-6296

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CA	Newbury Park, Westaironics	805-499-9844
CO	Denver, DMG, Inc.	303-231-6039
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MN	Minneapolis, Intl. Elctrns.	612-571-0000
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NC	Greensboro, Adams & Assocs.	919-272-6838
OH	Cincinnati, Tri-State Mktg.	513-761-7993
TX	Irving, Kite Elctrns. Sls.	214-986-0321
EXP	Jerusalem, Israel, Ben-R-Tek Elctrns.	972-2-380656
EXP	London, England, Reeves-Hoffman U.K.	44-844-275929
Can	Rexdale, Ont., Myelco, Inc.	416-790-8297

REGDON SOLENOID INC., See Magnet Schultz of America

REGENT CONTROLS, INC., 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-924-2924, FAX: 203-924-2928; Empl.: 20; *Sls. Mgr.:* Lora C. Murphy

REGULUS SYSTEMS, 11901 Forest View Dr., Nevada City, CA 95959, Tel: 415-593-4197

REICH ASSOCIATES, INC., Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 210-751-3220, FAX: 210-751-3054; FSC No.: 55916; Empl.: 20; *Sls. Mgr.:* W. Reich

REKCO, INC., See LEM U.S.A. Inc.

RELAY SERVICE CO., 1300 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-252-2700, FAX: 312-252-0300; Empl.: 25; *Sls. Mgr.:* Chas. H. Badger

RELAY SPECIALTIES, 17 Raritan Rd., Oakland, NJ 07436, Tel: 201-337-1000, TELEX: 642751, FAX: 201-337-1862; Empl.: 48; *Sls. Mgr.:* S. R. Gershberg

RELCO PRODUCTS, 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

RELCO/RITZ ELECTRONICS, 196 Queen St. N., New Dundee, Ont., Canada N0B 2E0, Tel: 519-696-2616 .... **C•1081; D•1913**

RELIABLE CAPACITORS/HI-REL CAPACITORS, 12931 E. Sunnyside Place, Sante Fe Springs, CA 90690, Tel: 310-946-8577, FAX: 310-944-7494; FSC No.: 54795-Hi-Rel;18489-Reliable Capacitors; Empl.: 32; *Sls. Mgr.:* Bas Lim; *Dist. Mgr.:* Shelley Spain .... **A•1156**

Local Sales Offices & Reps

CA	Fremont, C.B. King Assocs.	510-770-9188
MA	Framingham, Stone Comp. Sls.	508-875-3266
MN	Oakdale, Complete Sls.	612-731-2923
NY	New York, Radian Elctrns.	212-725-2860
OH	Alpha, Poliquin & Co., Inc.	513-426-8055
TX	Farmers Branch, Keats & Assocs.	214-243-5905

Local Distributors

NY	Hauppauge, Vargas Elctrns., Inc	516-273-1111
NY	Port Chester, Zeus Comp., Inc.	914-937-7400

RELIABLE ELECTRONIC MFG., Wyvern Technologies, 1205 E. Warner Ave., Santa Ana, CA 92705, Tel: 714-966-0710, FAX: 714-556-7014; FSC No.: 0FNJ8; *Sls. Mgr.:* Dave Hail

RELIABILITY INCORPORATED, P. O. Box 218370, Houston, TX 77218, Tel: 713-492-0550, FAX: 713-492-0615; *Sls. Mgr.:* Len Moscovitz; *Dist. Mgr.:* Mike Tenore

RELIANCE COMM/TEC, Reliance Electric, P.O. Box 17438, Cleveland, OH 44117, Tel: 800-245-4501

RELIANCE ELECTRIC CO., P.O. Box 17438, Cleveland, OH 44117, Tel: 800-245-4501

RELIANCE MOTION CONTROL, Reliance Electric, 6950 Washington Ave. So., Eden Prairie, MN 55344, Tel: 612-942-3600, FAX: 612-942-3636; *Sls. Mgr.:* Harry Webber; *Dist. Mgr.:* Brad Nelson

RELIANCE PLASTICS & PACKAGING, 217 Brook Ave., Passaic, NJ 07055, Tel: 201-473-7200, FAX: 201-473-1023; Empl.: 60; *Sls. Mgr.:* Hale Smith

RELM COMMUNICATIONS, INC., Adage, Inc., 7707 Records Street, Indianapolis, IN 46226, Tel: 317-545-4281, FAX: 317-545-2170; Empl.: 300; *Sls. Mgr.:* John Biljan

REMEE PRODUCTS CORP., 186 North Main Street, Florida, NY 10921, Tel: 914-651-4431, FAX: 914-651-4160; FSC No.: 4R362; Empl.: 135; *Sls. Mgr.:* Ken Pimental; *Dist. Mgr.:* Ken Pimental

RENARD MANUFACTURING COMPANY, INC., 3305 N.W. 79th Ave., Miami, FL 33122-1015, Tel: 305-592-1500, TELEX: 989326, ESYLNK: 62929141, FAX: 305-593-9990; Empl.: 250; *Sls. Mgr.:* S. Simerly

RENATA, 990 N. Bowser, Ste. 900, Richardson, TX 75081, Tel: 214-234-8091, FAX: 214-699-3900

RENCO ENCODERS INC., 26 Coromar Dr., Goleta, CA 93117-3094, Tel: 805-968-1525, FAX: 805-685-7965; FSC No.: 34479; Empl.: 100; *Sls. Mgr.:* Dan Baxter; *Dist. Mgr.:* Edward Burk

RENCO ELECTRONICS, INC.

FAX: 516-586-5562

RENCO ELECTRONICS, INC., 60 Jefryn Blvd., East, Deer Pk, NY 11729, Tel: 516-586-5566, 1-800-645-5828; FSC No.: 14778; Empl.: 275; *Sls. Mgr.:* Edward W. Rensing; *Dist. Mgr.:* Rhonda Rizzo ... **A•1283-1289, 2527-2531**

Toll-Free Engineering Hot Line 800-645-5828, in NY State 516-586-5566

Local Sales Offices & Reps

AL	Huntsville, Solutions Mfrs. Reps.	205-539-3152
AZ	Tempe, Border States Tech. Svc.	602-839-0248
AR	Arlington Heights, Russell Elctrn. Sls.	708-394-5560
CO	Wheat Ridge, Wescom Mktg. Inc.	303-422-8957
CT	East Hampton, Apex Assocs.	203-268-8401
GA	Marietta, Solutions Mfrs. Reps.	404-951-5683
IN	Indianapolis, Schark Mktg. Inc.	317-842-6204
MA	Needham, Apex Assocs.	617-444-8070
MS	Meridian, Solutions Mfrs. Reps.	601-482-4647
MO	St. Louis, Rush & West Assoc.	314-965-3322
NJ	Marlton, BGR Assocs.	609-983-1020
NM	Albuquerque, Border States Tech. Svc.	505-884-9100
NY	Skaneateles, NRM Mktg. Grp. Inc.	315-685-8991
NC	Raleigh, Solutions Mfrs. Reps.	919-790-7606
UT	Sandy, Moss Mktg.	801-562-9000
FL	Indian Harbor Bch., Solutions Inc.	407-777-0994
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Mt. Airy, Eltron Sls. Ltd.	410-875-0362
MI	Grosse Point Pk., Greiner Assocs.	313-499-0188
OH	Rocky River, Oak Hill Mktg. Inc.	216-333-0000
OR	Hillsboro, Temco Northwest	503-645-2030
TX	Dallas, Electra Reps	214-248-3852
VA	Front Royal, Eltron Sls. Ltd.	703-635-7201
WA	Bothell, Temco Nortwest	206-481-6150
WI	Brookfield, Bert Wartchow Assocs.	414-821-2993
Can	Montreal, Que, Eli Manis, Inc.	514-484-2923

REPRODUCTION TECHNOLOGIES INC., P.O. Box 790, Bristol, IN 46507-0790, Tel: 219-848-5233; Empl.: 10; *Sls. Mgr.:* Michael Stoll

REPUBLIC ELECTRONICS CO., Esterline Technologies, 200 Wireless Blvd., Hauppauge, NY 11788, Tel: 516-273-9800, FAX: 516-273-9820; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* Sy Newman, Mktg. Mgr.

RESEARCH DEVICES, INC., 121 Ethel Rd. West, Piscataway, NJ 08854, Tel: 908-572-4800, TELEX: 467058, FAX: 908-572-4808; Empl.: 30; *Sls. Mgr.:* Michael Schneider

RESEARCH INC., P.O. Box 24064, Minneapolis, MN 55424, Tel: 612-941-3300, TELEX: 29-0502, FAX: 612-941-3628; Empl.: 140; *Sls. Mgr.:* JD Strand, Al Day, Marianne Walmsley

RESEARCH SPECIALISTS, 1816 Settlers Oval, Cleveland, OH 44145, Tel: 216-871-8909; Empl.: 10; *Sls. Mgr.:* Tim Howard

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 612-636-8944; *Sls. Mgr.:* Roger H. Falde, Dir. Sls.

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 708-652-7555, FAX: 708-863-4272; Empl.: 35; *Sls. Mgr.:* Theresa McGraw

FAX: 408-441-7224

RESONANT POWER TECHNOLOGY, 1926 Junction Ave., San Jose, CA 95131-2102, Tel: 408-441-0800; FSC No.: 0BZ13; Empl.: 10; *Sls. Mgr.:* Dan H. Burgoon .... **D•1914-1915**

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NH	Salem, OEM Marketing & Sales	603-893-0009
TX	Richardson, Jim Gray & Associates	214-699-9976

RF ELECTRONICS, INC., 1091 Duryea Ave., Irvine, CA 92714-5517, Tel: 714-263-0661, FAX: 714-263-0662; Empl.: 18; *Sls. Mgr.:* Andy Webb; *Dist. Mgr.:* Andy Webb

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, FAX: 516-231-6465; FSC No.: 13619; Empl.: 140; *Sls. Mgr.:* Dave Radford **A•1157-1158, 1601, 1676, 2315, 2532**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	The James Gerry Co.	602-893-3543
CA	Alhambra, The James Gerry Co.	213-283-7694
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Commerce City, Williams Assoc.	303-289-5647
FL	Altamonte Springs, Tech-Rep Assoc.	813-572-9900
FL	Clearwater, Tech-Rep Assocs.	813-572-9900
FL	Ft. Lauderdale, Tech Rep Assocs.	305-791-2708
FL	Merritt Island, Tech-Rep Assocs.	407-453-3313
FL	Winter Springs, Tech-Rep Assocs.	407-699-4010
IL	Compucon West	708-513-7706
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MD	Kensington, Koebert Assoc.	301-493-8924
MO	Ballwin, Gillam Entrprs., Inc.	314-458-1896
MA	Burlington, Tritek, Inc.	617-272-4550
NM	Albuquerque, M.G. Elctrns.	505-255-1638
NY	Buffalo, Foster & Wager, Inc.	716-385-7744
NY	Great Neck, Trionic Assocs.	516-466-2319
NY	Ronkonkoma, Compucon Distrs., Inc.	516-981-8810
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Glenside, Koebert Assocs.,Inc.	215-887-2310
TX	Garland, McBride Sci. Sls.	214-494-5000
VA	Alexandria, koebert Assocs.	703-461-3655
WA	Bellevue, Olson Technical Sls. Corp.	206-883-7792
Can	Bedford, N.S., Norgay Entprs. Ltd.	902-864-2504
Can	Delta, B.C., Norgay Entprs. Ltd.	604-940-8988
Can	Ottowa, Ont., Norgay Entprs. Ltd.	613-745-4051
Can	Toronto, Ontario, Norgay Entprs. Ltd.	416-234-8966
Can	Westmount, Quebec, Norgay Entprs. Ltd.	514-932-3233

Local Distributors

IL	Des Plaines, Compucon Distrs., Inc.	708-513-7706
MA	Reading, Tritek, Inc.	617-272-4550
NY	Ronkonkoma, Compucon Distributors, Inc.	516-981-8810

RF INDUSTRIES LTD. (NUELINK), 7620 Miramar Rd., San Diego, CA 92126, Tel: 619-549-6340, 800-233-1728, FAX: 619-549-6340; Empl.: 25; *Sls. Mgr.:* Les Perlman

RFL ELECTRONICS INC., Powerville Rd., Boonton, NJ 07005-0239, Tel: 201-334-3100, FAX: 201-334-3863; FSC No.: 49673; Empl.: 300

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 200; *Sls. Mgr.:* C. Baker

R.F. POWER LABS., INC., Kalmus Engineering Inc., 21820 -87th S.E., Woodinville, WA 98072, Tel: 206-481-8833, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Jeannie Olson

RGB SPECTRUM, 950 Marina Village Parkway, Alameda, CA 94501, Tel: 510-814-7000, FAX: 510-814-7026; Empl.: 30; *Sls. Mgr.:* Lucien E. Long; *Dist. Mgr.:* Lucien E. Long

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RHG ELECTRONICS LABORATORY, INC., 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, FAX: 516-242-1222; Empl.: 205; *Sls. Mgr.:* David E. Krautheimer

RHINO ROBOTS, INC., P.O. Box 4010, Champaign, IL 61824, Tel: 217-352-8485, FAX: 217-356-7699; Empl.: 18; *Sls. Mgr.:* H.S. Sandhu

RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, FAX: 714-896-0971; FSC No.: 16714; Empl.: 60; *Sls. Mgr.:* Mary Manandik; *Dist. Mgr.:* Sheryl Lane **A•1579, 2533**

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AL	Huntsville, CMR Cross Assocs.	205-533-1320
CA	San Diego, Canusa Technlg.	619-729-8662
CO	Parker, A-5 Co.	303-841-3651
CT	Canterbury, Deltech Sls.	203-546-6322
FL	Altamonte Springs, Electramark	407-830-0844
FL	Boca Raton, Electramark	305-424-2872
FL	Tampa, Electramark	813-962-1882
MA	Littleton, Deltech Sls.	508-486-8294
NJ	Mt. Laurel, Wyck Mktg.	609-727-1070
OR	Lake Oswego, Joe Blanchard Sls.	503-620-6888
TX	Austin, Component Technlg.	512-288-7328
TX	Dallas, Component Technlg.	214-783-8831
TX	Houston, Component Technlg.	713-690-3011
VT	S. Burlington, Deltech Sls.	802-865-4454
WA	Redmond, Joe Blanchard Sls.	206-778-9622

Local Distributors

CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Manhattan Bch., Prime Electro Prods.	310-379-3642
CA	San Jose, Eric Elctrns.	408-432-1111
MA	Wakefield, Nu Horizons Elctrns. Corp.	617-246-4442
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Pine Brook, Nu Horizons Elctrns. Corp.	201-882-8300
NY	Amityville, Nu Horizons Elctrns. Corp.	516-226-6000
NY	E. Rochester, Nu Horizons Elctrns. Corp.	716-292-0777
WI	McQuon, Taylor Elec. Co.	414-241-4321

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FAX: 908-389-9066

RIA ELECTRONICS, 15 Meridan Rd., P.O. Box 447, Eatontown, NJ 07724, Tel: 908-389-1300; Empl.: 7 **C•1442-1449**

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AZ	Phoenix, Chaparral Elctrns., Inc.	602-996-5909
CA	Orange, Dobson Mktg.	714-639-3278
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8718
CO	Evergreen, Mid/West Co.	303-674-4829
CT	Milford, High Tech Sls.	203-874-6595
GA	Alpharetta, R A Sls.	404-442-6749
IL	Arlington Hgts., MJ Peterson & Assocs.	708-577-8200
IN	Ft. Wayne, M/S Sls.	219-436-3023
IN	Greenwood, M/S Sls.	317-881-0110
KS	Wichita, Mid/West Co.	316-264-0440
MD	Baltimore, Stitzer Co., Inc.	301-494-9100
MI	Livonia, Electro Mktg. Grp., Inc.	800-338-6856
MN	Roseville, TLC Elctrns.	612-483-2226
MO	Florissant, Mid/West Co.	314-837-3361
NE	Lincoln, Mid/West Co.	402-423-1386
NJ	Woodbridge, Jade Mktg.	908-750-2998
NM	Albuquerque, Chaparral Elctrns., Inc.	502-271-2266
NC	New Bern, R A Sls.	919-244-2672
OH	Dayton, Electro Mktg. Grp., Inc.	800-338-6856
OH	N. Royalton, Electro Mktg. Grp., Inc.	800-338-6865
PA	Allison Park, Electro Mktg. Grp., Inc.	800-338-6856
PA	Malvern, Stitzer Co., Inc.	215-644-5500
SC	Easley, R A Sls.	803-859-1859
TN	Rutherford, R A Sls.	901-655-6301
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
WA	Vancouver, Sls. & Engrg. Assoc.	206-573-5161
Can	Markham, Ont., Birde Mktg.	416-477-7722

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AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, Control Des. Supp.	602-829-7981
AR	Maumelle, Control Des. Supp.	501-851-3171
CA	Anaheim, Control Des. Supp.	714-821-1516
CA	Buena Pk., SEL Sls., Inc.	714-521-8673
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	San Carlos, Control Des. Supp.	415-592-4806
CA	San Carlos, Logan Elctrns.	415-592-4806
CA	Santa Monica, Master Distrs.	310-452-1229
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, Control Des. Supp.	303-296-1922
CT	Wallingford, Control Des. Supp.	203-269-9955
FL	Davie, Arco Distrs.. Inc.	305-473-2550
FL	Pompano Bch., Control Des. Supp.	305-783-1311
FL	Sanford, Control Design Supp.	407-328-8011
GA	Stone Mountain, Control Des. Supp.	404-479-3906
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Schaumburg, Control Des. Supp.	708-307-8900
IL	Wood Dale, Electro-Kinetics	708-595-6700
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Control Des. Supp.	317-788-4559
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
IA	Marion, Control Des. Supp.	319-373-2923
KS	Kansas City, Control Des. Supp.	913-362-4248
MA	Walpole, Richey-Impact Elctrns.	508-668-8200
MA	Woburn, Control Des. Supp.	617-932-9404
MI	Farmington Hills, Control Des. Supp.	313-473-0220
MI	Rose Mount, Advent Elctrns., Inc.	708-297-6200
MN	Minneapolis, Control Des. Supp.	612-721-1628
MO	Kansas City, Barr-Thorp Elec. Co.	816-531-8840
MO	Maryland Heights, Control Design Supp.	314-432-1116
NH	Goffstown, Key Comps.	603-626-1717
NJ	Bellmawr, Mid Atlantic Comps.	609-931-5303
NJ	Union, Lectron Inds.	908-687-2626
NY	Bohemia, EBL Svcs., Inc.	516-567-7577
NY	Ronkonkoma, Spectrum Comps.	516-737-6900
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NC	Winston-Salem, Kirkman Elctrns., Inc.	919-722-9131
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TX	Houston, Control Des. Supp.	713-868-4018
UT	Nephi, Control Des. Supp.	801-623-2908
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RITTAL CORP., One Rittal Place, Springfield, OH 45504-9807, Tel: 800-477-4000, TELEX: 513-390-5599; Empl.: 270

RITTER COIL, INC., 720 Sheridan Dr., P.O. Box 3130, Easton, PA 18043-3130, Tel: 215-258-6780, FAX: 215-258-6783; Empl.: 20; *Sls. Mgr.:* Jackie Berhel

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada NOB 2EO, Tel: 519-696-2616, FAX: 519-696-2670; Empl.: 30; *Sls. Mgr.:* Gary Ritz; *Dist. Mgr.:* Leonard Snow **C•1081; D•1913**

Local Sales Offices & Reps

CA	Torrance, U.S. Power Converting Co.	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Electronics Ltd.	519-696-2616

Local Distributors

CA	Torrance, Leonard Snow & Assocs./U.S. Power	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Electronics Ltd.	519-696-2616

RIVERHEAD CIRCUITS, AMP ∪ AKZO Corporation, P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, FAX: 516-284-2352; Empl.: 500; *Sls. Mgr.:* Dennis Marek

RJF INTERANTIONAL CORP., 3875 Embassy Pkwy., Fairlawn, OH 44333, Tel: 216-668-7689, FAX: 216-668-7701

R-K ELECTRONICS, 11560 Goldcoast Dr., Cincinnati, OH 45249, Tel: 513-489-4060; Empl.: 25

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, FAX: 914-241-1753; FSC No.: 12598; Empl.: 56; *Sls. Mgr.:* Walter Crofut; *Dist. Mgr.:* Walter Crofut

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RMS, Electrical Connector Division, 8600 Evergreen Blvd., Minneapolis, MN 55433, Tel: 612-786-1520, FAX: 612-786-1771; Empl.: 50; *Sls. Mgr.:* Connie Laumeyer

RMS INSTRUMENTS, 1415-2 Bonhill Rd., Mississauga, Ont., Can L5T 1R2, Tel: 416-564-5533, FAX: 416-670-0053; Empl.: 15; *Sls. Mgr.:* Edward A. McGovern

RMS TECHN., 11833 Canon Blvd., Ste 100, Newport News, VA 23606, Tel: 804-873-0100, FAX: 804-873-1512; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, FAX: 212-989-3285; FSC No.: 82872; Empl.: 80; *Sls. Mgr.:* Ray Lefebvre; *Dist. Mgr.:* Ray Lefebvre

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RO ASSOCIATES

FAX: 408-744-1521

RO ASSOCIATES, INC., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450; FSC No.: 24230; Empl.: 60; *Sls. Mgr.:* R. D. Okada .... **D•1916-1917, 2202-2205**

Local Sales Offices & Reps

AL	Huntsville, JSI, Inc.	205-883-4163
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
CA	Los Angeles, West Coast Reps.	310-690-9960
CA	San Diego, W. Coast Rep	619-581-2406
CA	San Jose, P & M Elctrns.	408-287-0402
CO	Denver, F.G. Mktg.	303-795-9176
CT	Redding, Power Factor	203-938-7013
DC	Washington, Gans & Pugh	703-709-0305
FL	Ft. Lauderdale, Panamtech	305-587-3769
FL	Orlando, Panamtech	407-679-5506
IL	Chicago, Mar-con Assocs. Inc.	708-675-6450
KS	Kansas City, Midtec	913-541-0505
MD	Baltimore, Gans & Pugh	410-442-2189
MA	Boston, Power Factor	508-234-6415
MN	Minneapolis, R J Inc.	612-866-3661
MO	St. Louis, Midtec	314-275-8666
NV	Henderson, Chaparral	702-433-5486
NM	Albuquerque, Chaparral	505-292-0007
NY	Buffalo, NRM Mktg.	716-634-4300
NY	Great Neck, M.O.S. Mktg.	516-487-3966
NY	Rochester, NRM Mktg.	716-352-9166
NY	Syracuse, NRM Mktg.	315-685-8991
OH	Centerville, Omega Sls., Inc.	513-434-5507
OR	Beaverton, Pacific Mktg.	503-641-9373
PA	Philadelphia, Gans & Pugh	215-699-6655
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Redmond, Pacific Mktg.	206-882-3144

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-948-0564, FAX: 812-945-0804; Empl.: 400; *Sls. Mgr.:* Bill Gruhn; *Dist. Mgr.:* Carl Pearcy

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 65

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, P.O. Box 3135, Princeton, NJ 08543, Tel: 609-844-0800, FAX: 609-895-9726; Empl.: 15; *Sls. Mgr.:* S.N. Thanos

ROCKWELL INTERNATIONAL, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532 COLLINS CSMA, FAX: 714-641-5320; Empl.: 60; *Sls. Mgr.:* Robert A. Johnson

ROCKWELL INT'L:SEMICONDUCTOR PRODUCTS DIVISION, 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 714-833-4600, TWX: 910-591-1698; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* Ernie Raper, Dir. of Sls.; *Dist. Mgr.:* K. Reutemann

ROCOM CORPORATION, 5957 Engineer Dr., Huntington Beach, CA 92649, Tel: 1-800-952-3539, 714-891-9922, FAX: 714-891-2121; FSC No.: 67361; Empl.: 21; *Sls. Mgr.:* Robert Jewell; *Dist. Mgr.:* Robert Jewell

RODALE
Technical Sales Inc.

FAX: 516-277-8375

RODALE TECHNICAL SALES INC., 577 Main Street, Islip, NY 11751, Tel: 516-277-5454, TELEX: 5106007812, ESYLNK: T8003254112; Empl.: 10; *Sls. Mgr.:* Gene Lipman .... **C•1640-1641, 1804-1805; D•1063**

Local Sales Offices & Reps

CA	Yorba Linda, Rodale Tech. Sls., Inc.	714-283-3140
IL	Bensenville, Connecting Technlg.	708-238-0509
IN	Carmel, Current Elctrns. Mktg.	317-844-1770
KS	Prairie Village, Crosslink Elctrl./Elctrns.	913-432-6100
NY	Islip, Rodale Tech. Sls., Inc.	516-277-5454
OH	Bedford Hgts., P.H.P.	515-472-5984

Local Distributors

AZ	Phoenix, Storm Prods.	602-269-3485
CA	Inglewood, Storm Prods.	213-776-8141
CA	Sacramento, AVAC Sunset	1-800-AVAC-DIV
CO	Broomfield, Storm Prods.	303-466-1991
MN	Bloomington, KL Tannehill	612-881-6700
MN	St. Paul, AVAC Mid-America	1-800-AVAC-DIV
NJ	Edison, AVAC National	1-800-AVAC-DIV
TN	Nashville, AVAC Pioneer Tenn.	1-800-AVAC-DIV
TX	Dallas, Storm Prods.	214-330-1381
UT	Salt Lake City, Standard Supp.	801-486-3371
WA	Woodinville, Storm Prods.	206-488-7400

RODANN ELECTRONICS MFG. CO., 3100 Airway Ave. 128, Costa Mesa, CA 92626, Tel: 714-662-3232, 800-366-7010, FAX: 714-662-3171; *Sls. Mgr.:* Alex Skarbek

RODELCO ELECTRONICS CORP., 111 Haynes Ct., Ronkonkoma, NY 11779, Tel: 516-981-0900, FAX: 516-981-1792; Empl.: 44

ROD-L
ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 923 Hamilton Ave., Menlo Park, CA 94025, Tel: 415-322-0711, 1-800-548-6305, TWX: 296210; *Sls. Mgr.:* Tom Cooke .... **D•1320-1321**

Local Sales Offices & Reps

AZ	Mesa, Scientific Dvcs. W.	602-839-6628
CA	Menlo Park, ROD-L (factory)	415-322-0711
CO	Louisville, Scientific Dvcs. W.	303-665-8089
FL	Boca Raton, Electromark	407-852-2259
GA	Helen, Electromark Sys.	706-865-3120
IL	Elk Grove, Loren Green Assocs.	312-593-0282
KS	Merriam, Tec Rep	913-262-9500
MN	Minneapolis, Hei-Lite Sls	612-861-6051
MN	Plymouth, Hei-Lite	612-550-0506
MO	St. Louis, Tec Rep	314-454-9100
NJ	Laurel Springs, Donald Williams	609-346-2876
NY	Liverpool, Northern Tech. Sls.	314-451-1091
NC	Winston-Salem, Nelson Assocs.	919-765-5520
OH	N. Olmsted, AM Sls.	216-779-5033
OK	Tulsa, Spectra Sls	918-665-8899
OR	Aloha, Core II Mktg.	503-649-0871
OR	Beaverton, Core II Mktg	503-641-0877
RI	Narragansett, Pat Assocs.	401-783-9598
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
VA	Alexandria, Dyna Rep	703-354-1222
Can	Scarborough, MultiTest Elctrns.	416-609-8399

Local Distributors

CA	Menlo Park, Rod-L (Factory)	415-322-0711
Can	Scarborough, MultiTest Elctrns.	416-609-8396

ROEDERSTEIN ELECTRONICS, INC., Vishay Electronic Components, 2100 W. Front St., Statesville, NC 28677, Tel: 704-872-8101, FAX: 704-872-8023; Empl.: 98; *Dist. Mgr.:* Teresa Alexander

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 708-498-2300, FAX: 708-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-786-8490; *Sls. Mgr.:* Darrel Brasch

ROGERS CORPORATION, Microwave & Circuit Matls. Div., 100 S. Roosevelt Ave., Chandler, AZ 85226, Tel: 602-961-1382, FAX: 602-961-4533

ROGERS CORPORATION, Molding Materials Div., P.O. Box 550, Manchester, CT 06040, Tel: 203-646-5500, FAX: 203-646-5503

ROGERS CORPORATION, Power Distribution Div., 5750 E. McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-396-6401

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500

ROH, Portland Instrument, 6120 San Fernando Rd., Glendale, CA 91201, Tel: 818-500-0137, FAX: 818-240-1828; Empl.: 10; *Sls. Mgr.:* Dick Herbert

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65

ROHM CORPORATION, Rohm Electronics Division, 3034 Owen Drive, Antioch, TN 37013, Tel: 615-641-2020, FAX: 615-641-2022; Empl.: 115; *Sls. Mgr.:* Mike DelGrippo; *Dist. Mgr.:* Steve Bishop

ROLLS BATTERY ENGINEERING, 8 Proctor St., Salem, MA 01970, Tel: 508-745-3333, FAX: 508-741-8956; FSC No.: 6140 6135; Empl.: 4-5; *Dist. Mgr.:* John J. Surrette

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ROSE ENCLOSURES SYS., INC., 7330 Executive Way, Frederick, MD 21701-8353, Tel: 301-696-9800, FAX: 301-696-9494; FSC No.: 4Y520/C0242; Empl.: 45; *Sls. Mgr.:* Warren Hudacek

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSEMOUNT ANALYTICAL INC., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 800-222-2600 ext. 400, FAX: 201-857-9403

ROSS ENGINEERING CORP.

FAX: 408-377-5182

ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Jim Ross; *Dist. Mgr.:* Jim Ross .... **B•1228, 1592-1594, 1802; D•1319**

ROTEK INSTRUMENT CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611, FAX: 617-894-7273; FSC No.: 06678; *Sls. Mgr.:* Paul Lualdi

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
FL	Palm Harbor, Teqspec	813-942-6006
MA	Randolph, EML Assocs.	617-341-0781
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NC	Winston-Salem, Teqspec	919-765-5553
PA	Lansdale, Techn. Instr. Sls.	215-361-7850
PA	Pittsburgh, Meas. Instr. East	412-459-8090
TX	Dallas, Kemp Instrs.	214-931-7100
VA	Dumfries, Electra-Tech Inc.	703-670-6962
WA	Seattle, Branom Instr. Co.	206-762-6050

ROTORK CONTROLS, INC., 19 Jetview Drive, Rochester, NY 14624, Tel: 716-328-1550, FAX: 716-328-5848; Empl.: 75; *Sls. Mgr.:* Chris Warnett; *Dist. Mgr.:* Chris Warnett

ROWE INDUSTRIES, INC. | Talley Industries

FAX: 419-729-1794

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761; FSC No.: 82878; Empl.: 89 .... **C•1807**

Local Sales Offices & Reps

AL	Huntsville, Giestings & Assoc.	205-830-4550
AZ	Scottsdale, Pinnacle Comps. Sls.	602-994-0441
CA	Laguna Hills, Rowe Inds.	714-643-2675
CA	Tustin, R.T.S. Assocs.	714-730-9561
CO	Denver, Spectrum	303-480-9991
CT	New England, R.F. Assocs.	203-458-3674
FL	Clearwater, R.F. Assocs., Inc.	813-442-8500
FL	Longwood, R.F. Assocs., Inc.	407-657-7332
GA	Duluth, Giestings & Assocs.	404-476-0025
IL	Naperville, Connect Plus	708-355-6363
IL	Rolling Meadows, Rowe Inds.	708-670-0913
IN	Carmel, Giestings & Assoc.	317-844-5222
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Topsfield, R.F. Assocs., Inc.	508-887-9762
MI	Livonia, Giestings & Assoc.	313-478-8106
MN	Stillwater, Kits Co.	612-439-8088
NY	Pittsford, Franklin Sls.	716-248-8251
NY	Smithtown, Koebert Assocs.	516-979-6683
OH	Cinicinnati, Makin Assocs.	513-871-2424
OH	Toledo, Rowe Inds.	419-729-9761
RI	Cranston, Rowe Inds., Inc.	401-946-0210
TX	Austin, Kruvand Assocs., Inc.	512-219-9441
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355
UT	Ogden, Spectrum	801-972-8552
VA	Alexandria, Koebert Assocs.	703-461-3655
WA	Bellevue, Advanced Power Comp.	206-747-9127
WA	Vancouver, Advanced Power Comp.	206-896-4239
WI	Hartland, Connect-Plus	414-367-2094
Can	Barnaby, B.C., Cartwright	416-528-0294
Can	Burnaby, B.C., Advanced Power Comp.	604-299-7330

Local Distributors

PA	Glenside, Mark Elctrns.	215-887-2310
TX	Ft. Worth, Ft. Worth Wire & Cable	817-232-4100

ROYAL ENTERPRISES CO., 4260 Valley Fair St., Simi Valley, CA 93063, Tel: 805-522-8730, 818-998-2455, FAX: 805-522-9055; Empl.: 5; *Sls. Mgr.:* Robert E. Burks

MILTON ROY CO, Process & Environ., 1238 W. Grove Ave., Orange, CA 92665-4134, Tel: 714-974-5560, FAX: 714-921-2531; Empl.: 60; *Sls. Mgr.:* Harold Peper

ROYONIC INC., 25345 Ave. Stanford, Ste. 201, Valencia, CA 91355, Tel: 805-257-0303, TELEX: 315672, ESYLNK: 62840158, FAX: 805-257-0802; Empl.: 7; *Sls. Mgr.:* Terry Josselyn

R-THETA INC.

FAX: 1-800-567-7115

R-THETA INC., 290 Larkin St., P.O. Box 1089, Buffalo, NY 14220-8089, Tel: 1-800-388-5428; Empl.: 75; *Sls. Mgr.:* Barry Butwell; *Dist. Mgr.:* Mike Taverner .... **C•1643**

Local Sales Offices & Reps

CA	Granada Hills, Timberlake Grp.	818-368-1782
MA	Brookline, Harman Assocs., Inc.	617-232-6687
MN	Eden Prairie, Hanna Lind Ltd.	612-942-8554
OH	Cleveland, Staffco	216-331-5100

Local Distributors

NJ	Darien, C.W. Assocs.	203-656-2339
NY	Syracuse, Leonard D. Allen Inc.	315-437-8387

RTRON CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-679-7180, FAX: 708-675-3709; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS SYSTEMS, TELEX COMMUNICATIONS, INC., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-566-6700, TELEX: 194855, FAX: 818-843-7953; FSC No.: 60572; Empl.: 45; *Sls. Mgr.:* Shelley Brown Harrison; *Dist. Mgr.:* Shelley Brown Harrison

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880, FAX: 714-472-1081; FSC No.: 01EG24; *Sls. Mgr.:* David Zoscak

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FAX: 401-884-4872

RUSTRAK INSTRUMENTS, Mark IV Industries, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-6800, 800-332-3202, TWX: 710-387-1500; Empl.: 250; *Sls. Mgr.:* John Olobri; *Dist. Mgr.:* John Olobri ...... **D•1416**

Local Distributors

AZ	Tempe, CMI Metermaster	602-431-0015
CA	Fullerton, Rustrak	714-879-6384
CA	Hayward, Coast Inst.	510-786-9300
CA	San Marcos, Mitchell Inst.	619-744-2690
CO	Commerce City, WACO Elctrns.	303-289-4743
FL	Palm Bay, EIL Instrs.	407-725-8300
GA	Forest Park, Brownell Electro	404-362-9009
MD	Hunt Valley, EIL Instrs.	410-584-7400
MA	Burlington, EIL Instrs.	617-272-9450
MI	Grand Rapids, Smith Inst.	616-245-1195
MI	Royal Oak, George Inst.	313-280-1111
MO	St. Louis, Indl. Svc. Labs	314-423-3141
NJ	Newark, Norman Bragar Prods.	201-344-1100
NC	Charlotte, Inotek Corp.	704-527-5000
OH	Cincinnati, Schlemmer Assocs.	513-522-8340
OH	Cleveland, M.A. Blankenberg	216-251-7010
PA	Philadelphia, Sunshine Scientific	215-673-5600
RI	E. Greenwich, Rustrak	800-332-3202
TX	Dallas, Inotek Corp.	214-243-8370
TX	Houston, American Analog	713-941-7265
WA	Seattle, Branom Inst.	206-762-6050
WI	Waukesha, Wisconsin Control Corp.	414-542-1588

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

R X D INC., Relm Communications, 806 Custer Ave., Norfolk, NE 68701, Tel: 402-379-0112, 800-228-8108, FAX: 402-379-3074 .... **A•1470-1473**

Local Sales Offices & Reps

AL	Huntsville, BITS, Inc.	205-881-2900
AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Cupertino, Prism Tech. Sls.	408-435-7377
CA	Huntington Beach, Solutech, Inc.	714-374-0130
CA	San Diego, Solutech, Inc.	619-581-2741
GA	Norcross, BITS, Inc.	404-564-5599
IL	Hoffman Estates, Astrotech Elctrns.	708-934-1538
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
IN	Leo, Mohrfield Mktg.	219-627-5355
MN	Oakland, Complete Sls.	612-731-2923
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	Canandaigua, S-J Assocs.	716-394-3281
NY	Rockville Centre, S-J Assocs.	516-536-4242
NY	Roslyn Heights, Michel Assocs.	516-621-6378
NC	Raleigh, BITS, Inc.	919-676-1880
OH	Columbus, S-J Assocs.	614-885-6700
UT	Salt Lake City, Wind River Mktg., Inc.	801-972-1151
VA	Falls Church, S-J Assocs.	703-533-2233
WI	Watertown, Astrotech	414-261-7600
Can	Mississauga, Source Elctrns.	416-676-0830
Can	Mont. Gabriel, Source Elctrns.	514-369-0321
Can	Orleans, Source Elctrns.	613-837-0220

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Scottsdale, Added Value Elec. Dist.	602-951-9788
CA	Chatsworth, E/W Elctrns.	818-718-2500
CA	Garden Grove, Ewing Elctrns.	714-891-9163
CA	Milpitas, California Capacitor	408-262-6000
CA	San Diego, Added Value Elec. Dist.	619-558-8890
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Inductive Comps.	408-971-0688
CA	Stanton, Inductive Comps.	714-828-3420
CA	Tustin, Added Value Elec. Dist.	714-259-8258
CA	Visalia, Added Value Elec. Dist.	209-734-8861
CO	Wheat Ridge, Added Value Elec. Dist.	303-422-1701
IN	Indianapolis, Custom Svc.	317-879-9119
MA	Methuen, AVED Elctrns., Inc.	508-688-3800
MN	Roseville, Parts 1	612-633-8079
MO	St. Louis, RIC-Tronics	314-997-4707
NH	Merrimack, Brevan Elctrns.	603-429-1900
NH	Salem, Diamond Elctrns.	603-894-4420
NC	Charlotte, E.M.C. (Elec. Mktg. Corp.)	704-394-6195
OH	Columbus, E.M.C. (Elec. Mktg. Corp.)	614-299-4161
OH	Highland Height, E.M.C. (Elec. Mktg. Corp.)	216-442-3441
TX	Austin, LCD Elctrns.	512-388-0900
TX	Carrollton, LCD Elctrns.	214-245-0600
TX	Richardson, Ewing Elctrns. Inc.	214-231-6725
UT	West Valley, Added Value Elec. Dist.	801-975-9500

RYE INDUSTRIES, INC., 3337 Air Park Rd., Fuquay-Varina, NC 27526, Tel: 919-557-0511, 800-626-1511, FAX: 919-557-0510; Empl.: 5

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* James D. Mack; *Dist. Mgr.:* Dick Fry

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-250-1244, FAX: 714-250-1009; FSC No.: 58795; Empl.: 49

SACO CONTROLS INC., 9700 Trans Canada Hwy., Montreal,Qc., Canada H4S 1V9, Tel: 514-745-0310, TELEX: 055-62171, FAX: 514-745-0315; Empl.: 36; *Sls. Mgr.:* Pat Argento

SAE POWER, INC., 282 Brokaw Rd., Santa Clara, CA 95050, Tel: 408-988-0700, FAX: 408-986-8529; *Sls. Mgr.:* Nick Markoff; *Dist. Mgr.:* Debbie Thomas

SAFT AMERICA INC., Power Sources Div., 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, FAX: 912-247-6680; Empl.: 200; *Sls. Mgr.:* Syd Reames .... **D•1418, 1467-1471**

Local Distributors

CT	Stamford, AeroQuality Sls.	203-351-8500
TN	Nashville, Ryder Aviall	615-754-7700

SAFT AMERICA INC., Research & Development Center, 109 Beaver Ct., Cockeysville, MD 21030, Tel: 410-771-3200, FAX: 410-771-1144 .... **D•1418, 1467-1471**

SAFT AMERICA INC., Lithium Battery Div., 313 Crescent St., Valdese, NC 28690, Tel: 704-874-4111. FAX: 704-874-2431; Empl.: 150; *Sls. Mgr.:* Glen Bowling .... **D•1418, 1467-1471**

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FAX: 912-247-6680

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 600; *Sls. Mgr.:* Michael Marcoux; *Dist. Mgr.:* George Lupul **D•1418, 1467-1471**

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CA	Camarillo, SAFT America, Inc.	805-491-2821
CA	Redwood City, SAFT America, Inc.	415-365-4539
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Oak Forest, SAFT America, Inc.	708-687-6690
IN	Indianapolis, SAFT America, Inc.	317-594-0443
TX	Dallas, SAFT America, Inc.	214-239-3935
MN	Inver Grove Hgts., SAFT America, Inc.	612-552-0121
NY	Plainview, SAFT America, Inc.	516-931-5902
NY	Stoney Point, SAFT America, Inc.	914-786-0213
PA	Bensalem, SAFT America, Inc.	215-744-8044

Local Distributors

AK	Fairbanks, Cold Spot	907-457-8555
AZ	Phoenix, Lynntronics	602-841-3900
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Huntington Beach, House of Batteries	800-432-3385
CA	Mountain View, Energy Sls.	415-969-0800
CA	San Diego, Tauber Elctrns.	619-274-7242
CO	Littleton, AVT	303-798-1958
FL	Altamonte Springs, TNR Tech.	407-682-4311
FL	Hialeah, Pro Battery	305-884-4040
GA	Decatur, ELS Prods.	800-334-5066
HI	Honolulu, Battery Factory	808-537-6797
IL	Downers Grove, TDI	708-971-3460
IL	Lisle, Jabro Batteries	708-964-9358
IL	Rosemont, Advent Elctrns.	708-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Andover, Generation Elctrns.	508-683-1177
MA	Middleboro, Glynn Elctrns.	508-947-4262
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	St. Paul, D. C. Battery Prods. Inc,	612-646-7478
NY	Pen Yan, Advacom	315-536-2221
NY	Plainview, Plainview Batteries	516-249-2873
PA	Bensalem, Avex Elctrns. Corp.	215-638-3300
PA	McKean, Advacom	814-476-7774
TN	Mt. Juliet, Batteries Unlimited	615-754-8179
TX	Houston, Kent Elctrns.	713-783-2288
TX	Houston, Lone Star Mktg.	713-589-0853
TX	Spring, Jabro Batteries, S.W.	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Redmond, Energy Sls.	206-883-2343
Can	Brampton, Ont., Innovative	416-791-2132
Can	Burnaby, B.C., Polar	604-294-1891
Can	Edmonton, D.C. Solutions	403-486-3636
Can	Mississauga, Ont., Advance	416-670-7159
Can	Mississauga, Ont., Alexander	416-568-9877
Can	Montreal, Que., Universal	514-722-3311
Can	Pointe-Claire, A.R. Grey	514-694-6378
Can	Regina, Regina	306-522-2221

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 508-653-0844, FAX: 508-653-5671; FSC No.: 07180; Empl.: 43; *Sls. Mgr.:* Tony Cieri

SAINT SWITCH, INC., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174, Tel: 708-377-3779, FAX: 708-377-7438; FSC No.: 60198; Empl.: 30

SAMARIUS PRECISION INSTRUMENTS, INC., 26 Beaver St., Ansonia, CT 06401, Tel: 203-736-9805, FAX: 203-736-9835; FSC No.: 18065; Empl.: 25; *Sls. Mgr.:* Joseph Mezei

SAMATIC WINDING MACHINE, Jenlor Ltd., 200 Highbridge St., Fayetteville, NY 13066, Tel: 315-637-9080, FAX: 315-637-9149; Empl.: 15; *Sls. Mgr.:* Jim Philips; *Dist. Mgr.:* Jim Phillips

SAMHWA U.S.A. INC., 9330 Eton Ave., Chatsworth, CA 91311, Tel: 818-727-0512, FAX: 818-727-0700/0800/0900; Empl.: 8; *Sls. Mgr.:* Joseph Buckle; *Dist. Mgr.:* Diane Lawrence

SAMSUNG ELECTRON DEVICES, See Samtron Displays, Inc.

SAMSUNG SEMICONDUCTOR, INC., 3655 North First Street, San Jose, CA 95134, Tel: 408-954-7000,1-800-423-7364, TELEX: 339544, FAX: 408-954-7883

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FAX: 812-948-5047

SAMTEC, INC., P.O. Box 1147, New Albany, IN 47151-1147, Tel: 1-800-672-6832; FSC No.: 55322; Empl.: 200; *Sls. Mgr.:* Mike Hynes **C•1548-1553**

Local Sales Offices & Reps

AZ	Tempe, Westrep/AZ	602-820-9932
CA	Anaheim, Westrep/CA	213-404-3881
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CA	San Jose, Kottmeier	408-371-8700
CO	Boulder, Front Range Mktg.	303-447-4780
FL	Margate, EPM Corp.	305-977-0331
IL	Lisle, W.G. Controls	312-963-5954
IN	Indianapolis, Needler Sls.	317-255-8056
IA	Cedar Rapids, W.G. Controls	319-373-1009
KS	Parker, S. W. Assocs.	913-898-6552
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MI	Holland, Com-Tek Sls.	616-399-7273
MN	Shorewood, Frank Anthony Mktg.	612-474-2850
MO	St. Louis, S.W. Assoc./Saunders	800-821-6344
NJ	Hackensack, CBA/Metro	201-440-4114
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, B. T. Funderburk	919-846-2373
OH	Medina, J. C. Hofstetter	216-241-4880
PA	Huntington Valley, Inacker Sls.	215-947-5660
RI	Warwick, Schumacher & Yarrington	401-884-5671
TX	Plano, High Tech Sls.	214-612-0216
WA	Lynnwood, Quadra Sls.	206-743-2633
WI	Mequon, Badgerep	414-241-9200
PR	Caguas, K. D. Tronics	809-746-0275
Can	Oakville, Ont., Haltronics	416-844-2121
Can	Surrey, B.C., Cana Comm Mktg.	604-589-3822

Local Distributors

AL	Birmingham, Forbes	205-251-4104
AL	Huntsville, Hammond Elect.	205-830-4764
AZ	Tempe, Cypress	602-966-2256
CA	Agoura Hills, Cypress Elect.	818-597-9491
CA	Buena Pk., Cypress	714-521-5230
CA	Chatsworth, Milcomm	818-998-3111
CA	Manhattan Bch., Prime Electro	310-379-3642
CA	Milpitas, Sierra West	408-945-1050
CA	Riverside, Elec. Supp.	714-683-7300
CA	San Diego, Cypress	619-535-0011
CA	San Diego, Neumann Elect.	619-695-3005
CA	Santa Clara, Cypress	408-980-2500
CA	Sunnyvale, Abacus	408-732-2000
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Indelco	303-694-9444
CT	East Haven, J.V. Elec.	203-469-2321
CT	Milford, Fleet Elect.	203-877-2577
CT	Yatesville, Schaal, Inc.	203-269-3779
FL	Ft. Lauderdale, KSM Elect.	800-327-8914
FL	Orlando, Hammond Elect.	407-841-1010
FL	Winter Park, Deanco	407-671-5100
GA	Marietta, Deanco	404-429-0126
GA	Norcross, Hammond Elect.	404-449-1996
IL	Addison, Belford Elec.	312-691-1100
IL	Wheaton, Mega/Deanco	708-665-6214
IN	Carmel, Altex	317-848-1323
IA	Cedar Rapids, Dee Elect.	319-365-7551
KS	Wichita, Mega/Deanco	316-636-5020
MD	Gaithersburg, Deanco	301-948-5444
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Middletown, Current Comps.	301-473-5333
MA	Burlington, Schaal, Inc.	617-272-1506
MA	Walpole, Richey/Impact	508-668-8200
MA	Wilmington, North Star	508-657-5155
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Grand Rapids, RM Elect.	616-531-9300
MN	Eden Prairie, Cypress Elect.	612-934-2104
MN	New Brighton, Parts 1	612-633-8079
MN	St. Peters, Mega/Deanco	314-939-9129
MO	Kansas City, Elec. Supp.	800-669-3752
MO	St. Louis, Franklin Elec.	314-993-5333
NJ	Fairfield, Deanco	201-575-7960
NM	Albuquerque, Walker Elec.	505-883-2992
NY	Hauppauge, Broadline Elec.	516-231-4100
NY	Ithaca, Deanco	607-257-4444
NY	Penn Yan, Advacom Tech'y	315-536-2221
NC	Raleigh, Century Elec.	919-782-2116
NC	Raleigh, Deanco	919-851-2065
NC	Winston-Salem, Kirkman Elec.	919-722-9131
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Beaverton, Cypress	503-641-2233
OR	Tualatin, Moore	503-692-5333
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elec.	215-631-5400
TX	Carrollton, North Star	214-980-2999
TX	Dallas, Cypress	214-869-1435
TX	Stafford, Southwest	713-240-4000
WA	Bothell, Cypress	206-483-1144
WA	Redmond, Priebe Elec.	800-426-9911
WA	Seattle, Radar Elect.	206-282-2511
WI	Milwaukee, Marsh	414-475-6000
Can	Burnaby, B.C., Intek	604-294-8100
Can	Calgary, Alberta, Intek	403-243-8035
Can	Dartmouth, Nova Scotia, Arcom	902-464-1600
Can	Gloucester, Ont., Elctrn. Whslr.	613-746-4413
Can	Mississauga, Ont., Rush Elect.	416-677-7280
Can	Montreal, Que., Elctrn. Whslr.	514-769-8851
Can	Montreal, Que., Ferro Technique Ltd.	514-341-3450
Can	Scarborough, Ont., UTech Elect.	416-609-2900
Can	Ste Foy, Que., Elctrn. Whslr.	418-657-5020
Can	Surrey, BC, Memco	604-590-1553
Can	Toronto, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	Victoria, B.C., Pacific Coast Elect.	604-385-5111

SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, 14251 E. Firestone Bl. No. 101, La Mirada, CA 90638, Tel: 310-802-8425, TWX: 183423 SEDLA; *Sls. Mgr.:* Myung Bang **B•1110-1111**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
AZ	Phoenix, Moss Mktg.	602-433-9349
CA	Aliso Viejo, Pro Assocs.	714-588-2700
CO	Aurora, Moss Mktg.	303-340-8535
CT	Torrington, Phoenix Sls. Co.	203-934-7135
IL	Hoffman Estates, Astro/Tech. Elctrns.	708-934-1538
IN	Ft. Wayne, Gen II Mktg.	219-436-4485
IA	Marion, A.E.M., Inc.	319-377-1129
KS	Lenexa, A.E.M., Inc.	913-888-0022
KY	Louisville, Gen II Mktg.	502-491-5250
MA	Peabody, Orion Grp.	508-532-6266
MN	Eden Prairie, Comprehensive Tech. Sls.	612-941-7181
MO	Bridgeton, A.E.M., Inc.	314-298-9900
NJ	Allendale, Eastec Assocs.	201-934-7135
NM	Albuquerque, Moss Mktg.	505-292-7505
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Lyndhurst, Gallant III Elctrns.	216-291-1185
OK	Locust Grove, IMPAQ Sls. Co.	918-479-6493
OR	Beaverton, A.T.M.I., Inc.	503-643-8307
PA	Erdenheim, Omni Sls.	215-233-4600
TX	Irving, IMPAQ Sls. Co.	214-650-0000
UT	Salt Lake City, Moss Mktg.	801-363-5875
WA	Redmond, A.T.M.I., Inc.	206-869-7636
WI	Watertown, Deaken Tech. Sls. Co.	414-261-7600

Local Distributors

AZ	Scottsdale, Added Value	602-951-9788
CA	Laguna Hills, Jaco/Distel, Inc.	714-837-8966
CA	San Diego, Added Value	619-558-8890
CA	San Jose, JACO/DISTEL INC.	408-432-9290
CA	Sunnyvale, LCD Sys.	408-747-0277
CA	Tustin, Added Value	714-259-8258
CA	Visalia, Added Value	209-734-8861
CA	Westlake, JACO/DISTEL	805-495-9998
CA	Westlake Village, Added Value	818-889-2861
CO	Wheat Ridge, Added Value	303-422-1701
CT	Meriden, JACO Elctrns, Inc.	203-235-1422
FL	Tampa, JACO/Q.C.	813-628-4665
MA	Tewksbury, Jaco Elctrn. Inc.	508-640-0010
MI	Farmington Hills, Key Elctrns.	313-489-5455
NY	Hauppauge, Jaco Elctrns.,Inc.	516-273-5500
NC	Raleigh, Jaco/Q.C.	919-876-7767
OK	Tusla, Jaco/Q.C.	918-664-8515
OR	Beaverton, IEC	503-641-1690
TX	Addison, Jaco/Q.C.	214-733-4300
TX	Austin, Added Value	512-454-8845
TX	Austin, Jaco/Q.C.	512-835-0220
TX	Sugar Land, Jaco/Q.C.	713-240-2255

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VA	Charlottesville, Virginia Elctrns.	804-296-4184
WA	Redmond, Jaco/Distel, Inc.	206-881-9700

S & EI MANUFACTURING, 18800 Parthenia St, Northridge, CA 91324, Tel: 818-349-4111, FAX: 818-349-4651; FSC No.: 24152; Empl.: 35; *Sls. Mgr.:* Howard Johnson, VP Mktg. Sls.

SANDMAN ELECTRIC CO., INC., 530 West St, Braintree, MA 02184, Tel: 617-848-2111, FAX: 617-848-2129; Empl.: 30

S&S ASSOCIATES, INC

FAX: 805-544-3109

S & S ASSOCIATES, INC., 863 Via Esteban, San Luis Obispo, CA 93401, Tel: 805-544-2500; *Sls. Mgr.:* Bob Priest; *Dist. Mgr.:* Bob Priest ...... **C•1082-1085, 1534**

SAN FERNANDO ELEC. MFG., See SFE Technlgs.

SANFORD-MILLER CORP., 1800 A Access Road, Oceanside, NY 11572, Tel: 516-763-0926, 800-645-5900, FAX: 516-678-1355; Empl.: 10

SANGAMO COMPONENTS DIV., See Cornell Dubilier Electronics

SANKEN ELECTRIC USA CORP., 2500 W. Higgins Rd. Ste. 730, Hoffman Estates, IL 60195, Tel: 708-519-1717, FAX: 708-884-1511; Empl.: 9; *Sls. Mgr.:* Lanny C. Anderson

SANLAR, INC. T/A, Harbison Industrial Products, 7205 Hibbs La., Levittown, PA 19057, Tel: 215-943-9000, FAX: 215-949-1518; Empl.: 40

SAN-O INDUSTRIAL CORP., 91-3 Colin Dr., Holbrook, NY 11741, Tel: 516-472-6666, FAX: 516-472-6777; Empl.: 50; *Sls. Mgr.:* N. Sato; *Dist. Mgr.:* P. Wernick

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SANWA COMPONENTS USA INC., 50 Brigham St, Marlboro, MA 01752, Tel: 508-480-9555, FAX: 508-481-2042; Empl.: 8; *Sls. Mgr.:* Mark Johnson

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FAX: 619-661-6743

SANYO ENERGY (U.S.A.) CORPORATION, 2001 Sanyo Avenue, San Diego, CA 92173, Tel: 619-661-6620; Empl.: 500; *Sls. Mgr.:* Joseph A. Carcone ...... **D•1472**

Local Sales Offices & Reps

AZ	Phoenix, Lynntronics	602-841-3900
CA	Mountain View, Energy Sls.	415-969-0800
CO	Denver, Car-Go Battery	303-296-8763
NJ	Teterboro, Engrd. Assembilies	201-288-4477
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NC	Winston-Salem, Progressive Techngs.	919-368-1375
OR	Aloha, Elctrn. Concepts	503-642-9715
TX	Houston, K-Power	713-785-1300
WA	Redmond, Energy Sls.	206-883-2343
WA	Seattle, Rep West	206-283-8351

Local Distributors

CA	Costa Mesa, Battery Specialties	714-755-0888
CA	Escondido, Alexander Batteries	619-480-4445
CA	Santa Clara, Cypress Elctrns.	408-980-8400
FL	Altamonte Springs, TNR Tech.	800-346-0601
FL	Tampa, Reptron Elctrns. (Lithium Only)	800-800-5441
MI	Livonia, LWC Distrs.	313-464-7700
MN	Eden Prairie, Imtron Corp.	612-942-8554
TX	Stafford, Southwest Elctrns.	713-240-4000
UT	Salt Lake City, Standard Supp.	801-486-3371

SANYO SEMICONDUCTOR CORPORATION, 453 Ravendale Dr., Ste. G, Mountain View, CA 94043, Tel: 415-960-8591, FAX: 415-960-8591

SANYO SEMICONDUCTOR CORP., 80 Commerce Dr., Allendale, NJ 07401, Tel: 201-825-8080, FAX: 201-825-0163; Empl.: 50; *Sls. Mgr.:* Yoshi Paulovich

SAPHIKON, INC., 33 Powers St, Milford, NH 03055, Tel: 603-673-5831, FAX: 603-673-1256; Empl.: 75; *Sls. Mgr.:* Linda Berthiaume

SaRonix

FAX: 415-856-4732

SARONIX, 151 Laura Lane, Palo Alto, CA 94303, Tel: 415-856-6900, TELEX: 348465; FSC No.: 61441; Empl.: 44; *Sls. Mgr.:* Mike Nusbaum; *Dist. Mgr.:* Mike Nusbaum ...... **A•1474-1479**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs. Inc.	205-881-1096
CO	Parker, Parker Webster Co.	303-841-4888
CT	Torrington, Phoenix Sales	203-496-7709
FL	Altamonte Springs, Sls. Engrg. Concepts	305-830-8444
FL	Deerfield Beach, Sls. Engrg. Concepts	305-426-4601
GA	Norcross, Interep	404-449-8680
IL	Rolling Meadows, Phase II	708-806-1330
IN	Indianapolis, EMCI	317-921-3450
MA	Norwell, Norris Assocs. Inc.	617-659-7988
MI	Jenisen, R. C. Nordstrom & Co.	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Innovate	612-225-9772
NV	Reno, Galena Technlg. Grp.	702-746-0642
NJ	Kenvil, Harold Gray Assocs.	201-927-6662
NY	Buffalo, Lynn Assocs.	716-631-0054
NC	Raleigh, J & B Sls.	919-783-9440
OH	Dayton, J. C. Hofstetter	513-296-1010
OH	Medina, J. C. Hofstetter	216-241-4880
TN	Greenville, Interep	615-639-3491
TX	Austin, Strategic Mktg.	512-335-4535
UT	Murray, Parker Webster Co.	801-266-9939
WI	Wauwatosa, Phase II	414-771-9986
EXP	CA, Palo Alto, SaRonix	415-856-6900

Local Distributors

CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	San Diego, Deco Elctrns.	619-693-1595
CA	Sherman Oaks, Delay Line Dists., Inc.	818-986-9455
CA	Sunnyvale, Target Elctrns.	408-733-0384
CO	Englewood, Indelco	303-795-3431
FL	Melbourne, Genl. Radio Supp. Co.	407-242-8151
FL	Miami, All American	305-621-8282
IL	Palantine, Technlg. Sls. Inc.	708-991-6600
MD	Columbia, Genl. Radio Supp.	301-995-6744
MD	Rockville, All American	301-251-1205
MA	Wakefield, All American	617-246-2300
MA	Wilmington, Northstar Elctrns.	508-657-5155
MN	Eden Prairie, All American	612-944-2151
NJ	Camden, General Radio Supp. Co.	609-621-8098
NY	Mt. Vernon, All American	914-699-2224
NY	Stonybrook, Dove Elctrn. Comps.	516-689-7733
OR	Portland, Radar Elec. Co.	503-232-3404
TX	Richardson, All American	214-231-5300
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Milwaukee, Technlg. Sls. Inc.	414-964-5015

SAS INDUSTRIES INC., Wading River Manor Rd., Manorville, NY 11949, Tel: 516-727-1441, 1-800-544-5238, FAX: 516-727-1387; FSC No.: 4L975; Empl.: 35; *Sls. Mgr.:* Steve Steckis

SAVOY ELECTRONICS, INC., P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-359-5400, FAX: 305-563-1378; FSC No.: 13075; Empl.: 20; *Sls. Mgr.:* June Harris

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SAYLOR ELECTRONICS INT'L, INC., 3680 Research Way, Carson City, NV 89706, Tel: 702-883-4184; Empl.: 7

SBE, INC., 4550 Norris Canyon Rd., San Ramon, CA 94583-1389, Tel: 510-355-2000, 800-925-2666, FAX: 510-355-2020; Empl.: 120; *Sls. Mgr.:* Bill Allen VP Sls.; *Dist. Mgr.:* Bill Allen VP Sls.

SB ELECTRONICS, INC., 131 South Main St, Barre, VT 05641, Tel: 802-476-4146, FAX: 802-476-4149; FSC No.: 49588; Empl.: 100; *Sls. Mgr.:* Mark Browning, Sr.

SCANBE, See Zero Enclosures, Zero Corp.

SCANNING DEVICES, INC., 108 Elm St, Waltham, MA 02154, Tel: 617-891-8991, FAX: 617-899-2235; Empl.: 16; *Sls. Mgr.:* David Chanoux

SCHAEFER, INC., Schaefer GmBH, 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-879-8658, ESYLNK: 510-100-3630, FAX: 508-879-8669; Empl.: 60; *Sls. Mgr.:* Richard Sakakeeny

SCHAFFNER EMC, INC. COMPONENTS DIVISION, 9 Fadem Road, Springfield, NJ 07081, Tel: 201-379-7778, 800-367-5566, FAX: 201-379-1151; *Sls. Mgr.:* Steve Cogger, VP of Sls. ... **A•1602-1605; D•1322**

Local Sales Offices & Reps

AL	Huntsville, SACS	205-533-4229
AZ	Phoenix, C.T. Carlberg & Assoc.	602-468-0750
CA	Auburn, Ewing-Foley, Inc.	916-885-6591
CA	Fallbrook, Gary Chilcote Assoc.	619-728-7678
CA	Irvine, Groh Assocs.	714-837-9871
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CO	Englewood, Delltron Co.	303-741-2122
FL	Ft. Lauderdale, Hawkins-Frederickson Assoc. Inc.	305-321-6702
FL	Maitland, Hawkins-Frederickson Assoc. Inc.	407-831-2474
GA	Norcross, SACS	404-447-6154
IL	Arlington Heights, Brainard-Nielsen Mktg.	708-437-2700
IA	Marion, A.E.M. Inc.	319-377-1129
KS	Lenexa, A.E.M. Inc.	913-888-0022
MD	Randallstown, Beacon North	703-478-2480
MI	Livonia, Electro Mktg. Grp.	313-421-7590
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	St. Louis, A.E.M. Inc.	314-298-9900
NM	Albuquerque, C.T. Carlberg	505-899-2155
NY	Kings Park, Mil-Com Sls.	516-366-2156
NY	Rochester, H. C. Johnson Agys.	716-586-0777
NC	Raleigh, SACS	919-859-9970

OH	Dayton, Electro Mktg. Grp.	513-890-8322
OH	N. Royalton, Electro Mktg. Grp.	216-582-0075
OK	Broken Arrow, D.J. Sls.	918-258-1445
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Allison Park, Electro Mktg. Grp.	412-492-0688
SC	Irmo, SACS	803-732-0816
TN	Knoxville, Beacon Electronics	615-588-4168
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, D.J. Sls.	214-783-8876
VA	Sterling, Beacon North	703-478-2480
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Manitowa, Brainard-Nielsen Mktg.	414-682-1201
PR	Bayamon, Selmark Assoc.	809-797-2096
Can	Ontario, Avotronics Ltd.	416-475-2024
Can	Quebec, Avontronics Ltd.	514-697-2135

Local Distributors

AL	Huntsville, Comp. Distrs.	205-851-7800
AZ	Mesa, Richey Impact Sls.	602-641-2313
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tempe, Cypress	602-966-2256
CA	Agora Hills, Cypress	818-597-9491
CA	Costa Mesa, Cypress	714-549-2424
CA	Fremont, Acacia/Deanco	415-623-7500
CA	Garden Grove, Richey Impact Sls.	714-895-0060
CA	Gardena, Cal Switch	213-770-2330
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Manhattan Bch., Prime Electro Prods.	310-379-3642
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	San Diego, Acacia	619-597-0577
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Richey Impact Sls.	619-271-4511
CA	San Jose, Richey Impact Sls.	408-956-8010
CA	San Jose, Rose Elctrns.	408-943-0255
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sun Valley, Richey Impact Sls.	818-768-0403
CO	Denver, IEC	303-292-6121
CO	Englewood, Cypress	303-792-5829
CO	Wheatridge, Acacia/Deanco	303-421-7004
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Orlando, Sager Elctrns.	407-240-3114
GA	Norcross, Component Distrs.	404-441-3320
GA	Norcross, Sager Elctrns.	404-446-0085
IL	Hoffman Estates, IEC	708-843-2040
IL	Schaumburg, QPS Elctrns.	708-884-6620
MD	Columbia, D.K. Elctrns.	301-995-1950
MD	Columbia, Sager Elctrns.	410-995-4900
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Walpole, Richey Impact Sls.	508-668-8200
MI	Farmington Hills, Key Elctrns.	313-489-5455
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Roseville, Chris Elctrns.	612-631-2647
MO	St. Charles, Finnigan Elctrns.	314-946-6201
MO	St. Charles, Heartland	314-928-6010
NH	Salem, Sager Electrns.	603-898-1348
NJ	Moorestown, Marlac	609-234-4200
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Sager Elctrns.	919-850-9550
OR	Portland, Cypress	503-223-8900
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Dallas, Comp. Distrs.	214-644-0373
TX	Irving, Cypress	214-255-0065
UT	Salt Lake City, IEC	801-977-9750
WA	Blaine, Memco	604-590-1553
WA	Bothell, Cypress	206-483-1144
WA	Redmond, Acacia/Deanco	206-881-5566
WA	Seattle, Kam Elctrns.	206-382-1300
WA	Seattle, Richey Impact Sls.	206-575-1910
WV	McKean, Advacom	814-476-7774
Can	Burlington, Ont., Sanbek Sls.	519-746-5801

SCHAFFNER EMC, INC. INSTR. DIV., 9 Fadem Rd., Springfield, NJ 07081, Tel: 201-379-7778, FAX: 201-379-1151; *Sls. Mgr.:* Michael O'Connor, VP Sls. ..... **D•1322**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs.	205-534-6020
AZ	Phoenix, Tech. Mktg. Spec.	602-678-4940
CA	Redondo Beach, Ward/Davis Assoc.	310-643-6977
CA	San Diego, Ward/Davis Assoc.	619-292-1000
CA	Santa Clara, Ward/Davis Assoc.	408-245-3700
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
FL	Longwood, Southern Mktg. Assoc.	407-682-7317
FL	Satelite Beach, Southern Mktg. Assoc.	407-777-3587
GA	Alpharetta, Southern Mktg. Assoc.	404-664-9797
IL	Willowbrook, PVA Corp.	708-655-3355
IN	Fishers, Carter Technlg.	317-842-9277
KS	Lenexa, Midtec	913-541-0505
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Farmington Hills, Carter Technlg.	313-477-7700
MN	Apple Valley, Alliance Tech. Prod.	612-432-2111
MO	St. Louis, Midtec	314-275-8666
NM	Albuquerque, Tech. Mktg. Spec.	505-291-1363
NY	Rochester, Eastern Sys.	716-292-1460
NC	Greensboro, Southern Mktg. Assoc.	919-632-9370
OH	Englewood, Carter Technlg.	513-836-0951
OH	Parma, Carter Technlg.	216-398-0400
OR	Wilsonville, Syntek	503-682-2750
PA	Huntington Valley, Sci-Rep	215-322-6500
PA	Pittsburgh, Carter Technlg.	412-826-3800
TX	Austin, Barnhill Assocs.	512-472-2398
TX	Houston, Barnhill Assocs.	713-266-2666
TX	Richardson, Barnhill Assocs.	214-917-6777
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
Can	St.Laurent, Que., Interfax Sys.	514-336-0392

SCHAFFNER EMC, INC., Intepro, 9 Fadem Rd., Springfield, NJ 07081, Tel: 201-379-7778; *Sls. Mgr.:* Mike O'Connor

SCHAUER MANUFACTURING, 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, FAX: 513-791-7192; Empl.: 195; *Sls. Mgr.:* Dave Blice, VP Mktg.; *Dist. Mgr.:* Dan Shaw

SCHELL INC., P.O. Box 12689, St. Petersburg, FL 33733, Tel: 813-822-2600, 800-237-2600, FAX: 813-822-8800; Empl.: 50; *Dist. Mgr.:* Steve Hahn

SCHENCK PEGASUS CORPORATION, 2890 John R Road, Troy, MI 48083, Tel: 313-689-9000, FAX: 313-689-8578; Empl.: 130; *Sls. Mgr.:* David Sallberg

SCHLEGEL CORP., P.O. Box 23197, Rochester, NY 14692, Tel: 800-828-6237, ext. 2126, TELEX: 6854121, FAX: 716-427-9993; Empl.: 500; *Sls. Mgr.:* Duncan Tyrrel

SCHLEICHER GMBH & CO., c/o Progressive Automation Controls Co., 8300 Parkview Rd., Greendale, WI 53129-2161, Tel: 414-421-4380, 1-800-803-0444, FAX: 414-421-5964; FSC No.: 39-1749933; Empl.: 5; *Sls. Mgr.:* Robert J. Yoblin; *Dist. Mgr.:* Robert J. Yoblin

SCHLEUNIGER, INC., 150 Dow St. Tower Four, Manchester, NH 03101, Tel: 603-668-8117, FAX: 603-668-8119; Empl.: 20; *Sls. Mgr.:* Marc Amiet

SCHLUMBERGER INDUSTRIES, Tranducers Div., 11321 Richmond, M-102, Houston, TX 77082, Tel: 713-558-2587, TELEX: 791209, FAX: 713-558-8954; *Sls. Mgr.:* Mike Masso

SCHLUMBERGER INSTRUMENTS, Schlumberger Technlgs., 829 Middlesex Turnpike, Billerica, MA 01821, Tel: 508-671-9700, 1-800-225-5765, FAX: 508-671-9704; Empl.: 70

SCHNEIDER CORP. OF AMERICA, 400 Crossways Park Drive, Woodbury, NY 11797, Tel: 516-496-8500, FAX: 516-496-8524; Empl.: 13; *Sls. Mgr.:* Dwight Lindsey; *Dist. Mgr.:* Dwight Lindsey

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, FAX: 703-471-1795; Empl.: 45; *Sls. Mgr.:* O. K. Davis

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, FAX: 612-475-1786; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* K. Nicholls

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535, FAX: 717-457-6960; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* J. Nimmerfroh

SCHOTT HIGH VOLTAGE, 1161 W. 2320 So., Salt Lake City, UT 84119, Tel: 801-972-3690, FAX: 801-972-3699; Empl.: 35; *Sls. Mgr.:* Jeff Dalebout

SCHRACK COMPONENTS, INC., 5305 NW 35th Terrace, Ft. Lauderdale, FL 33309, Tel: 305-733-3330, FAX: 305-733-7373; Empl.: 10; *Sls. Mgr.:* R. Biddle, T. DiLeonardo, C. Gilliland; *Dist. Mgr.:* Christopher Meza

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Phoenix/Scottsdale, Vikeland Sls.	602-948-7921
CA	Montrose, Signal Entprs.	818-957-0640
CO	Boulder, Stratford Grp.	303-530-3194
FL	Longwood, M & H Assoc.	407-332-7912
IL	Arlington Hgts., Thermek Inc.	708-577-6900
IN	Mishawaka, Power Comps.	219-256-6630
MD	Baltimore, Micro-Comp	410-644-5700
MA	Swansea, Poisson	508-677-3655
MN	Roseville, T.L.C.	612-483-2226
MO	Bridgeton/St. Louis, Dy-Tronix	314-291-4777
NJ	Lawrenceville, D.V.S.	609-896-1112
NJ	Totowa, R.D.I. Sls.	201-812-9606
NY	Buffalo, Lynn Assoc.	716-631-0054
OH	Westlake, Baehr Greenleaf & Assoc.	216-892-1770
TX	Dallas, Rem Comps.	214-234-1069
WA	Seattle, Caruso & Camelleri Assoc.	206-455-8811
WI	Wauwatosa, Larsen & Assoc.	414-258-0529

Local Distributors

AZ	Mesa, Consolidated Elctrn. Distr.	602-962-9141
AZ	Tempe, L Comp	602-730-1633
CA	City of Industry, ITAL Elctrns. Sls.	818-968-8515
CA	Irvine, Kelex Controls	714-863-1230
CA	Martinez, GE Supp. Co.	513-229-6425
CA	Sacramento, GE Supp. Co.	916-648-3144
CA	San Jose, GE Supply Co.	408-534-0600
CA	Tustin, Western Switches & Controls	714-259-8144
CO	Denver, Control Des. Supp.	303-296-1922
CO	Denver, CSID	303-292-9594
FL	Coral Springs, G.R.E.	305-341-1103
FL	Miami, All American	305-621-8282
GA	Stone Mountain, Control Des. Supp.	404-979-3500
ID	Boise, Bolen's Control House	208-362-5280
IL	Addison, L Comp	708-628-1400
IL	Carol Stream, Lectro Comps.	708-690-0520
IN	Indianapolis, Control Des. Supp.	317-788-4559
KS	Kansas City, Control Des. Supp.	913-362-4248
ME	Gray, Longhill Electro. Tech.	207-657-2183
MD	Gaithersburg, Axis Elec.	301-840-9640
MA	Cambridge, Hi-Tek	617-491-0442
MA	Methuen, Aved	508-688-3800
MA	Norwood, Emtel	617-769-9500
MI	Brighton, H.H. Barnum	313-229-2961
MN	Minneapolis, Control Des. Supp.	612-721-1628
MN	Plymouth, Leeds	612-557-1277
MN	Roseville, Chris Elctrns.	612-631-2647
MO	Kansas City, L Comp	816-241-0111
MO	St. Louis, Elctrn. Controls Supp.	314-645-2400
MO	St. Louis, L Comp	314-298-7231
NJ	E. Rutherford, A.A. Elec.	201-777-5477
NJ	Oakland, Relay Spec.	201-337-1000
NJ	Pennsauken, I.M.S.	609-662-1770
NJ	S. Hackensack, Nassor	201-641-3737
NY	Newburgh, Electrol Control Supp.	914-561-5330
NY	Orchard Park, Park Elctrn.	716-662-7070
NC	Charlotte, Control Des. Supp.	704-588-4410
OH	Cincinnati, Cincinnati Controls	513-530-0044
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Malvern, Control Des. Supp.	215-296-0150
PA	McKean, Advacom	814-476-7774
TX	Houston, Wofford Elctrns.	713-351-2722
UT	Nephi (Salt Lake City), Control Des. Supp.	801-623-2906
WA	Spokane, Consolidated Elctrn. Distr.	509-535-8891
WI	New Berlin, Control Des. Supp.	414-784-1015

SCHROFF, INC., 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, FAX: 401-738-7988; Empl.: 120; *Sls. Mgr.:* William Bottis ..... **C•1088-1089**

Local Sales Offices & Reps

AL	Huntsville, W.L.A. & Assoc.	205-721-1788
AZ	Phoenix, JBS Assocs.	602-244-1212
CA	Downey, Buffa Inc.	310-923-4618
CA	Los Gatos, Luscombe Engrg.	408-370-2020
CO	Longmont, Luscombe Engrg.	303-772-3342
FL	Melbourne, R-Rep. Co.	407-722-1900
GA	Lawrenceville, W.L.A. Assoc.	404-339-9443
IL	Hillside, Cadre Tech. Rep.	708-449-3900
KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MD	Baltimore, Leading Edge Sls.	301-644-0016
MI	Troy, C. B. Jensen	313-643-0506
MN	Minneapolis, D. A. Case Assoc.	612-831-6777
MO	St. Louis, Tech. Sls. Assoc.	314-521-2044
NH	Salem, Sales Engr.	603-893-5521
NJ	Englewood, Sprung & Rea, Inc.	201-569-5666
NY	E. Syracuse, Bastian Sls.	315-437-1482
NY	Fairport, Bastian Sls.	716-223-0237
NC	Raleigh, W.L.A. Assoc.	919-231-9939
OH	Aurora, EMA	216-562-6104
OH	Centerville, EMA	513-433-2800
TX	Garland, C.M.A.	214-681-1414
TX	Houston, C.M.A.	713-771-1500
UT	Salt Lake City, Luscombe Eng.	801-268-3434
WA	Woodinville, T.E.A.M.	206-485-1111
WI	Brookfield, Mc Mahon Sls. Inc.	414-782-3335

Local Distributors

CT	Wallingford, Sager	203-265-4600
FL	Orlando, Sager	407-354-1130
GA	Norcross, Sager	404-446-0085
IL	Chicago, Leeds Elctrns.	312-625-3800
MD	Columbia, Sager	410-995-4900
MA	Hingham, Sager	617-749-6700
MI	Madison Heights, Tracer Control Co.	313-545-7140

MN	Minneapolis, Leeds Elctrns.	612-557-1277
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, Sager	919-850-9550
PA	Philadelphia, Sager	215-464-4336
WI	Milwaukee, Leeds Elctrns.	414-789-6994

SCHUMACHER ELECT. CORP., 7474 N. Rogers Ave., Chicago, IL 60626, Tel: 312-973-1600, FAX: 312-973-7781; Empl.: 700; *Sls. Mgr.:* Norman Patinka

SCHURTER

FAX: 707-778-6401

SCHURTER, INC., 1016 Clegg Ct, Petaluma, CA 94954, Tel: 800-848-2600 ext.62; FSC No.: 61935; *Sls. Mgr.:* Janet Barrett .... **A•1606-1608; B•1386-1388, 1803; C•1450-1455**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls. Inc.	205-464-0033
AZ	Scottsdale, JK & Assos.	602-990-8804
AR	Little Rock, Doby Assoc.	501-221-0326
CA	Chatsworth, Cygnus Sls. Engrg. Corp.	818-727-0312
CA	San Diego, Cygnus Sls. Engrg. Co.	619-268-7771
CA	San Jose, Arnold Tech. Sls., Inc.	408-954-0400
CO	Broomfield, Summit West Mktg., Inc.	303-460-9600
FL	Pompano Bch., IMR, Inc.	305-942-2449
GA	Norcross, Benchmark Tech. Sls. Inc.	404-446-1711
IL	Arlington Hgts., MJ Petersen & Assoc., Ltd.	708-577-8200
IN	Carmel, Current Elctrn. Mktg.	317-844-1770
KS	Overland Park, Acorn Elctrns.	913-649-6402
MD	Baltimore, Chesapeake Indl. Mktg.	410-653-0476
MN	Shorewood, Frank Anthony Mktg.	612-474-2850
MS	Jackson, Doby Assocs.	601-981-1138
MO	St. Louis, Acorn Elctrns. Inc.	314-421-1751
NH	Nashua, Bell Controls	603-882-6984
NJ	Ho-Ho-Kus, D. J. Fisher Co.	201-652-0090
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NY	Fairport, TAC Sls, Inc.	716-223-7610
NC	Raleigh, Benchmark Tech. Sls. Inc.	919-850-0633
OH	Beachwood, Electronic Salesmasters	216-831-9555
OR	Hillsboro, Doran Sls.	503-640-4500
TX	Dallas, Reese & Assocs.	214-224-1000
UT	Salt Lake City, Luscombe Engrg. Co.	801-268-3434
WA	Bothell, Doran Sls.	206-488-1200

Local Distributors

AZ	Phoenix, BeSwitched	602-275-4805
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Irvine, Kensington Elctrns., Inc.	714-588-0575
CA	Livermore, Quail Elctrns.	510-373-6700
CO	Aurora, Jet Elctrns.	303-364-1000
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Orlando, Sager	407-354-1130
GA	Norcross, NRC Elctrns.	404-729-0411
ID	Boise, Radar Elec. Co.	208-336-2227
IL	Chicago, Leeds Electro Cmpnts.	312-625-3800
IL	Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc.	708-437-7120
IN	Carmel, Altex Elctrns.	317-848-1323
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Sager Elctrns.	301-995-4900
MA	Hingham, Sager Elctrns.	617-749-6700
MI	Livonia, RS Elctrns.	313-525-1155
MN	Plymouth, Leeds Electro Comps., Inc.	612-557-1277
NH	Salem, Sager Elctrns.	603-898-1348
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Strongsville, Fuse World	216-238-1330
OR	Portland, Radar Elctrns. Co.	503-232-3404
OR	Tualatin, Moore Elctrns., Inc.	503-692-5333
PA	Harrisburg, Ad-Tech Elctrns., Inc.	717-561-9905
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Dallas, Fuses Unlimited	214-907-8600
WA	Kent, Moore Elctrns.	206-251-8090
WA	Richland, Radar Elec. Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Oconomowoc, GW Elctrns. Ltd.	414-567-9445
Can	Markham, Ont, Birde Mktg.	416-477-7722

SCHUSTER ELECTRONICS, 54 Cove Rd., Huntington, NY 11743, Tel: 516-271-0590; *Sls. Mgr.:* Norman Schuster

SCIENCE ACCESSORIES CORP., 200 Watson Blvd., Stratford, CT 06497, Tel: 203-386-9978, FAX: 203-381-9270; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE & ENGRG. CONSULTANTS, INC., 11800 Sunrise Valley Dr., Ste. A, Reston, VA 22091-5302, Tel: 703-471-1600, FAX: 703-620-1561; Empl.: 2; *Sls. Mgr.:* Mr. Kevin B. Deasy

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-859-5555, FAX: 513-859-7930; Empl.: 25; *Sls. Mgr.:* E. E. Pohl

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994, FAX: 303-444-9229; Empl.: 35

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

Esterline SCIENTIFIC COLUMBUS

FAX: 614-272-2288

SCIENTIFIC COLUMBUS CO., 1900 Arlingate Lane, Columbus, OH 43228-4105, Tel: 614-274-0400; Empl.: 150 .... **B•2007-2012**

Local Sales Offices & Reps

AL	Birmingham, Spader & Assocs.	205-979-5500
NC	Charlotte, Robert W. Chapman & Co.	704-525-2421
OH	Grove City, Leidy Engrg. Sls.	614-875-1524
PA	Collegeville, GEE Co., Inc.	215-489-8860
TN	Chattanooga, Spader & Assocs.	615-899-3823
AZ	Scottsdale, Young Power Equip. Co.	602-991-9191
AR	Little Rock, BFCO, Inc.	501-753-9977
CA	Glendale, Young & Co.	818-242-2171
CA	San Francisco, Wrathall & Krusi, Inc.	415-777-0226
CO	Littleton, The Beabout Co., Inc.	303-795-1000
FL	Gainesville, RJC Assocs.	904-372-4635
FL	Orlando, RJC Assocs.	407-894-7371
GA	Decatur, Spader & Assocs.	404-296-3024
HI	Honolulu, Berkley Engrg. & Equip. Co.	808-845-9377
IL	Naperville, O'Conner, Serra & Assoc., Inc.	708-420-7812
IN	Nobelsville, C.D. Arnold Co.	317-773-5821
IA	Cedar Rapids, Harry Ferris Co.	319-377-1226
KS	Kansas City, Power Equip. Sls. Co., Inc.	913-384-3848
LA	Kenner, John J. Aertker Jr. Co., Inc.	504-469-0136
MA	Quincy, Fantasia Assocs., Inc.	617-479-0800
MI	Brighton, Dale P. Seyfried Co., Inc.	313-227-5353
MI	Grand Rapids, Dale P. Seyfried Co., Inc.	616-453-8603
MN	Minneapolis, Arjay Automation, Inc.	612-861-1749
MO	Springfield, Power Equip. Sls. Co. Inc.	417-833-3056
MO	St. Louis, Ken Way Co.	314-469-9998
NE	Lincoln, Harry Ferris Co.	402-464-6148
NM	Albuquerque, Young Power Equip. Co.	505-843-9450
NY	Albany, Expert Industrial Sys., Inc.	518-869-3355
NY	N. Tonawanda, Expert Industrial Sys. Inc.	716-694-3935
NY	North Chili, Expert Industrial Sys. Inc.	716-594-5755
NY	Syracuse, Expert Industrial Sys. Inc.	315-455-2469
NC	Raleigh, Robert W. Chapman & Co.	919-782-2624
OH	N. Canton, Leidy Engrg. Sls.	216-497-9585
OK	Tulsa, C. B. Anderson Elec. Co.	918-836-4661
OR	Portland, McLaren Inc.	503-627-0757
PA	Pittsburgh, Russell F. Clark Co., Inc.	412-242-9500
SC	Greenville, Robert W. Chapman & Co.	803-288-8821
SC	W. Columbia, Robert W. Chapman & Co.	803-739-0220
TX	Arlington, Ev Smith Sls. Co.	817-572-2911
TX	Houston, Ev Smith Sls. Co.	713-931-0403
VA	Alexandria, The Hildenbrand Co., Inc.	703-998-0445
VA	Midlothian, Robert W. Chapman & Co.	804-323-6088
WA	Kirkland, McLaren Inc.	206-827-9400
WI	Milwaukee, Reynolds & Co.	414-351-1100
Can	Calgary, Alb., Landel Controls Ltd.	403-254-8900
Can	Mississauga, Ont., Sircon Controls, Ltd.	416-238-9505
Can	Richmond, B.C., Landel Controls Ltd.	604-244-7331
Can	St. Laurent, Que., Le Groupe Rotalec	514-341-3685

SCIENTIFIC CONVERSION, INC., 42 Truman Dr., Novato, CA 94947, Tel: 415-892-2323, FAX: 415-892-2321; Empl.: 15; *Sls. Mgr.:* Maura Vrydaghs

SCIENTIFIC INSTRUMENTS, 4400 W. Tiffany Dr., West Palm Beach, FL 33407, Tel: 407-881-8500, FAX: 407-881-8556; FSC No.: 591197614; Empl.: 52; *Sls. Mgr.:* Mike Capers; *Dist. Mgr.:* Mike Capers

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

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FAX: 510-471-9752

SCIENTIFIC TECHNOLOGIES INC., Control Components Div., 31069 Genstar Rd., Hayward, CA 94544-7831, Tel: 510-471-9717, 800-221-7060; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Paul N. Dreiseszun .... **B•1595-1596**

SCIENTIFIC TECHNOLOGIES INC., Optical Sensor Div., 31069 Genstar Rd., Hayward, CA 94544, Tel: 510-471-9717, FAX: 510-471-9752; Empl.: 120

SCI TECHNOLOGY, INC., PO Box 1000, 8600 So. Memorial Pkwy., Huntsville, AL 35807, Tel: 205-882-4569, FAX: 205-882-4659

SCITEQ ELECTRONICS, INC., 4775 Viewridge Ave., San Diego, CA 92123, Tel: 619-292-0500, FAX: 619-292-9120; FSC No.: 70561; Empl.: 40; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, FAX: 703-471-6750; Empl.: 95; *Sls. Mgr.:* T. Titcomb

SCORPION SEMICONDUCTOR, 2360 Qume Dr., Ste. B, San Jose, CA 95131, Tel: 408-944-6270, FAX: 408-944-6272

SCOTT SPECIALTY GASES, INC., 6141 Easton Rd., P.O. Box 310, Plumsteadville, PA 18949-0130, Tel: 215-766-8861, FAX: 215-766-0320; FSC No.: SIC 2818; *Sls. Mgr.:* James Wallis

SC TECHNOLOGY, INC., 368 Earhart Way, Livermore, CA 94550, Tel: 510-373-9230, FAX: 510-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch

SEABOARD ELECTRONICS, 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, FAX: 914-235-8369; FSC No.: 63,58,Y,Z; Empl.: 30; *Sls. Mgr.:* Jerrold Hacker; *Dist. Mgr.:* Subhash Grandhi

SEACOR INC

FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 20; *Sls. Mgr.:* D. Calamaras .... **A•1160-1162**

Local Sales Offices & Reps

AL	Huntsville, Summit Mktg.	205-721-1701
AZ	Tempe, FP Sls.	602-894-5303

CA	Alhambra, James Gerry Co., Inc.	213-283-7694, FAX:818-282-3836
CA	San Jose, H. W. Assocs.	408-996-9940, FAX:408-996-0885
CO	Denver, English/Damco Sls. Co.	303-782-0683, FAX:303-782-0670
FL	Palm Harbor, Francois & Assocs., Inc.	813-784-4812,FAX:813-784-4854
GA	Norcross, Summit Mktg. Assoc.	404-498-4530
IN	Indianapolis, Schank Elctrn. Mktg., Inc.	317-842-6204,FAX:317-842-6205
MD	Bel Air, Freedman/Malta Assoc.	410-879-3148, FAX:410-838-0789
MA	Sudbury, KSA of New England	508-443-5881, FAX:508-443-0483
MI	Troy, Schank Elctrn. Mktg., Inc.	313-588-2040
MN	Plymouth, Highland Elctrns. Sls. Co.	612-557-7002, FAX:612-557-7014
NJ	Budd Lake, T & K Sls.	201-347-1856, FAX:201-691-1468
NM	Albuquerque, FP Sls.	505-345-5553, FAX:505-345-5555
NY	Skaneateles, NRM Mktg. Grp., Inc.	315-685-8991, FAX:315-685-6199
NY	Smithtown, T & K Sls.	516-724-3456, FAX:516-724-3485
NC	Chapel Hill, Summit Mktg. Assoc.	919-968-7808
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932, FAX:513-574-2854
OH	Miamitown, Bob Gilbert & Assocs.	513-353-4889, FAX:513-353-4689
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211,FAX:215-265-8764
TX	Richardson, Barry Sls., Inc.	214-234-0255, FAX:214-235-0271
Can	Markham, Ont., Kellock Sls. & Mktg.	416-471-0202, FAX:416-472-4519

Local Distributors

CT	Bridgeport, Park Distrs.	203-366-7200
CT	Wallingford, Mid-State Elctrns.	203-265-9900, FAX:203-269-2374
FL	Boca Raton, NRC Elctrns.	407-241-8600, FAX:407-241-3328
FL	Ft. Lauderdale, Brothers Elec.	305-561-6700, FAX:305-564-8080
GA	Norcross, NRC Elctrns.	404-729-0411, FAX:404-448-2854
IN	Carmel, Altex Elctrns.	800-783-2589, FAX:317-848-1323
MA	Marlboro, NOW Elctrns.	508-460-0187, FAX:508-460-0467
MA	Sudbury, ASK Elctrns.	508-443-5881, FAX:508-443-0483
MN	Eitzen, Capacitor Assocs.	507-495-3306, FAX:507-495-3454
MN	Fridley, Voyager Elctrns.	612-571-7766, FAX:612-571-9519
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200, FAX:201-238-2218
NJ	Rockaway, Tonar Inds.	201-586-9000, FAX:201-586-2075
NY	Ronkonkoma, Spectrum Comp. Supp.	516-737-6900,FAX:516-737-6642
WA	Seattle, Vesco Elctrns.	206-575-3607

SEACOR PIEZO CERAMICS, 8 Huntington St. Ste. 300, Huntington, CT 06484, Tel: 203-925-1320, FAX: 203-925-1320

SEAFAB, INC., 14648 N.E. 95th St., Redmond, WA 98052, Tel: 206-881-2778, FAX: 206-882-0707; Empl.: 80; *Sls. Mgr.:* Bruce Murray

SEALING DEVICES, INC., 4400 Walden Ave., Lancaster, NY 14086, Tel: 716-684-7600, FAX: 716-684-0760; Empl.: 95; *Sls. Mgr.:* Wayne K. Carrig

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, FAX: 513-733-0131; FSC No.: 3678; Empl.: 140; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 800-634-2356, FAX: 818-246-6803; FSC No.: 86928; Empl.: 80; *Sls. Mgr.:* Dave Buddecke

secma inc.

A MEMBER OF SECME GROUP

FAX: 714-261-8390

SECMA, INC., Secme, 17752 Skypark Circle No. 200, Irvine, CA 92714, Tel: 714-261-0610; Empl.: 250 **B•1804-1807, 1850-1851**

Local Sales Offices & Reps

AL	Huntsville, Progressive Technlg.	205-551-7770
CA	Alameda, Liaison, Inc.	510-769-1991
CA	Chula Vista, PCA Mktg. & Sls. Eng.	714-493-3434
CA	Dana Point, PCA Mktg. & Sls. Engrg.	714-493-9822
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
IL	Elk Grove Vlg., Tristar Grp.	708-593-0200
IL	Elk Grove Vlge., Tristar Grp.	708-364-6507
IN	Greenwood, Liberty Sls.	317-888-8396
IN	Lafayette, Liberty Sls.	317-474-5058
MA	Scituate, Olsen Tech. Sls.	617-545-5101
NY	Bohemia, Optimum Metro Sls.	516-244-5744
OH	Mentor, Sls. Plus	216-942-7811
OR	Lake Oswego, SPS Elctrns.	503-697-7768
TX	Lewisville, Elctrn. Prod. Rep.	817-467-0377
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Mountlake Perris, SPS Elctrns.	503-697-7768
Can	Brossard, Que., D B Lectro	514-923-4525
Can	Brossard, Que., DB Lectro	514-923-4525
Can	Markham, Ont., Avotronics	416-475-1858
Can	Ontario, Avotronics	416-475-2024

Local Distributors

CA	Covina, SelectaSwitch	818-697-4119
MA	Woburn, Control Des. Supp.	617-932-9404
Can	Markham, Ont., ARMA	416-475-1858

SECTOR MICROWAVE IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TELEX: 673-2151, TWX: 510-227-6075, FAX: 516-242-8158; Empl.: 45; *Sls. Mgr.:* Thomas Nelson

SECTOR SYSTEMS CO., INC., 416 Ocean Ave., Marblehead, MA 01945, Tel: 617-639-2625; Empl.: 10

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-7400, 1-800-333-7706, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 370; *Sls. Mgr.:* Phil Ortiz, V.P Worldwide Sls.; *Dist. Mgr.:* Pat Bringuel

SII

Seiko Instruments

FAX: 310-517-7792

SEIKO INSTRUMENTS U.S.A., INC. ELECTRONIC COMPONENTS, 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 310-517-7770; *Sls. Mgr.:* A. Kishida; *Dist. Mgr.:* T. Touji **A•1480; B•1113; D•1106, 1473**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Phoenix, C.T. Carlberg & Assocs.	602-468-0750
AZ	Scottsdale, C.T. Carlberg & Assocs.	602-994-9388
AZ	Tucson, C.T. Carlberg & Assocs.	602-299-1508
CA	Irvine, Groh Assoc.	714-837-9871
CA	Newbury Park, Groh Assocs.	805-498-8410
CA	Poway, Groh Assocs.	619-673-4321
CA	San Jose, H-Technical Sls.	408-453-2111
CO	Aurora, Electrodyne	303-695-8903
CT	Madison, Focus Elctrn. Sls.	203-245-4314
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Elk Grove Village, TriStar Grp., Inc.	708-593-0200
IN	Ft. Wayne, Electro Rep Inc.	219-489-8205
IN	Indianapolis, Electro Rep Inc.	317-842-7202
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
KS	Overland Park, Electri-Rep	913-649-2168
MD	Burtonsville, Chesapeake Technlg.	301-236-0530
MA	Taunton, Focus Elctrns. Sls.	508-824-3840
MI	Farmington Hills, Rathsburg Assoc., Inc.	313-489-1500
MN	Bloomington, Matrix Mktg. Grp.	612-835-6977
MO	St. Louis, Electri-Rep	314-993-4421
NJ	E. Brunswick, Shepard & Assoc.	908-254-5757
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Brunswick, J. N. Bailey & Assocs.	216-273-3798
OH	Columbus, J.N. Bailey & Assocs.	614-262-7274
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OR	Tigard, Earl & Brown Co. Inc.	503-639-2100
PA	Frazer, Industrial Comps., Inc.	215-889-0650
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
Can	Markham, Ont., Birde Mktg.	416-477-7722
TX	Austin, TI Mktg. Inc.	512-371-7272
TX	Dallas, TL Mktg. Inc.	214-490-9300
TX	Houston, TL Mktg. Inc.	713-587-8100
UT	Salt Lake City, Electrodyne	801-264-8050
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
WI	Menomonee, TriStar Grp., Inc.	800-654-4105
Can	Kanata, Ontario, Birde Mktg.	613-592-5411
Can	St. Laurent, Quebec, Birde Mktg.	514-335-4050
Can	Vancouver, B.C., Birde Mktg.	604-431-0426

Local Distributors

AZ	Phoenix, Aerospace S.W.	602-582-2779
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Agoura Hills, Cypress Elctrns.	818-597-9491
CA	Chatsworth, Sterling Elctrns.	818-407-8850
MD	Columbia, Sterling Elctrns.	301-290-3800
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Sterling Elctrns.	619-560-8097
CA	San Jose, All American	408-943-1200
CA	San Jose, Electro Alliance, Inc.	408-280-0221
CA	San Jose, Sterling Elctrns.	408-435-0835
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Sunrise, All American	305-572-7999
CA	Tustin, OBI	714-258-1411
CA	Tustin, Sterling Elctrns.	714-259-0900
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Miami, All American	305-621-8282
GA	Norcross, Applied Power Inc. (printers only)	404-263-0421
IL	Rosemont, Advent Elctrns., Inc.(printers only)	708-297-6200
IL	Schaumburg, Marsh Elctrns.	708-240-9290
IL	Schaumburg, Sterling Elctrns.	708-303-9900
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, Advent Elctrns., Inc.(printers only)	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.(printers only)	319-363-0221
IA	Cedar Rapids, Dee Elctrns., Inc. (LCD only)	319-365-7551
KS	Lenexa, Sterling Elctrns.	913-492-5406
MD	Middletown, Current Comps.	301-473-5333
MD	Raynham, Current Comps.	508-824-7900
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns., Inc.(printers only)	313-477-1650
MN	Eden Prairie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Aerospace Computer Supps.	612-884-4725
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	Edison, Sterling Elctrns.	908-417-1000
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NC	Raleigh, Century Elctrns.	919-782-2116
NY	Ronkonkoma, All American	516-981-3935
NC	Raleigh, Sterling Elctrns.	919-596-2220
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OH	Solon, Sterling Elctrns.	216-248-1122
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Tualatin, Moore Elctrns.	503-692-5333
OR	Beaverton, Micropower (Batteries Only)	503-626-7086
PA	Norristown, Century Elctrns.	215-631-5404
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Irving, Cypress Elctrns.	214-255-0065
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-323-5510
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Kent, Moore Elctrns., Inc.	206-251-8090
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Burnaby, B.C., Semad/DGW Elctrns.	604-420-9889
Can	Calgary, Alb., Semad/DGW Elctrns.	403-252-5664
Can	Markham, Ont., Carsten Elctrns. Ltd.	416-477-7705
Can	Markham, Ont., Semad/DGW Elctrns.	416-475-8500
Can	Ottawa, Ont., Semad/DGW Elctrns.	613-727-8325
Can	Pointe Claire, Que., Semad/DGW Elctrns.	514-694-0860
Can	St. Laurent, Que., Carsten Elctrns. Ltd.	514-334-8321

SEIKO INSTS. USA, INC., Graphic Devices & Systems Div., 1130 Ringwood Ct., San Jose, CA 95131, Tel: 408-922-5800, FAX: 408-922-5840; *Sls. Mgr.:* Steve Dodds; *Dist. Mgr.:* Ralph Kosoff

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7850, FAX: 213-517-7793; Empl.: 250; *Sls. Mgr.:* K. Curtis; *Dist. Mgr.:* P. Simpson

SEKAI ELECTRONICS OF AMERICA, INC., 14535H Valley View Ave., Santa Fe Springs, CA 90670-5234, Tel: 310-921-7775, FAX: 310-921-7875; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski; *Dist. Mgr.:* Ron Burnett selco

FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673; Empl.: 18; *Sls. Mgr.:* Ray Anton; *Dist. Mgr.:* Ray Anton .... **B•1896-1897; C•1535; D•1368-1370**

Local Sales Offices & Reps

CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mission Viejo, Summit Sls.	714-830-5545
CA	Sunnyvale, Pass Assocs.	408-735-9040
CO	Littleton, Summit Sls.	303-973-9681
FL	Sarasota, Rep-USA	813-923-2897
IL	Woodridge, Golten Assocs.	708-985-5100
IN	Indianapolis, S & M Sls. & Mktgs.	317-843-5519
MA	Andover, Crawford Assocs.	508-470-2122
NY	Hauppauge, Sticom	516-366-4221
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Valley Forge, J.E. Cuesta & Co.	215-935-0400
TX	Dallas, H.H. & Assoc.	214-247-8308
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
IL	Wheeling, Hawk Elctrns.	312-459-4091
NY	Hauppauge, A J Elctrns.	516-361-9780

SELECO, INC., P.O. Box 68809, Indianapolis, IN 46268, Tel: 317-872-4148, FAX: 317-875-3276; Empl.: 30

SELECT CONTROLS INC., 350 I Central Ave., Bohemia, NY 11716, Tel: 516-467-8577, FAX: 516-567-9013; Empl.: 14

SEMICON COMPONENTS, INC., A Subsidiary of Semicon, Inc., 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, FAX: 617-272-9109

SEMICONDUCTOR CIRCUITS, INC., Astec America, Inc., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 52; *Sls. Mgr.:* Douglas E. Hemingway, VP/Sls. .... **D•2207-2209**

Local Sales Offices & Reps

AZ	Chandler, Technisource Corp.	602-497-0711
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Los Gatos, Luscombe Engr. Co. of San Francisco	408-370-2020
CO	Lakewood, Frontier Mktg.	303-980-5888
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Plainfield, Rathsburg Assoc.	317-838-0360
MD	Pasadena, Elctrn. Engr. & Sls., Inc.	410-255-9686
MI	Farmington Hills, Rathsburg Assocs.	313-489-1500
MN	Edina, Ohms Technlg., Inc.	612-932-2920
MO	Florissant, Delltron Co., Inc.	314-839-0033
NH	Nashua, Bennetron	603-880-7008
NJ	Morrestown, TAI Corp.	609-778-5353
NM	Albuquerque, Technisource Corp.	505-268-4232
NY	Melville, Parallax	516-351-1000
NY	Syracuse, L.D. Allen Co.	315-437-8387
OH	Columbus, Rathsburg Assocs.	614-457-2242
OR	Lake Oswego, Luscombe Engr. N/W	503-636-6664
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
WA	Bellevue, Luscombe Engr. N/W	206-223-1541
Can	Ottawa, Ont., Cantec Reps., Inc.	613-725-3704

Local Distributors

CA	Santa Clara, Foresight Elctrns.	408-980-9700
CT	Seymore, Target Elctrns.	203-888-1480
GA	Norcross, Applied Power Inc.	404-263-0421
IN	Carmel, Altex Elctrns.	317-848-1323
MA	Wellsley Hills, Target Elctrns.	617-235-2545
MA	Westwood, Target Elctrns.	617-329-2700
MI	Brighton, Applied Power Inc.	313-227-3604
NH	Derry, Target Elctrns.	603-434-8440
NJ	Lodi, TRC Elctrns.	201-779-8282
TX	Stafford, Southwest Elctrns.	713-240-4000

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, FAX: 914-698-5386; Empl.: 57; *Sls. Mgr.:* Dolores Bankose

Local Sales Offices & Reps

AZ	Chandler, Mission Mktg.	602-786-0804
CA	Anaheim, Chalman Technlgs.	714-632-1724
CA	San Ramon, California Tech. Svcs.	510-743-8544
CO	Fort Collins, Rep Sls., Inc.	303-226-1504
CT	Southington, Libby Assoc.	203-747-5601
CT	Southington, Libby Assocs.	203-747-5601
CT	Washington Depot, Gemair Inc.	203-868-1390
IL	Palatine, M & S Sls.	708-934-1200
MD	Walkerville, KH Sls.	301-898-0758
MN	Minneapolis, Ferrian Sls.	612-721-8915
PA	Franconia, Scharas Assocs.	215-582-0450
TX	Dallas, Dallas Indl. Sls.	214-669-2608
TX	Richardson, PSI	214-644-5090
WA	Bellevue, Mars	206-747-3292
WA	Redmond, Advanced Elec. Resources	206-881-5207

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 407-283-4500, FAX: 407-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Pleasanton, Leddy Assocs.	510-417-1033
CO	Englewood, Component Sls.	303-779-8060
FL	Longwood, Delmac Sls.	407-831-0040
IL	Downers Grove, Frank Mendell Assoc.	708-719-0099
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, Lorenz Sls.	913-469-1312
MD	Towson, Arbotek	301-825-0775
MA	Burlington, Conti-Younger	617-273-1582
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
MO	St. Louis, Lorenz Sls.	314-997-4558
NE	Lincoln, Lorenz Sls.	402-474-7094
NJ	Hasbrouck Heights, Comp Tech Sls.	201-288-7400
NM	Albuquerque, Q.A. Elctrns.	505-888-1121
NY	New Hyde Park, Comp Tech Sls.	516-593-2628
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Westerville, Scott Elctrns.	614-882-6100
OR	Beaverton, Westmark Elctrns.	503-641-8780
PA	Paoli, Stitzer Co. Inc.	215-644-5500
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Austin, M-Rep	512-250-0828
TX	Dallas, M-Rep	214-484-5711
UT	Midvale, Utah/CSI	801-561-5099
WA	Bellevue, Westmark Elctrns.	206-454-1944
Can	Montreal, Que., Solid State Engrg.	514-481-3313

SEMIKRON, INC., 11 Executive Dr., Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, FAX: 603-883-8021; FSC No.: 58687; Empl.: 12; *Sls. Mgr.:* Arthur Connolly

SEMTECH CORPORATION

FAX: 805-498-3804

SEMTECH CORPORATION, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111; FSC No.: 14099; Empl.: 350; *Sls. Mgr.:* Jack Poe; *Dist. Mgr.:* Shawn O'Grady .... **A•2180-2218; D•1845**

Local Sales Offices & Reps

AL	Huntsville, Giesting & Assocs.	205-830-4554
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Anaheim, First Rep of S. CA	805-373-0887
CA	La Jolla, Coastal Elctrns.	619-459-4148
CA	Newbury Pk., Semtech Western Reg. Sls.	805-498-2111
CA	Santa Clara, Quorum Tech. Sls.	408-980-0812
CA	Westlake Village, First Rep of S. CA	805-373-0887
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Deerfield Beach, Delmac Sls., Inc.	305-427-7788
FL	Longwood, Delmac Sls., Inc.	407-831-0040
GA	Duluth, Giesting & Assocs.	404-476-0025
IL	Glendale Hgts., Synergistics Sls., Inc.	708-858-8686
IN	Carmel, Giesting & Assocs.	317-844-5222
KY	Versailles, Giesting & Assocs.	606-873-2330
MD	Glen Burnie, Logical Technlg., Inc.	410-766-7444
MA	Chelmsford, Semtech Eastern Reg. Sls.	508-256-0506
MA	Framingham, Stone Comp. Sls.	508-875-3266
MI	Comstock Park, Giesting & Assocs.	616-784-9437
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	New Brighton, Design Technlg. Comps., Inc.	612-631-3738
MO	Florissant, Central Tech. Sls.	314-831-4069
NJ	Fairfield, Metro Logic Corp.	201-575-5585
NY	Bellmore, Compar New York, Inc.	516-221-7300
NY	Rochester, Ontec Elctrn. Mktg.	716-464-8636
NY	Wappingers Falls, Ontec Elctrn. Mktg.	914-462-7188
OH	Cincinnati, Giesting & Assocs. (Home Off.)	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OH	Dublin, Giesting & Assocs.	614-792-5900
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Horsham, Nexus Technlg. Sls., Inc.	215-675-9600
PA	Pittsburgh, Giesting & Assocs.	412-828-3553
TX	Richardson, Semtech Central Reg. Sls.	214-783-9903
WA	Renton, Quest Mktg.	206-228-2660
WI	Brookfield, Synergistics Sls., Inc.	414-821-1516
EXP	Shijuku-Tokyo, Japan, Jepico-Shinjuku	03-348-0611
Can	Hamilton, Ont., Cartwright Southall Assoc., Inc.	416-528-0294

SEMTECH CORPUS CHRISTI, Semtech Corporation, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, FAX: 512-289-0472; Empl.: 200 .... **A•2180-2218; D•1845**

SEMTRONICS CORP., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Bradford Jubin

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 1-800-736-2673, 605-339-0100, FAX: 605-339-0317; FSC No.: 33347; Empl.: 230; *Sls. Mgr.:* George Gonos

SENSIDYNE, INC., 16333 Bay Vista Drive, Clearwater, FL 34620, Tel: 813-530-3602, 1-800-451-9444; Empl.: 70; *Sls. Mgr.:* Bob Duff; *Dist. Mgr.:* John Lavezzorio

SENSITEK CORPORATION, See Biddle Instruments

SENSITIVE RESEARCH INSTRUMENTS, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35

SENSITRON SEMICONDUCTOR, RSM Electron Power Div., 221 W. Industry Ct., Deer Park, NY 11729, Tel: 516-586-7600, FAX: 516-242-9798; FSC No.: 13409; Empl.: 150; *Sls. Mgr.:* Bryan Rogers; *Dist. Mgr.:* Bryan Rogers

SENSORAY

FAX: 503-684-8164

SENSORAY, 15800 Upper Boones Ferry Rd., # 150, Lake Oswego, OR 97035, Tel: 503-684-8005

SENSOR CORP., 303 Scottdale Ave., Scottdale, PA 15683, Tel: 412-887-4080, FAX: 412-887-0383; Empl.: 6

SENSOR DEVELOPMENTS INC., PO Box 290, Lake Orion, MI 48361, Tel: 313-391-3000, FAX: 313-391-0107; Empl.: 80; *Sls. Mgr.:* Bill Wood

SENSOR PRODUCTS, INC., 171 Castle Ridge Park, E. Hanover, NJ 07936, Tel: 201-884-1755, FAX: 201-884-1699; Empl.: 5

SENSOR SCIENTIFIC, INC., 6 Kingsbridge Rd., Fairfield, NJ 07004, Tel: 201-227-7790, 800-524-1610, FAX: 201-227-8063; FSC No.: 0AES7; Empl.: 125; *Sls. Mgr.:* Robert Gliniecki .... **B•1898-1901**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	Van Nuys, Vale Elctrns.	818-705-0283
CO	Ft. Collins, Rep. Sls.	303-226-1504
MA	Lexington, Jodan Technlg.	617-863-8898

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583, FAX: 818-341-9059; *Sls. Mgr.:* E. Schneider

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188, FAX: 614-486-0506; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, FAX: 408-734-0407; FSC No.: 5955; Empl.: 150; *Sls. Mgr.:* Fred Jones; *Dist. Mgr.:* Fred Jones

SENTECH, INC., 518 Ryers Ave., Cheltenham, PA 19012, Tel: 215-663-0422, FAX: 215-663-0461; Empl.: 5

SENTRY MANUFACTURING COMPANY, P.O. Box 250, Chickasha, OK 73023, Tel: 405-224-6780, FAX: 405-224-8808; FSC No.: 5955; Empl.: 26; *Sls. Mgr.:* Barbara Maberry

SERCO PRODUCTS DIVISION:SERCO MOLD, INC., 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.), FAX: 818-331-8584; Empl.: 70; *Sls. Mgr.:* Neil Reckon .... **C•1090-1091**

Local Sales Offices & Reps

CA	Covina, Serco Prods.	818-331-0517
CA	Los Gatos, Shur Sls.	408-399-7487
CA	Valencia, Lessing & Assocs.	805-295-0225
GA	Atlanta, Beacon Elec.	404-256-9640
KY	Louiseville, O.H. Bromberg	502-456-1498
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MN	S. IMinneapolis, R.J., Inc	612-866-3661
MO	Florissant, Delltron Co., Inc.	314-839-0033
NY	Latham, L-Tron Corp.	518-785-5032
NY	Pt. Washington, Ashtec, Inc.	516-767-0336
OR	Portland, Brown Co.	503-293-1683
PA	Ft. Washington, Simon Mktg. Consultants	215-628-3394
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447

Local Distributors

AL	Montgomery, Handey's Elctrn. Ctr. Inc.	205-262-4885
AZ	Phoenix, Capital Elctrns.	602-252-5897
AZ	Phoenix, Elctrn. Emporium Inc.	602-437-8633
AZ	Tucson, Electronic City	602-622-1173
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Costa Mesa, Mar Vac Elctrns.	714-650-2001
CA	Cucamonga, Abletronics	714-944-4952
CA	Culver City, DOW Elctrns.	213-391-6763
CA	El Monte, Marshall Ind.	800-522-0084
CA	Fremont, Fry's Elctrns.	415-770-3797
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawiian Gardens, DOW Elctrns.	213-421-3786
CA	Hollywood, Pacific Radio Exchange	213-462-1393
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Oxnard, DOW Elctrns.	805-486-6353
CA	Palo Alto, Fry's Elctrns.	415-496-6100
CA	Pasadena, DOW Elctrns.	818-793-1195
CA	Pomona, DOW Elctrns.	818-966-8461
CA	Sacramento, Mar Vac California Radio	916-922-6531
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Maria, Elctrn. Parts Supermart	805-925-8604
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CO	Aurora, Jet Elec. Supp.	303-364-1000
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Tampa, Sunex Elctrn. Supp. Inc.	813-885-4074
FL	West Palm Beach, Dolphin Elctrn. Supp. Inc.	305-659-7166
MA	Burlington, Atlantic Comps.	617-270-0051
MA	Lynn, Land Elctrns. Inc.	617-592-2220
MN	S. Minneapolis, Tortec Corp.	612-866-3662
MN	Thief River Falls, Digi-Key	218-681-6674
NV	Las Vegas, Sandy's Elctrns.	702-383-8353
NJ	Lodi, Nidisco Inc.	201-773-1771
NJ	Rockaway, Tonar Ind.	201-586-9000
NY	Ronkonkoma, Jet Comps.	516-471-3124
NY	Woodside, Switches Unlimited	718-478-5000
NC	Durham, Southeastern Elctrns.	919-638-8204
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Hudson, Hamshire	216-425-8888
TN	Clarksville, Randolph, Hale & Matthews Inc.	615-647-2325
TX	Austin, Electrotex, Inc.	512-454-0318
TX	Dallas, Electrotex, Inc.	214-234-0433
TX	Ft. Worth, Allied Elctrns.	800-433-5700
TX	Houston, Electrotex, Inc.	713-526-3456
WI	Fond du Lac, Fedco Elctrns. Inc.	414-922-6490
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000
Can	Kingston, Ont., Electronic Packaging Sys. Ltd.	613-384-1142
Can	Markham, Ont., Arma Elctrns.	416-475-1858
Can	Montreal, Future Elctrns.	800-388-8731

SERVOBYTE INC., P.O. Box 112, Millbury, MA 01527, Tel: 508-865-0225, FAX: 508-865-0295; Empl.: 5; *Sls. Mgr.:* C. Harris

SERVO CORPORATION OF AMERICA, 111 New South Rd., Hicksville, NY 11801-5259, Tel: 516-938-9700, FAX: 516-938-9644; FSC No.: 92110 & 05627; Empl.: 220

SERVOMEX COMPANY, INC., 90 Kerry Pl., Norwood, MA 02062, Tel: 617-769-7710, TELEX: 4430161, FAX: 617-769-2834; *Sls. Mgr.:* Michael Hammond

SERVO-TEK

FAX: 201-427-4249

SERVO-TEK PRODUCTS CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100; Empl.: 47; *Sls. Mgr.:* T. J. Daly .... **B•1306**

SESCOM, INC., 2100 Ward Dr., Henderson, NV 89015-4249, Tel: 702-565-3400, FAX: 702-565-4828; FSC No.: 7Z174; Empl.: 12; *Sls. Mgr.:* Franklin J. Miller ... **C•1093**

setra

FAX: 508-264-0292

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243; FSC No.: 53367; Empl.: 110 .... **B•2014-2015**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno Metrics	205-830-2832
AK	Anchorage, Unit Process	907-522-1010
CA	Concord, QCon, Inc.	510-682-2020
CA	Downey, Dynasales Co.	310-806-1400
CO	Westminster, RMS Sls.	303-429-1111
FL	Tampa, Quantum Measurements Corp.	813-933-8078
GA	Atlanta, Craft Assocs.	404-256-0420
IL	W. Dundee, Precision Meas. Prods.	708-426-4446
IN	Ft. Wayne, Domino, Inc.	219-456-5512
IN	Indianapolis, Domino, Inc.	317-841-6159
KY	Louisville, Domino, Inc.	502-425-2848
MD	Columbia, Stein Instrs.	301-596-3748
MA	Wilbraham, NEDT, Inc.	413-596-8853
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	St. Louis, Adelphi, Inc.	314-821-1232
NJ	Little Falls, KLS Assocs.	201-785-4450
NY	Cazenovia, Ritec Entprs., Inc.	315-655-4158
NY	Rochester, Ritec Entprs., Inc.	716-271-3170
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OK	Tulsa, Inotek Corp.	918-627-1500
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, ADI Instrs.	214-340-3445
WA	Seattle, EMRA Controls, Inc.	206-244-4341
WI	Waukesha, Ray Knitter Assocs.	414-544-1976
Can	Ontario, Alpha Controls & Instr.	416-477-2133

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559, FAX: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 800; *Sls. Mgr.:* Michael Rosenberg

SGS-THOMSON MICROELCTRONICS, INC., 1000 Bell Road, Phoenix, AZ 85022, Tel: 602-867-6100

SGS-THOMSON MICROELECTRONICS, INC., 1310 Electronics, Carrollton, TX 75006, Tel: 214-466-6000, FAX: 214-466-7602; FSC No.: 7X328; Empl.: 1700; *Sls. Mgr.:* Carlo Bozotti; *Dist. Mgr.:* Jack Dauber

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135, 1-800-876-3135, FAX: 919-934-3298; Empl.: 30; *Sls. Mgr.:* M. D. Sutton .... **B•1808; D•1323**

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346, FAX: 919-965-6620; FSC No.: 58258; *Sls. Mgr.:* Joe Deans .... **D•1324**

Local Sales Offices & Reps

TX	Arlington, Electronic Prod. Reps.	817-467-0377

SHAMROCK PLASTICS & RUBBER, INC., 5330 E. 25th St., Indianapolis, IN 46218, Tel: 317-543-3540, 800-382-4635, FAX: 317-543-3553; Empl.: 25; *Sls. Mgr.:* Bill Crispen

SHAPE ELECTRONICS, INC., The Wiremold Co., 901 DuPage Ave., Lombard, IL 60148, Tel: 708-620-8394, 1-800-367-5811, FAX: 708-620-0784; Empl.: 110; *Sls. Mgr.:* Jim Piantanida; *Dist. Mgr.:* Jim Piantanida

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024, FAX: 714-675-9063; Empl.: 7

SHARP ELECTRONICS CORP., Microelectronics Grp., 5700 NW Pacific Rim Blvd., M/S. 20, Camas, WA 98607, Tel: 206-834-2500, FAX: 206-834-8903; *Sls. Mgr.:* Doug Goodyear; *Dist. Mgr.:* George Campot

SHATTUCK INDUSTRIES, 117 Fern St., Santa Cruz, CA 95060, Tel: 408-427-3122, FAX: 408-427-3134; *Sls. Mgr.:* Bruce Shattuck; *Dist. Mgr.:* Julie Murray

SHELDAHL, INC., 1150 Sheldahl Rd., Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8545; Empl.: 1,257; *Sls. Mgr.:* Ed Lundstrom

SHELDON INSTRUMENTS, 1021 North University Ave., Ste. 204, Provo, UT 84604, Tel: 801-376-7861, FAX: 801-374-8022; Empl.: 6; *Sls. Mgr.:* Robert Gaurie

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FAX: 714-669-1081

SHELLY ASSOCIATES, INC., 14811 Myford Rd., Tustin, CA 92680, Tel: 714-669-9850, TELEX: 85-2263; FSC No.: 00303; Empl.: 30; *Sls. Mgr.:* Bill Alarlon .... **B•1114-1117, 1179**

Local Sales Offices & Reps

AZ	Mesa, Spectrum Assocs., S.W.	602-966-1788
CA	Pleasanton, Leddy Assocs., Inc.	510-417-1033
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	Torrance, O'Donnell Assocs., Inc.	310-781-2255
CO	Westminster, Wsetern Reg. Mktg.	303-428-8088
FL	Satellite Beach, Curtis Mktg.	407-779-3912
GA	Marietta, Intronics	404-973-6605
IL	Glen Ellyn, Lincoln Hoages, Inc.	708-469-6750
MN	Hopkins, Steve Forsythe & Assocs.	612-933-8267
MO	Grandview, R. R. Burton & Assocs.	816-763-5385
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Port Washington, TMA	516-883-2432
RI	Lincoln, Global Tech. Sls.	401-334-3830
TX	Dallas, de Forest Sls. Co.	214-349-3290
UT	Salt Lake City, Western Reg. Mktg.	801-268-9768
WA	Bellevue, AIE	206-455-4697
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AR	Ft. Smith, Radio, Inc.	501-646-5200
CA	Anaheim, Bisco Inds. Inc.	714-635-0380
CA	San Jose, Bisco Inds. Inc.	408-435-8980
IL	Franklin Park, Bisco Inds. Inc.	708-451-1230
MA	Woburn, Bisco Inds.	617-938-8590
MO	Kansas City, Elctrns. Supp.	816-931-0250
NY	Elmsford, White Plains Elctrl.	914-592-9555
OH	Dayton, Advacom	513-272-5900
OH	Middleburg, Advacom	216-826-3300
OH	Strongsville, Roberts Elctrns. Co., Inc.	216-238-1711
OK	Tulsa, Radio, Inc.	918-587-9123
TX	Arlington, Bisco Inds.	817-640-7046
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-1294
TX	Houston, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Bisco	801-972-3525

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SHINANO KENSHI CORP. (SKC), 5737 Mesmer Ave., Culver City, CA 90230, Tel: 310-915-7300, FAX: 310-915-7304; Empl.: 7; *Sls. Mgr.:* Bill Dowis **B•1307**

Local Sales Offices & Reps

AL	Madison, Benchmark Sls.	205-464-0033
CA	Culver City, Shinano Kenshi Corp.	310-915-7300
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
CO	Denver, Tech Rep Sls. Co.	303-758-7031
CO	Englewood, Tech. Rep. Sls.	303-799-8877
CT	Bloomfield, SIR/DSA Assocs.	203-243-9343
FL	Lighthouse Pt., Krutek & Assocs.	305-783-2501
GA	Norcross, Benchmark Sls.	404-446-1711
IN	Carmel, Current Elctrn. Mktg.	317-844-1770
MA	Westford, SIR/DSA Assocs.	508-692-2500
MI	Royal Oak, Elctrl. Sys. Co.	313-542-1747
MN	Minneapolis, HMR, Inc.	612-888-2122
NJ	Mt. Laurel, Paragon Sls.	609-778-1190
NY	Clark Mills, KLM Garner	315-853-6126
NY	Mineola, DOL Engrg.	516-747-3944
NY	Pittsford, KLM Garner	716-381-8350
NC	Raleigh, Benchmark Sls.	919-850-0633
OH	Dayton, Elctrl. Sys. Co.	513-545-9822
OH	Orville, Elctrl. Sys. Co.	216-682-5530
OR	Portland, Intertech Sls.	503-775-7885
PA	Blue Bell, Deltronics	215-641-9930
TX	Austin, Capitol Sls.	512-250-0201
TX	Dallas, Theodore Borek Assoc.	214-985-7702
WA	Redmond, Halbar	206-882-0990

Local Distributors

CA	Culver City, Digilog Devices Inc.	310-915-7346

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2985 E. Hillcrest Dr., Westlake Vl., CA 91362, Tel: 800-634-3654; Empl.: 10; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski **D•1918-1919, 2210-2211**

Local Sales Offices & Reps

AZ	Phoenix, Hartland Sls.	602-492-0012
CA	Murrieta, Mil-Com Sls., Inc.	714-677-2097
CA	San Diego, Power Assocs.	619-275-0641
CA	Santa Clara, Integrated Tech. Sls.	408-727-3408
CO	Bloomfield, Summitwest Mktg., Inc.	303-460-9600
FL	Land O' Lakes, A.J.'s Power Source, Inc.	813-996-2583
IL	Rolling Meadows, Eagle Tech. Sls., Inc.	312-991-0700
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Baltimore, Chesapeake Indl. Mktg.	301-653-0476
MI	Lathrup Vl., R. C. Nordstrom & Co.	313-559-7373
MN	Mancato, E. I. Sls.	507-345-5786
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Hampton, Primary Source	603-926-8044
NY	Hauppauge, Aurora-Schmitt	516-434-1313
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
OR	Beaverton, Olsen Tech. Sls. Corp.	503-643-9488
PA	Blue Bell, Deltatronics Inc.	215-641-9930
TX	Richardson, Jim Gray & Assocs.	214-699-9976
TX	Richmond, Jim Gray & Assocs.	713-342-1710
UT	Midvale, Arrowhead/CSI	801-561-5688
WA	Bellevue, Olsen Tech. Sls. Corp.	206-883-7792
WI	Waukesha, Eagle Tech. Sls.	414-549-3622

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supply	602-275-2626
AZ	Tucson, Dalis Elctrn Supply	602-294-2628
CO	Littleton, Displays Plus, Inc.	303-730-7333
CT	Danbury, Aved Elctrn. Dist., Inc.	203-744-7838
IL	Schaumburg, QPS Elctrns.	312-884-6620
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Andover, Aved Elctrn. Dist., Inc.	508-688-3800
MA	Tewksbury, Armor Elctrns.	508-640-1499
MI	St. Clair Shores, Spemco	313-771-2700
NJ	Pennsauken, Alta Elctrns.	609-488-1442
NM	Albuquerque, Summit Elec. Supp. Co.	505-884-4400
NM	Albuquerque, Walker Elctrn. Supply	505-883-2992
NY	Glen Head, Livera Polk Assocs.	516-759-9300
NY	Rochester, Masline ELctrns.	716-546-5373
OH	Cleveland, Major Elctrns.	216-442-6200
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	El Paso, Midland Wintronic Co.	915-779-8391
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Stafford, Southwest Elctrns.	713-240-4000

SHIN-ETSU POLYMER AMERICA, INC., 34135 7th St., Union City, CA 94587, Tel: 510-475-9000, TWX: 910-338-2229, FAX: 510-475-0613; *Sls. Mgr.:* Doug Hall

Local Sales Offices & Reps

CA	Newbury Park, Interconn Tech. Mktg.	714-589-4655
IL	Crystal Lake, Mid America Reps.	815-455-5310
IN	Carmel, Technology Mktg. Corp.	317-844-8462
MA	Lexington, Jodan Technlg.	617-863-8898
MI	Farmington Hills, J.L.Montgomery	313-489-0099
TN	Greenville, Lamons Sls. Co.	615-639-8711
TX	Dallas, THT Sls.	214-783-1501

SHIPLEY COMPANY, INC., 2300 Washington St., Newton, MA 02162, Tel: 617-969-5500, FAX: 508-234-4055; *Sls. Mgr.:* Timothy S. Tubergen

SHOGYO

FAX: 516-466-0922

SHOGYO INTERNATIONAL CORP., 287 Northern Blvd., Great Neck, NY 11021-4799, Tel: 516-466-0911, TELEX: 4758024 **A•2534; B•1180, 1809; C•1457-1459, 1808-1809; D•1064-1065, 1474, 1921**

SHOKAI®

FAX: 914-736-3656

SHOKAI FAR EAST LTD., 9 Elena Court, Peekskill, NY 10566, Tel: 914-736-3500, TELEX: 224219; Empl.: 362; *Sls. Mgr.:* Shirlee Serber; *Dist. Mgr.:* Robert Craig **A•2118; B•1181; C•1460; D•1067**

SHURE BROTHERS INC., 222 Hartrey Ave., Evanston, IL 60202-3696, Tel: 708-866-2200, TELEX: 4330191, FAX: 708-886-2279; *Sls. Mgr.:* A.G. Hershner, Dir. of Sls.

SHURITE METERS, A Prime Technology Co., P.O. Box 185, Twin Lakes Rd., North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 82239; Empl.: 15; *Sls. Mgr.:* James L. Jamieson, Mktg. VP **D•1371**

Local Sales Offices & Reps

AK	Please Consult Factory, Please Consult Factory	203-481-5721
CA	Burbank, Modco Co.	818-848-2215
CA	San Diego, Qualtronics	619-873-0118
CA	So. San Francisco, Carelli-EMA	415-873-3365
CO	Denver, Nelson Co. Inc.	303-295-1017
CT	Gilman, Adams McGregor Inc.	203-537-3033
FL	Lakeland, Munday Sls. Co.	813-858-5606
IL	Cary, Bob Burns Assocs.	708-516-3322
IN	Indianapolis, John Sukup Inc.	317-253-5501
IA	Des Moines, The Beams Co.	515-255-1148
KS	Lenexa, The Beams Co.	913-541-9197
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Franklin, D. F. Tobias & Co.	201-751-8680
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Rochester, D. F. Tobias	201-751-8680
NC	Raleigh, B.T. Funderburk Inc.	919-846-2373
OH	Cleveland, John Olsen Co.	216-838-0510
PA	Glenshaw, DVS Co.	609-896-1112
SC	Landrum, B.T. Funderburk Inc.	919-846-2373
TX	Dallas, The Crockett Sls. Co.	214-350-3377
Can	Thornhill, Ont., R. C. Kahnert Sls. Ltd.	416-764-2596
Can	Winnipeg, Manitoba, Smith-Patterson & Assocs.	204-885-1376

Local Distributors

AL	Birmingham, ACK Radio Supply	205-322-0588
AZ	Phoenix, Capital Elctrns. Supp.	602-252-5897
AR	Little Rock, Carlton-Bates	501-562-9100
CA	San Francisco, Zack Elctrns.	415-624-1444
CA	San Jose, Quements Elctrns.	408-998-5900
CA	San Rafael, Electronics Plus	415-457-0466
CO	Denver, Fistells Elec. Supp.	303-629-1312
CT	New Haven, Hatry Elctrns.	203-787-5921
IN	East Chicago, Acro Elctrns.	219-397-8681
IA	Des Moines, Radio Trade Supp.	515-288-7237
KY	Louisville, Peerless Elctrn.Eqpt.	502-637-7677
LA	Baton Rouge, Ralph's Elctrn. Supp.	504-344-3761
MO	Kansas City, Elctrn. Supp. Co.	816-931-0250
MO	Kansas City, Walters Indl. Elect. Inc.	1-800-821-5248
NM	Los Cruces, Elctrn. Parts Co.	505-523-4578
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Lima, Hutch & Sons	419-229-8751
OK	Tulsa, Radio Inc.	918-587-9123
PA	Reading, Barbey Elctrns. Corp.	215-376-7451
RI	Pawtucket, Jabbour Elctrns.	401-728-4600
TX	Fort Worth, Allied Elctrns.	1-800-433-5700
TX	Houston, City Elctrns. Supp.	713-621-1060
TX	Houston, Elctrn. Prts. Outlet	713-784-0140
WI	Milwaukee, E.M. Instrs. Inc.	414-272-7799
Can	Willowdale, Ontario, Electro Sonic Inc.	416-494-1666

SIEMENS-B C L MAGNETICS, Siemens Automotive Ltd., 5045 North Service Rd., Burlington, Ont., Canada L7L 5H6, Tel: 416-335-2530, FAX: 416-335-8474; Empl.: 180; *Sls. Mgr.:* Dave Dore

SIEMENS COMPONENTS, INC., 2191 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-980-4568, TELEX: 84-4491

SIEMENS COMPONENTS, INC., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, TELEX: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Chuck Berghoff; *Dist. Mgr.:* Regina Walls

SIEMENS COMPONENTS, INC., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529, FAX: 201-321-3961; Empl.: 800; *Sls. Mgr.:* Curt Hozian; *Dist. Mgr.:* Dick Robert

SIENNA TECHNOLOGIES INC., 2535 Pilot Knob Road, St. Paul, MN 55120, Tel: 612-688-6106, FAX: 612-688-2417; Empl.: 18; *Sls. Mgr.:* Deborah L. Bernard; *Dist. Mgr.:* George Doerfler

SIERRA AUTOMATED SYSTEMS & ENGINEERING CORP., 2112 N. Glenoaks Blvd., Burbank, CA 91504, Tel: 818-840-6749, FAX: 818-840-6751; *Sls. Mgr.:* Al Salci

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., Carlsbad, CA 92008, Tel: 619-438-3321, FAX: 619-438-4987; Empl.: 150

SIERRACIN POWER SYSTEMS, See Valor Electronics

SIERRA MONITOR CORP., 1991 Tarob Ct., Milpitas, CA 95035, Tel: 408-262-6611, TELEX: 17-1618; FSC No.: MSGSNDR; Empl.: 30; *Sls. Mgr.:* Stephen R. Ferree; *Dist. Mgr.:* Stephen R. Ferree

SIERRA POWER SYSTEMS, See Valor Electronics

SIERRA SEMICONDUCTOR CORP., 2075 N. Capitol Ave., San Jose, CA 95132, Tel: 408-263-9300, FAX: 408-263-3337

SIERRA WEST POWER SYSTEMS, 2615 Missouri Ave., Bldg. No. 5, Las Cruces, NM 88001, Tel: 505-522-8828, FAX: 505-522-8828; Empl.: 12

SIGMA ELECTRONICS INC., 10830 Kinghurst Dr., Houston, TX 77099, Tel: 713-933-4700, 800-874-7121, FAX: 713-933-9067; FSC No.: 60767; Empl.: 87; *Sls. Mgr.:* K. Johnson

SIGMA PLASTRONICS, INC., P.O. Box 649, Whitmore Lake, MI 48189, Tel: 810-231-2871, FAX: 810-231-2960; Empl.: 3

SIGMAPOWER, INC, FPBSM Industries, Inc., 19060 S. Dominguez Hills Dr., Rancho Dominguez, CA 90220-6404, Tel: 310-884-5200, FAX: 310-635-1956; FSC No.: 55196; Empl.: 150

SIGMA SYSTEMS CORP., 3163 Adams Ave., San Diego, CA 92116, Tel: 619-283-3193, FAX: 619-283-6526; Empl.: 21; *Sls. Mgr.:* David L. Russell **D•1211**

Local Sales Offices & Reps

AZ	Scottsdale, Allen Sls. Assocs.	602-443-1820
CA	San Carlos, Electronic Engrg. Assoc.	415-593-2189
IL	Elgin, R.K. Elctrns., Inc.	312-695-8552
MA	Wilbraham, N.E.D.T.	413-596-8853
NJ	Parsippany, Creative Tech. Sls.	201-335-7881
EXP	Bristol, England, Wesser Elctrns.	272-571-404
Intl	Palaiseau, France, Salies S.A.	920-40-10

SIGNAL PROCESSING TECHNOLOGIES, 4755 Forge Rd., Colorado Springs, CO 80907, Tel: 719-528-2300, FAX: 719-528-2370; Empl.: 57; *Sls. Mgr.:* Rick Mintle; *Dist. Mgr.:* Sharon McDaniel

SIGNAL RESEARCH INC., River Road, P.O. Box 357, Titusville, NJ 08560, Tel: 609-737-1917

SIGNAL SWITCH COMPANY, 1791 Capital St., Ste. F, Corona, CA 91720, Tel: 909-736-5404, FAX: 909-736-5406; FSC No.: 58468; Empl.: 10; *Sls. Mgr.:* Stan Adams .... **B•1479**

Local Sales Offices & Reps

CA	Redlands, Esco Elctrns.	909-335-1444, FAX:909-335-2996
FL	Orlando, E.G. Holmes & Assocs.	407-281-0067
IL	Berkley, ESA Tech. Mktg.	708-544-0120, FAX:708-544-0266
MD	Silver Springs, Instrucom Inc.	301-384-0700, FAX:301-984-6202
MA	Holliston, E.S.I.	508-429-2493,FAX:508-881-4577
NM	Albuquerque, C.T. Carlsberg & Assocs.	505-899-2155,FAX:505-899-2160
NY	Kings Park, E Square Mktg. Assocs.	Voice, FAX:516-544-4788
OH	Cleveland, Leading Edge Elctrn. Sls.	216-232-4946, FAX:216-232-9510
PA	Holland, W.A. Drobile, Inc.	215-364-2501, FAX:215-364-2051
Can	Halifax, N.S., Gates Engrg. Ltd.	902-457-0805

SIGNAL SYSTEMS INTERNATIONAL, P.O. Box 470, Lavalette, NJ 08735, Tel: 908-793-4668, FAX: 908-793-4679; Empl.: 7; *Sls. Mgr.:* W. Kinney

signal
TRANSFORMER

FAX: 516-239-7208

SIGNAL TRANSFORMER CO., INC., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, Tel: 516-239-5777; FSC No.: 08779; Empl.: 450; *Sls. Mgr.:* John Marino .... **A•2536-2556**

Direct sales only. Inwood, NY 516-239-5777

Local Sales Offices & Reps

Can	Toronto, Ont., Calbrooke Mktg.	416-346-2551

SIGNATRON, A Subsidiary of Meteor Communications Corp., 110 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-1500, TELEX: 299551 (RCA GLOBCOM), FAX: 617-863-8039; FSC No.: 59371; Empl.: 25; *Sls. Mgr.:* Joseph T. McNamara

SIGNUM, INC., 80 Hovey Street, Watertown, MA 02172-3356, Tel: 617-926-3566, FAX: 617-926-0333; *Sls. Mgr.:* Thomas DiGennaro

SIGNUM SYSTEMS CORP., 171 E. Thousand Oaks Blvd. No. 202, Thousand Oaks, CA 91360, Tel: 805-371-4608, ESYLNK: ATTMAIL!SIGNUM, FAX: 805-371-4610; Empl.: 15; *Sls. Mgr.:* Don Mull; *Dist. Mgr.:* J. Pennese

SIKAMA INTERNATIONAL, INC., 301 B Donaldson Place, Santa Barbara, CA 93117, Tel: 805-683-6379, FAX: 805-683-6740; Empl.: 10; *Sls. Mgr.:* Len Cardoza; *Dist. Mgr.:* Len Cardoza

SILICONES UNLIMITED, INC., 3939 Roswell Rd., Ste. 250, Marietta, GA 30062, Tel: 404-578-1274, FAX: 404-578-8209

SILICON GENERAL, 11861 Western Ave., Garden Grove, CA 92641, Tel: 714-898-8121, TELEX: 692-411, TWX: 910-596-1804, FAX: 714-893-2570; FSC No.: 34333; Empl.: 250; *Sls. Mgr.:* Roger Holliday; *Dist. Mgr.:* Louise Toussaint

SILICON POWER CUBE, See Crydom Company

SILICON SENSORS, Old Hwy. 18 East, Dodgeville, WI 53533, Tel: 608-935-2707, TWX: 910-997-0072, FAX: 608-935-2775; FSC No.: 54822; Empl.: 30; *Sls. Mgr.:* Phil Lulewicz

SILICON SYSTEMS INC., 14351 Myford Rd., Tustin, CA 92680, Tel: 714-731-7110, TWX: 910-595-2809

SILICON TRANSISTOR CORP., Katrina Rd., Chelmsford, MA 01824, Tel: 508-256-3321, FAX: 508-250-1046; FSC No.: 07256; Empl.: 200; *Sls. Mgr.:* John J. Flynn; *Dist. Mgr.:* Fred Wheaton

SILONEX INC., 331 Cornelia St., Plattsburgh, NY 12901, Tel: 518-561-3160, FAX: 514-747-3906; Empl.: 110; *Sls. Mgr.:* Carol Larsen .... **B•1339**

Local Sales Offices & Reps

FL	Tampa, Standard Mktg. Inc.	813-933-5833
IL	Crystal Lake, Komac Entprs. Inc.	815-459-7456
KS	Lenexa, Midtec Assocs. Inc.	913-541-0505
MD	Ellicott City, Nelson Elctrns. Inc.	410-747-7887
MA	Topsfield, RFC-Elctrns. SLs., Inc.	508-887-8545
MI	Livonia, Amtech Reps.	313-474-8300
NJ	Denville, T. J. Sls., Inc.	201-361-5352
TX	Lewisville, Silonex Inc.	214-317-7585

SILTRONICS LTD., P.O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 110; *Sls. Mgr.:* G. Urban

SIMCO

FAX: 305-233-1990

SIMCO, 21401 SW 127 Ave., Miami, FL 33177, Tel: 305-233-9900, 800-780-9090; Empl.: 15 .... **C•1094-1096**

Local Sales Offices & Reps

CA	San Diego, Qualtronics, Inc.	619-695-0118
CT	Bethel, Instr. Dynamics	203-743-5045
GA	Atlanta, Electro Sls. Inc.	404-394-1122
IL	Cary, Bob Burns & Assocs.	708-516-3322
MD	Baltimore, Muncy Sls. Assocs.	301-484-6376
MA	Wakefield, Instr. Dynamics Inc.	617-245-5100
MN	St. Paul, Heyda-Hanks Assoc.	612-484-8531
NY	Great Neck, F & F Metro Inc.	516-482-4080
OR	Beaverton, Luscombe Eng./NW	206-223-1541
TX	Dallas, Southwest Elctrn. Ind. Inc.	214-690-9881
WA	Bellevue, Luscombe Eng./NW	206-223-1541
WI	Wauwatosa, Larsen Assocs. Inc.	414-258-0529
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

SIMCO CO., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-2171, FAX: 215-822-3795; Empl.: 150; *Sls. Mgr.:* Bob Heacock

SIMMONDS PRECISION ENGINE SYSTEMS, BF Goodrich Aerospace, P.O. Box 310, Norwich, NY 13815, Tel: 607-335-5000, FAX: 607-335-5440; Empl.: 650; *Sls. Mgr.:* G. D. Cummings

SIMPSON ELECTRIC CO., 853 Dundee Ave., Elgin, IL 60120, Tel: 708-697-2260, FAX: 708-697-2272; Empl.: 550; *Sls. Mgr.:* Brian Gieler/Jack Femmel

SIMTEK CORP., 1465 Kelly Johnson Blvd., Colorado Springs, CO 80920, Tel: 719-531-9444, FAX: 719-531-9481; Empl.: 25; *Sls. Mgr.:* L.D. Hockaday; *Dist. Mgr.:* David Bowers

SIMULEX CORPORATION, 2832-C Walnut Avenue, Tustin, CA 92680, Tel: 714-730-1500, FAX: 714-730-7176; *Sls. Mgr.:* Dave Guss

SINCLAIR RADIO LABORATORIES LTD., 85 Mary St., Aurora, Ont., Canada L4G 3G9, Tel: 416-727-0165, FAX: 416-727-0861; Empl.: 130; *Sls. Mgr.:* J.C. Stratt

SINGER DATA PRODUCTS, INC., 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6500, FAX: 708-860-3672; Empl.: 54; *Sls. Mgr.:* Shelly Kroan .... **D•1107**

Local Sales Offices & Reps

NJ	Haddonfield, Singer Data	609-429-6927

SINOTECH MADE IN CHINA, INC., Technology Communications Group, Inc., 23590 Stafford Hill Drive, West Linn, OR 97068, Tel: 503-638-1000, FAX: 503-638-1002; Empl.: 45; *Sls. Mgr.:* John Vezmar

SIPEX CORP., 22 Linnell Circle, Billerica, MA 01821, Tel: 508-667-8700, FAX: 508-667-8310; FSC No.: 33256; Empl.: 300; *Sls. Mgr.:* Emil Verano, Jack Worthen; *Dist. Mgr.:* Beth Tebbetts

SITCO ANTENNAS DIV.OF SIMPLICITY TOOL CORP., 10330 N.E. Marx St., Portland, OR 97220, Tel: 503-253-2000, FAX: 503-253-2009; Empl.: 18; *Sls. Mgr.:* M. Bureker

S.I. TECH, 901 N. Batavia Ave., Batavia, IL 60510, Tel: 708-232-8640, FAX: 708-232-8677; Empl.: 17; *Sls. Mgr.:* Ramesh Sheth; *Dist. Mgr.:* George Hain .... **B•1229**

Local Sales Offices & Reps

AL	Saraland, Coastal Computer Comm.	205-679-8657
FL	Melbourne, Raynolds & Raynolds	407-259-7000
MA	Holliston, Olson Mktg.	508-429-8066
MN	Hibbing, Minntech Ec.	218-262-5228
NM	Albuquerque, S & S Technlg.	505-298-7177
PA	Canonsburg, Performance Metrics	412-942-3035
TN	Memphis, Professional Technlg.	901-458-1228
WA	Bellevue, Interconnect Tech.	206-462-9508

Local Distributors

AL	Birmingham, Newark Ec.	205-942-4044
AK	Anchorage, Potelcom Supp.	907-274-8525
AR	Little Rock, Carlton Bates	817-293-5558
CA	Los Angeles, Anixter	213-625-7828
CA	San Francisco, Anixter	415-543-6070
CO	Denver, Newark Ec.	303-373-4540
FL	Miami, Newark Ec.	800-631-4608
IL	Chicago, Newark	312-792-8233
IL	Skokie, Anixter	800-243-8344
LA	Baton Rouge, Anixter	504-922-7755
MA	Boston, Anixter	508-682-8870
MI	Detroit, Anixter	313-478-3900
MO	St. Louis, Newark Ec.	314-821-7466
NY	Hauppauge, Manchester Equip. Co.	516-294-5351
OH	Columbus, Hughes-Peters	614-294-6215
PA	Pittsburgh, South-Hills Ec.	800-245-6215
TN	Chattanooga, Horizon Ec.	615-899-8585
TN	Clarksville, Randolph, Hale, Matthews	615-647-2325
TX	Houston, Anixter	713-460-9473
VA	Chantilly, Newark Ec.	703-471-7447
WA	Bellevue, Newark Ec.	206-641-9800
WI	Milwaukee, Anixter	414-355-0222
Can	London, Newark Ec.	519-685-4280
Can	Toronto, Anixter	416-568-8999

SITRONIC GMBH, Weissenwolffstr.14, 4221 Steyregg, Steyregg, Austria, Tel: 732-640-591-0, FAX: 732-640-592-5; Empl.: 8; *Sls. Mgr.:* Ing. Franz Peter Kogl; *Dist. Mgr.:* Mrs. Michaela Eibl

SIVERS IMA AB, 11520 Jefferson Blvd., Culver City, CA 90230, Tel: 213-306-4248, FAX: 213-390-4350; Empl.: 300; *Sls. Mgr.:* Marshall Cleland

SJOBERG, C., & SON, INC., 415 Station St., P.O. Box 3583, Cranston, RI 02910, Tel: 401-461-8220, FAX: 401-467-5446; Empl.: 20

SKB COPORATION, 434 W. Levers Place, Orange, CA 92667, Tel: 714-637-1252, FAX: 714-637-0491; FSC No.: 61302; Empl.: 170; *Sls. Mgr.:* Allan Evavold

SKF CONDITION MONITORING, 4141 Ruffin Rd., San Diego, CA 92123-1841, Tel: 619-496-3400, FAX: 619-496-3546; Empl.: 150

SKO-DIE, INC., 8050 Austin Ave., Morton Grove, IL 60053, Tel: 708-965-1130, FAX: 708-966-0322; FSC No.: 7P145; Empl.: 50; *Sls. Mgr.:* Richard J. Steininger

SKY COMPUTERS, INC., Subsidiary of Analogic Corporation, 27 Industrial Ave., Chelmsford, MA 01824, Tel: 508-250-1920, TELEX: 499-1331, FAX: 508-250-0036; Empl.: 75

SKYDYNE DIV., AAR MFG., 21 River Rd., Port Jervis, NY 12771, Tel: 914-856-6655, 800-428-CASE, FAX: 914-856-8378; Empl.: 110; *Sls. Mgr.:* M. Timney

SKYWAY MAGNETICS, 35372 Hwy 79, Warner Springs, CA 92086-9714, Tel: 619-782-3342; FSC No.: 3612,5950,3677,7584,3670,3820; Empl.: 12; *Sls. Mgr.:* John Grudziadz

SLAUGHTER CO, R.E. Phelon Co., 801 Hailey St., Ardmore, OK 73401, Tel: 405-223-4773, TELEX: 697-5577, FAX: 405-226-5757; FSC No.: 05611; *Sls. Mgr.:* T. Medrick .... **D•1325**

SL CORPORATION, 240 Tamal Vista Blvd. No. 110, Corte Madera, CA 94925, Tel: 415-927-1724, FAX: 415-927-2931; Empl.: 40; *Sls. Mgr.:* Christopher Wilson; *Dist. Mgr.:* Christopher Wilson

SLOAN™

FAX: 818-768-8326

SLOAN CO., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, Tel: 213-875-1123, TWX: 910-498-2250; FSC No.: 08717; Empl.: 25 .... **B•1182-1187**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	Montrose, Signal Entprs. Inc.	818-957-0640
CA	Mtn. View, Francisco & Assocs.	415-962-1717
RI	Warwick, Schumacher & Yarrington	401-884-5671

IL	Wheaton, CS Tech Sls.	708-653-8126
MD	Glen Burnie, Macrotech Assoc.	301-766-1111
MN	Minneapolis, Loren Green Assoc. of Minn.	612-571-6666
MO	Shawnee Mission, Microtronics	913-262-1444
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NY	Rochester, Tech. Comps.	716-342-2406
OH	Cleveland, Allan Scraga	216-232-4946
TX	Dallas, IBL Engrg. & Sls.	214-363-2921
WA	Bellevue, Olson Tech Sls.	206-883-7792

Local Distributors

AL	Huntsville, Powell Elctrns.	205-529-2731
CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Canoga Park, AMC Radio Hardware	818-998-2584
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Powell Elctrns.	408-943-9020
CT	W. Hartford, Signal Ctr. Inc.	203-236-6005
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
CA	Los Angeles, Trebor Elctrns.	213-641-8304
FL	Pompano Beach, Peerless Radio	305-973-4141
KS	Wichita, Lee Prods.	316-264-2172
MD	Annapolis, Powell Elctrns.	301-880-3355
IL	Arlington, Mar'Lyn Elctrns.	312-364-7880
MA	Westborough, Powell Elctrns.	617-366-6100
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NJ	Englewood, Powell Elctrns.	201-568-5600
OH	Dayton, D & D Packaging Co., Inc.	513-233-8585
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TN	Memphis, GFI Sls.	901-683-6252
TX	Austin, The Altair Co.	512-837-4490
NC	Cary, Powell Elctrns.	919-467-1212
TX	Houston, Altair Co.	713-462-3029
TX	Irving, Powell Elctrns.	214-258-6841
TX	Richardson, Altair Co.	214-231-5166

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
A UNIT OF GENERAL SIGNAL
SOLA ELECTRIC
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

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[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

SLOAN TECHNOLOGY, 602 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-963-4431, FAX: 805-965-0522; Empl.: 75; *Sls. Mgr.:* Drew Osterman

SL WABER, INC., 520 Fellowship Rd. Ste. 306, Mt. Laurel, NJ 08054, Tel: 609-866-8888, 800-257-8384, FAX: 609-866-1945; Empl.: 370; *Sls. Mgr.:* Edward Brown

SMART RELAY TECHNOLOGY, INC., 97 Gannet Dr., Commack, NY 11725, Tel: 516-543-7161, FAX: 516-543-7162; *Sls. Mgr.:* Ron Colino

H H SMITH, NT-T Inc., 632 Arch St., Meadville, PA 16335, Tel: 814-724-6440, FAX: 814-333-1912; Empl.: 300; *Sls. Mgr.:* Larry Zeiser; *Dist. Mgr.:* Larry Zeiser

SMK CORPORATION

FAX: 714-779-2790

SMK ELECTRONICS CORPORATION, U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960; FSC No.: 637-7400; Empl.: 219; *Sls. Mgr.:* Gary Redman/ T. Klymenko .... **C•1461**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-880-0592
CA	San Jose, Signet Tech. Sls.	408-453-0611
CO	Denver, Donohue Sls. Co.	303-455-1719
GA	Norcross, Electro-Mech.	404-447-6478
IL	Parkridge, Metcom Assocs.	708-696-1490
IN	Indianapolis, John H. Weaver Co.	317-849-1659
IN	Indianapolis, Lat-Tronics	317-846-5788
MI	Southfield, M. Gottlieb Assocs.	313-358-4151
MN	Eden Prairie, PWC Inc.	612-934-1409
NY	Dewitt, Interactive Comp. Sls.	315-445-9600
NC	Raleigh, Electro-Mech	919-790-9300
PA	Flourtown, C.G.M. Inc.	215-233-0333
RI	Warwick, Circuit-Pro, Inc.	401-738-7332
TX	Plano, Ram Elctrns.	214-578-5400
WA	Bothel, Quadra Sls. Corp.	206-489-3428
Can	Ottawa, Elctrn. Sls. Profs.	613-567-8547

Local Distributors

AZ	Phoenix, Aero-Space Southwest	602-582-2779
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Agoura Hills, Cypress Elctrns.	818-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CO	Englewood, Cypress Elctrns.	303-792-5829
CT	Danbury, Pilgrim Elctrns.	203-792-7274
FL	Ft. Lauderdale, Comp. Assocs.	305-733-4100
GA	Smyrna, ERC Parts, Inc.	404-984-0276
IN	Carmel, Altex Elctrns.	317-848-1323
MI	Grand Rapids, EC Elctrns.	616-530-0576
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Aero-Space Computer Supps. Inc.	612-884-4725
PA	Essington, Tri-Com, Inc.	215-259-7400
TX	Irving, Cypress Elctrns.	214-255-0065
WA	Bothel, Cypress Elctrns.	206-483-1144
Can	Markham, Ont., Carsten Elctrns.	416-477-7705
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321

S-MOS SYSTEMS, INC., 2460 North First St., San Jose, CA 95131, Tel: 408-922-0200, FAX: 408-922-0238

SMT EAST CORPORATION, 200 Foxborough Blvd., Foxborough, MA 02035, Tel: 800-888-SMT1, FAX: 508-543-3515; Empl.: 55; *Sls. Mgr.:* Steven E. Dutton; *Dist. Mgr.:* Kanan Technologies

SNAPTITE/ALLIED, 6424 W. Ridge Rd., Erie, PA 16506, Tel: 814-838-3190, FAX: 814-833-5439; Empl.: 75; *Sls. Mgr.:* Ed Kindlin

SOFTAID, INC., 8300 Guilford Rd., Columbia, MD 21046, Tel: 410-290-7760, FAX: 410-381-3253; Empl.: 9; *Sls. Mgr.:* Al Saxon

SOLA, 1717 Busse Rd., Elk Grove Village, IL 60007-5666, Tel: 708-439-2800, FAX: 800-626-6269; *Sls. Mgr.:* James Kimball; *Dist. Mgr.:* Brian Crowe

SOLAOYNE DIVISION, Rogers Corporation, 7447 Convoy Ct., San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105; FSC No.: 55655; Empl.: 76; *Sls. Mgr.:* Dale Reed; *Dist. Mgr.:* Rick Jansen

SOLAR ELECTRONICS CO., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038, Tel: 800-952-5302, TWX: 910-997-1921, FAX: 213-462-3721; FSC No.: 13222; Empl.: 17; *Sls. Mgr.:* Roy Talley

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981, FAX: 213-678-0103; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108, Tel: 800-628-8862, FAX: 413-788-0490; Empl.: 3; *Sls. Mgr.:* Joyce White

SoLiCo/mec
Sorenson Lighted Controls, Inc.

FAX: 1-800-275-7092

SOLICO/MEC, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092 .... **B•1812**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
CO	Denver, Advent Comps.	303-455-1985
IL	Shiller Park, WRB Inc.	708-678-7888
IN	Fort Wayne, Menze Sls.	219-747-5616
MD	Gaithersburg, Naudin Assoc., Southern, Inc.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	Minneapolis, Technical Comps. Grp.	612-561-5556
NJ	Burlington, VDE Elctrns.	609-387-9331
NY	Great Neck, Pacent Engrg.	516-482-4678
NC	Siler City, Crossroads Elctrns.	919-742-2372
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
WI	Mequon, WM Bolles Inc.	414-241-3320

Local Distributors

CA	Anaheim, Electro Comps. Distr.	213-628-2844
CA	Covina, Selecta-Switch Inc.	818-967-4123
CA	Freemont, Kea Elctrns.	415-651-2600
CA	Gardena, California Switch & Signal	213-538-9830
CA	Hayward, Electro Comps. Distr.	415-783-5800
CA	Los Angeles, Electric Switchs	213-660-1310
CA	Sunnyvale, Target Elctrncs.	408-733-0384
CA	Tustin, Western Switches & Controls	714-259-8144
CA	Van Nuys, Wes-Garde Compts.	818-786-3724
CT	Hartford, Wes-Garde Comps.	203-527-7705
FL	Lakeland, Wes-Garde Comps.	813-644-7564
GA	Tucker, CID Inc.	404-491-3143
IL	Carol Stream, Wes-Garde Comps.	708-653-1460
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Canton, Xenell	617-828-2948
MI	St. Clair Shores, Spemco Inc.	313-771-2700
MN	Minneapolis, Carl Berquist Co.	612-835-2322
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Nashua, Wes-Garde Comps.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
OR	Wilsonville, Wes-Garde Comps.	503-682-1333
SC	Columbia, Dixie Elctrns. Inc.	803-779-5332
TX	Dallas, Wes-Garde Comps.	214-357-1768
WI	Grafton, Lakeview Elctrns.	414-377-8250
WI	Milwaukee, Progressive Image	414-321-4722

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003-2596, Tel: 201-429-8700, FAX: 201-429-8683; Empl.: 110; *Sls. Mgr.:* Tom Smith, Gen. Sls. Mgr.

SOLID STATE DEVICES, 14849 Firestone Blvd., La Mirada, CA 90638, Tel: 714-670-7734; FSC No.: 30043; Empl.: 200; *Sls. Mgr.:* Sharon Pfifer

Local Sales Offices & Reps

AZ	Parker, Howard Assoc.	303-841-5755
IN	Ft. Wayne, M/S Sls. & Assoc., Inc.	219-436-3023
CA	Los Angeles, Varigon	818-594-5080
CO	Parker, Howard Assoc.	303-841-5755

FL	St. Petersburg, Bolton Assoc., Inc.	813-864-2294
FL	Pompano Bch, Bolton Assocs.	305-975-7245
IN	Greenwood, M/S Sls. And Assocs., Inc.	317-881-0110
MN	Bloomington, Bill Deming & Assoc.	612-888-5000
OH	Dublin, M/S Sls. & Assoc., Inc.	201-288-7400
NJ	Hasbrouck Heights, Comp. Tech. Sls.	201-288-7400
WA	Seattle, J.J. Backer	206-285-1300
Can	Oakville , Ont., Haltronics	800-387-7949

SOLID STATE ELECTRONICS CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257, FAX: 818-993-8259; FSC No.: 11911; Empl.: 15

Solid State
Optronics, Inc.

FAX: 408-436-1392

SOLID STATE OPTRONICS, 2 North First St., San Jose, CA 95113-1201, Tel: 408-436-1390 ...... **B•1597-1601**

SOLID STATE RELAYS, 71 Regent, Oak Brook, IL 60521, Tel: 708-932-1660, FAX: 708-887-9522

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, FAX: 617-273-4896; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, INC., Semiconductor Group, 3301 Electronics Way, West Palm Beach, FL 33407-4697, Tel: 407-848-4311, FAX: 407-863-5946; FSC No.: 21845; Empl.: 275; *Sls. Mgr.:* Margaret McNutt; *Dist. Mgr.:* Joanne Crumbley ...... **A•2219**

SOLITRON/MICROWAVE, Solitron Devices, Inc., 3301 Electronics Way, West Palm Beach, FL 33407-4697, Tel: 407-848-4311, FAX: 407-848-4311, Ext.116; FSC No.: 95077; Empl.: 175; *Sls. Mgr.:* Brian Jackson; *Dist. Mgr.:* Brian Jackson ...... **A•2219**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CO	Longmount, Piper Sls. Co.	303-443-5337
CT	Danbury, Phase One	203-791-9042
CT	Washington, Tri-Com Assocs.	203-868-7027
IL	Elgin, R.H.I. Sls. Corp.	708-888-0099
MA	Burlington, Tri-Com Assocs.	617-272-8163
MN	Edina, Gibb Tech. Sls.	612-835-3370
MO	Grandview, R.R. Burton & Assocs., Inc.	816-763-5385
NJ	Marlton, Solitron Dvs., Inc.	609-988-5470
NM	Albuquerque, Piper Sls. Co.	505-828-1300
NY	tappan, Solitron Dvs., Inc.	914-359-5050
NY	Syracuse, PiTronics, Inc.	315-455-7346
OH	Centerville, Solitron Dvs., Inc.	513-438-3308
OR	Beaverton, Quest Mktg., Inc.	503-641-7377
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Plano, Zeus Engnr.	214-423-2027
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Piper Sls. Co.	801-466-9336
WA	Renton, Quest Mktg., Inc.	206-228-2916
Can	Montreal, Que., Cana-Rep Grp., Inc.	514-576-4477

Local Distributors

CA	Burbank, Elmo Semicond.	818-768-7400
CA	Centerville, Koehike Comps., Inc.	513-435-5435
CA	San Jose, All American Semicond., Inc.	408-943-1200
CA	Torrance, All American Semicond., Inc.	213-320-0240
CA	Walnut, 3893004trns. Corp.	714-594-1731
CT	Killingworth, ACI Elctrns. Corp.	203-663-3311
FL	Miami, All American Semicond.	305-621-8282
FL	Sunrise, All American Semicond., Inc.	305-572-7999
MD	Rockville, All American Semicond., Inc.	301-251-1205
MA	Wakefield, All American Semicond.	617-246-2300
MA	Woburn, ACI Elctrns. Corp.	617-935-7230
MN	Eden Prairie, All American Semicond., Inc.	612-944-2151
NJ	Totowa, ACI Elctrns. Corp.	201-812-0507
NY	Mt. Vernon, All American Semicond., Inc.	914-699-2224
NY	Plainview, ACI Elctrns. Corp.	516-293-6630
NY	Ronkonkoma, All American Semicond., Inc.	214-231-5300
X	Richardson, All American Semicond., Inc.	214-231-5300

SOLTEC CORP., 12977 Arroyo Street, San Fernando, CA 91340-1597, Tel: 818-365-0800, 800-423-2344, FAX: 818-365-7839; Empl.: 40; *Sls. Mgr.:* Byron G. McIntire

SONICALL, INC., 3288 E. Willow Street, Signal Hill, CA 90806, Tel: 213-490-2143, FAX: 213-490-2145; *Sls. Mgr.:* Frank Handler

SONICOR INSTRUMENT CORP., 100 Wartburg Ave., Copiague, NY 11726, Tel: 516-842-3344, TELEX: 649494, FAX: 516-842-3389; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONNENSCHEIN BATTERIES INC., See East Penn Manufacturing

SONOBOND ULTRASONICS INC., Inductotherm Industries, 887 S. Matlack St., West Chester, PA 19382, Tel: 610-696-4710, 800-323-1269, FAX: 610-692-0674; FSC No.: 15882; Empl.: 21; *Sls. Mgr.:* Thomas Walraven; *Dist. Mgr.:* Kyle Kimbro

SONY COMPONENT PRODUCTS CO, Semiconductor Division, 108333 Valley View St., Cypress, CA 90630, Tel: 714-229-4197, FAX: 714-229-4271; Empl.: 120; *Sls. Mgr.:* Chuck Schouw, V.P.; *Dist. Mgr.:* Mark Marrietta

SOPHIA SYSTEMS & TECHNOLOGY, 777 California Avenue, Palo Alto, CA 94304, Tel: 415-493-6700, 800-824-9294, FAX: 415-493-4648

SORENSEN COMPANY, 615 N. Railroad Ave., Paxton, IL 60957, Tel: 800-525-2024, FAX: 217-379-9216; Empl.: 115; *Sls. Mgr.:* Gerald J. Demirjian

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, 1-800-275-7089, FAX: 1-800-275-7092; Empl.: 100; *Sls. Mgr.:* Ted Ogorzalek ...... **B•1812**

Local Sales Offices & Reps

CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
CA	San Rafael, Wright Assocs.	415-457-9940
CO	Denver, Advent Comps.	303-455-1985
FL	Tampa, Florida Comp. Sls.	813-873-3622
IL	Schiller Park, W.R.B. Inc.	708-678-7888
IN	Fort Wayne, Menze Sls.	219-747-5616
KS	Shawnee Mission, The Mertens Co.	913-432-9323
MD	Gaithersburg, Naudian Assoc. Southern, Inc.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MI	Dearborn, Pitcher-Poulin, Inc.	313-582-5450
MN	Minneapolis, Tech. Comps. Grp.	612-561-5556
MO	Clayton, Mertens Co.	314-993-6600
NJ	Burlington, VDE Elctrns.	609-387-9331
NJ	Hazlet, Pacent Engrg.	908-264-2202
NY	Great Neck, Pacent Eng. Co.	516-482-4678
NC	Siler City, Crossroads Elctrns.	919-742-2372
TX	Dallas, Glidden Electro Equip.	214-341-0610
WI	Mequon, WM Bolles Assoc., Inc.	414-241-3320

Local Distributors

AZ	Phoenix, Minarik Elec. Co.	602-233-3000
CA	Anaheim, Electro Comps. Dist.	213-628-2844
CA	Covina, Selecta Switch	818-967-4123
CA	Freemont, KEA Elctrns.	510-651-2600
CA	Gardena, California Switch & Signal	310-538-9830
CA	Glendale, Minarik Elec. Co.	818-507-6445
CA	Los Angeles, Electric Switches	213-660-1310
CA	San Diego, Minarik Elec. Co.	619-560-6632
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, Wes-Garde Comps. Grp.	818-786-3724
CO	Commerce City, Minarik Elec. Co.	303-289-5800
CT	Hartford, Wes-Garde Comp. Grp.	203-527-7705
FL	Lakeland, Wes-Garde Comp. Grp.	813-644-7564
GA	Tucker, CID, Inc.	404-491-3143
IL	Carol Stream, Wes-Garde Comp. Grp.	708-653-1460
KS	Overland Pk., Wes-Garde Comps.	913-262-2718
MA	Canton, Xenell	617-828-2948
MI	St. Clair Shores, Specialities Mfg.	313-771-2700
MN	Minneapolis, Carl Bergquist	612-835-2322
MO	St. Louis, Wes-Garde Comp. Grp.	314-567-7776
NH	Nashua, Wes-Garde Comp. Grp.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comp. Grp.	609-778-8190
NY	Woodside, Switches Unltd.	718-478-5000
OH	Valley City, Roberts Elctrns.	216-225-4646
OH	Westerville, Wes-Garde Comps. Grp.	614-885-0319
OR	Portland, Minarik Elec.	503-253-3402
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Wes-Garde Comp. Grp.	214-357-1768
TX	San Antonio, Minarik Elec.	512-822-7097
WI	Grafton, Lake-View Elctrns.	414-377-8250
WI	Milwaukee, Progressive Image	414-321-4722
Can	Edmonton, Deskin Sls.	403-466-2106
Can	Montreal, Deskin Sls.	514-331-2860
Can	Ottawa, Deskin Sls.	613-228-1201
Can	Toronto, Deskin Sls.	416-475-1412
Can	Vancouver, Deskin Sls.	604-324-8343
Can	Winnipeg, Deskin Sls.	403-466-2106

SOR, INC., 14685 W. 105th St., Lenexa, KS 66215, Tel: 913-888-2630, TELEX: 4992783, FAX: 913-888-0767; Empl.: 200; *Sls. Mgr.:* Steve Highberger

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 3775-9119, TELEX: 246-6377, FAX: (03) 3775-7092; Empl.: 1150; *Sls. Mgr.:* M. Chiba, Overseas Dept.

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729-5701, Tel: 516-242-2200, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Anthony Fischetti

SOUTH AMERICAN DEVELOPMENT CORP., 29 Noxon Rd., Poughkeepsie, NY 12590, Tel: 914-452-1305, FAX: 914-452-2526; Empl.: 80; *Sls. Mgr.:* C. Healy

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, FAX: 404-252-8929; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONIC, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 50; *Sls. Mgr.:* John Levyssohn

SOUTHTRONICS, INC., 1265 Kennestone Circle, Marietta, GA 30066-6029, Tel: 404-429-1000, FAX: 404-424-2000; *Sls. Mgr.:* David Coleman

SOUTHWALL TECHNOLOGIES INC., 1029 Corporation Way, Palo Alto, CA 94303, Tel: 415-962-9111, FAX: 415-967-8713; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.:* Terri Harris, Prod. Mgr.

SOUTHWESTERN NAMEPLATE & MFG. CO., INC., P.O. Box 35, Fourth St., Anna, TX 75003, Tel: 214-231-6663, 214-924-3289, 1-800-331-6600, FAX: 214-924-3090; Empl.: 14

SPACE ELECTRONICS, INC., 81 Fuller Way, Berlin, CT 06037, Tel: 203-829-0001, FAX: 203-829-0005; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPECIAL ELECTRIC CO., INC., 3628 W. Pierce St., Milwaukee, WI 53215, Tel: 414-383-6370, TELEX: 910-262-3106, FAX: 414-383-6725; Empl.: 40; *Sls. Mgr.:* F. James Heider

SPECIALIZED PRODUCTS COMPANY, 3131 Premier Dr., Irving, TX 75063, Tel: 214-550-1923, TELEX: 732764, FAX: 214-550-1386; Empl.: 39; *Sls. Mgr.:* Paul Jones

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 800-456-SPEC, FAX: 203-269-5293; Empl.: 72

SPECIALTY COATING SYSTEMS, INC., 5707 W. Minnesota St., Indianapolis, IN 46241, Tel: 317-244-1200, FAX: 317-240-2073; Empl.: 135; *Sls. Mgr.:* Bill Yager

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SPECIALITY ELECTRONICS, INC., 19200 Asheville Hwy., Landrum, SC 29356, Tel: 803-457-3824; Empl.: 80; *Sls. Mgr.:* Tim Smith; *Dist. Mgr.:* Frank Pellatt .... **C•1462-1467; D•1475**

Local Sales Offices & Reps

PA	Lewisberry, Specialty Elctrns., Inc.	717-938-6171, FAX:717-938-5910

SPECO DIV., Components Specialties, Inc., 1172 Rte. 109, P.O. Box 624, Lindenhurst, NY 11757-0624, Tel: 516-957-8700, 800-645-5516, FAX: 516-957-9142; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman/Angela Carolan; *Dist. Mgr.:* Mel Hulkower

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587, FAX: 716-381-4998; *Sls. Mgr.:* Edward F. O'Connor

SPECTRAL INNOVATIONS, 4633 Old Ironsides Dr., Ste. 401, Santa Clara, CA 95054-1807, Tel: 408-727-1314, FAX: 408-727-1423

SPECTRA LUX CORP., 11825 120th Ave. NE, Kirkland, WA 98034, Tel: 206-823-6857, FAX: 206-821-3193; FSC No.: 51896; Empl.: 120; *Sls. Mgr.:* Woody Hertzog

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 508-347-2261, FAX: 508-347-1211; FSC No.: 6V569; Empl.: 150

SPECTRA-PHYSICS LASERS INC., 1330 Terra Bella Ave.,P.O. Box 7013, Mountain View, CA 94039-7013, Tel: 415-961-2550, 800-456-2552, TELEX: 348-488, FAX: 415-969-4084; *Sls. Mgr.:* Bob Turcotte

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 719-599-9254, FAX: 719-599-0815; Empl.: 15; *Sls. Mgr.:* Don Trutwin

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP, See Amphenol Products

Spectrol®

FAX: 909-923-6765

SPECTROL ELECTRONICS CORP., 4051 Greystone Dr., Ontario, CA 91761, Tel: 909-923-3313; FSC No.: 02111; Empl.: 200; *Sls. Mgr.:* Rob Taflinger; *Dist. Mgr.:* Rob Taflinger .... **A•2119-2121; B•2016-2017**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-536-9775
AZ	Scottsdale, JK Assocs.	602-990-8804
CA	Huntington Beach, West Elctrns. Sls.	714-375-5500
CA	San Diego, Hadden & Assoc.	619-565-9444
CA	San Jose, Silicon Valley	408-432-1967
CO	Denver, West, Inc.	303-477-8180
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, DHR Mktg.	407-331-1199
IL	Naperville, Lancastle Sls.	708-527-1142
IA	Cedar Rapids, Lowell-Kangas	319-362-9290
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
GA	Duluth, DHR Mktg.	404-564-0529
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Bloomington, Mumco	612-854-4161
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NM	Scottsdale, AZ, J.K. Assocs.	602-990-8804
NY	Commack, E.R.A.	516-543-0510
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg.	919-829-1970
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Dayton, Luebbe Sls.	513-438-0490
OH	Westlake, Luebbe Sls.	216-899-0071
OR	Beaverton, Westmark Elctrn., Inc.	503-641-8780
PA	Pittsburgh, Luebbe Sls.	412-364-0490
TN	Nashville, DHR Mktg.	205-722-0440
TX	Richardson, Pro Comp. Sls. Co.	214-669-1500
VA	Sterling, Beacon North	703-478-2480
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Lancastle, Lancastle	414-569-9084
Can	Markham, Deskin Sls.	416-475-1412

Local Distributors

AL	Mobile, Newark Elctrns.	205-471-6500
AZ	Phoenix, Newark Elctrs.	602-864-9905
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Scottsdale, Kent/Shelley-Ragon	602-998-0399
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Fountain Valley, Component Center	714-979-0433
CA	Orange, Newark Elctrs.	714-634-8224
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Kent/Shelley-Ragon	303-762-0670
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Largo, Kent/Shelley-Ragon	813-545-0057
GA	Norcross, Newark Elctrns.	404-448-8500
ID	Boise, Newark Elctrns.	208-342-4311
IL	Bensenville, Voyager	312-860-1300
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Rosemont, Advent	708-297-6200
IN	Ft. Wayne, Newark Elctrns.	219-484-0766
IN	Indianapolis, Olive Elctrns.	317-253-9065
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Lenexa, Sterling Elctrns.	913-492-5406
MD	Columbia, Newark Elctrns.	301-964-4482
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Tewksbury, Armor Elctrns.	508-640-1499
MA	Waltham, Newark Elctrns.	617-894-8050
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oakpark, Newark Elctrns.	313-967-0600
MN	Bloomington, Sterling Elctrns.	612-831-2666
MN	Fridley, Voyager	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	St. Paul, Kent/Shelley-Ragon	612-642-2828
MN	St.Paul, Gopher Elctrns.	612-483-3322
MO	Independence, Kent/Shelley-Ragon	816-254-3410
MO	Maryland Heights, Olive Elctrns.	314-997-7709
NJ	Randolph, Mouser Elctrns.	201-328-3322
NJ	Union, Newark Elctrns	908-851-2290
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Medford, Kent/Shelley-Ragon	516-447-2000
NC	Charlotte, Newark Elctrns.	704-535-5650
OH	Akron, Akron Elctrns. Supp.	216-762-8818
OH	Cincinnati, Newark Elctrns.	513-722-8181
OH	Columbus, Electronics Mktg.	614-299-4161
OH	Dayton, Stotts-Friedman	513-298-5555
OK	Tulsa, Altair	918-252-5781
OR	Portland, Radar Elec.	503-232-3401
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	N. Versailles, CMD	412-678-6020
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Knoxville, Newark Elctrns.	615-588-6493
TN	Nashville, Randolph & Rice	615-255-5601
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Kent/Shelley-Ragon	713-780-7770
TX	Houston, Sterling Elctrns.	713-623-3900
TX	Mansfield, Mouser Elctrns.	817-483-0165
TX	Richardson, Altair	214-231-5166
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Newark Elctrns.	206-641-9800
WA	Redmond, Kent/Shelley-Ragon	206-883-7200
WA	Seattle, Radar Electrns.	206-282-2511
WV	Charleston, Newark Elctrns.	304-744-9022
WI	Milwaukee, Newark Elctrns.	414-453-9100

SPECTRON ENGINEERING INC., 255 Yuma Ct., Denver, CO 80223, Tel: 303-733-1060, FAX: 303-733-2432; Empl.: 9; *Sls. Mgr.:* Zdzislav Krzystek

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; Empl.: 70; *Sls. Mgr.:* Bob Marshall

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840/1-800-274-8888, TWX: 510-222-5877, FAX: 516-333-4859; Empl.: 150; *Sls. Mgr.:* David Ross

SPECTRUM CONTROL, INC.

FAX: 814-835-9000

SPECTRUM CONTROL, INC., 6000 West Ridge Rd., Erie, PA 16506, Tel: 814-835-4000; FSC No.: 33095;5733; Empl.: 604; *Sls. Mgr.:* D. Reynolds; *Dist. Mgr.:* D. Zaday .... **A•1677-1679; C•1468**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-880-8050
AZ	Tempe, Westrep	602-820-9932
CA	Huntington Bch., West Elctrn. Sls.	714-375-6500
CA	Mountain View, RF Assocs. North	415-694-4972
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Margate, EPM Corp.	305-977-0331
GA	Atlanta, EMA, Inc.	404-448-1215
IL	Crystal Lake, Spectrum Control, Inc.	815-477-2600
IA	Cedar Rapids, T. L. Dowell & Assoc.	319-393-7920
KS	Overland Park, T. L. Dowell & Assoc.	913-722-4242
MD	Centerville, EMC Technlgsts.	410-758-3510
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Bloomington, Mumco	612-854-4161
MO	St. Louis, T. L. Dowell & Assoc.	314-849-4234
NJ	Brielle, EMC Technlgsts.	908-223-6699
NY	Victor, EMC Technlgsts.	716-924-1844
NC	Raleigh, EMA, Inc.	919-847-8800
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
TX	Dallas, J.Y. Schoonmaker Co.	214-349-1650
UT	Salt Lake City, Lindberg Co.	801-484-8689
VA	Sterling, EMC Technlgsts.	703-450-7988
WA	Redmond, EMG, Inc.	206-882-0962
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121

SPECTRUM CORP., 10048 Easthaven, Houston, TX 77075, Tel: 713-944-6200, 1-800-392-5050(Sls), FAX: 713-944-1290; Empl.: 35; *Sls. Mgr.:* Gary W. Liddell; *Dist. Mgr.:* Jim B. Bishop

SPECTRUM DEVICES, P.O. Box 1586, Sugar Land, TX 77487-1586, Tel: 713-242-6417, FAX: 713-242-6415; FSC No.: 0RNT4; Empl.: 7; *Sls. Mgr.:* Sajid Rafique

SPECTRUM SIGNAL PROC., 250 H st., P.O. Box 8110-25, Blaine, WA 98231-0025, Tel: 1-800-663-8986 (US), 604-421-5422, FAX: 604-421-1764; Empl.: 48; *Sls. Mgr.:* Brian Lowe; *Dist. Mgr.:* Rod Jensen

Local Sales Offices & Reps

CA	Mountain View, Spectrum Signal Processing	415-903-7355
MA	Westborough, Spectrum Signal Processing	800-323-1842,508-366-7355
Can	Burnaby, B.C., Spectrum Signal Processing	800-663-8986,604-421-5422

Local Distributors

CA	Mountainview, Thorson West	415-964-9300

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 749 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-7791, TWX: 910-334-1163, FAX: 805-683-3481; FSC No.: 32464; Empl.: 70; *Sls. Mgr.:* R.L. Waguespack

SPEEDY CIRCUITS, PJC Technologies, Inc., 5332 Commerical Dr., Huntington Bch., CA 92649, Tel: 714-898-4901, FAX: 714-891-0607; Empl.: 36; *Sls. Mgr.:* Jon P. Herkins

Spellman
High Voltage Electronics Corp

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 180; *Sls. Mgr.:* Eric Marko; *Dist. Mgr.:* Eric Marko .... **D•1922-1935**

Local Sales Offices & Reps

Can	British Columbia, Broman Engrg.	604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12; *Sls. Mgr.:* Andrew Richardson

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104, FAX: 516-434-3128; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296-465 SPIR UR, FAX: 801-735-5231; Empl.: 15; *Sls. Mgr.:* Ed Danahy

SPRAGUE, 70 Pembroke Rd., Concord, NH 03301, Tel: 603-224-1961, FAX: 603-224-1430 .... **A•1166-1167**

SPRAGUE, Solid Tantalum Capacitors, 678 Main Street, Sanford, ME 04073-0231, Tel: 207-324-4140, FAX: 207-324-7223; *Sls. Mgr.:* Bob Marlowe ... **A•1166-1167**

SPRAGUE, Wet & Foil Tantalum Capacitors, 1600 Curran Hwy., North Adams, MA 01247-3987, Tel: 413-664-4431, FAX: 413-663-5079; *Sls. Mgr.:* Mike Duffy .... **A•1166-1167**

SPRAGUE, 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200, 603-883-9774 (Mktg), FAX: 603-880-1910; *Sls. Mgr.:* Phil Brucato

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Martin D. Markson .... **A•1164-1165**

Local Sales Offices & Reps

AL	Huntsville, TMA	205-883-7893
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
CA	Dana Point, Quattro Sls. Assocs.	714-493-1720
CA	Hermosa Bch., Quattro Sls. Assocs.	310-372-4221
CA	Moorpark, Quattro Sls. Assocs.	805-523-2978
CA	San Diego, Quattro Sls. Assocs.	619-581-3093
CO	Englewood, Cain Technlg.	303-220-8118
CT	KSA Connecticut	203-524-5849
FL	Deerfield, TMA	305-427-1090
FL	Largo, TMA	813-531-4405
FL	Winter Park, TMA	407-671-2245
GA	Norcross, TMA	404-446-3565
IL	Wood Dale, B.N.I. Elctrns.	708-595-9210
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665
IA	Marion, M.S.B. Assocs.	319-377-6261
KS	Roeland Park, M.S.B. Assocs.	913-432-2131
MD	Manchester, Imagitron Sls.	410-374-5600
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
MO	St. Charles, M.S.B. Assocs.	314-946-5577
NJ	Imagitron Sls. Co., Inc.	800-638-3592
NM	Albuquerque, SSA of New Mexico	505-889-2901
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Johnson City, Upstate Engrg. Sls.	607-729-0827
NY	Melville, R F Elctrns. Sls. Co. Inc.	516-420-8890
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	Raleigh, TMA	919-872-5104
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-582-0003
OH	Stow, Stegman Blaine Mktg.	216-688-6421
OH	Vandalia, Stegman Blaine Mktg.	513-890-7975
OK	Tulsa, Delta Comps.	918-592-7711
OR	Beaverton, Harry Levinson Co.	503-690-1312
TX	Seagoville, Delta Comps.	214-287-6333
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Waukesha, BNI Elctrns.	414-784-3544
PR	Caroline, Elctrn. Sls. Assocs.	809-762-6459
Can	Halifax, Norgay Entprs.	902-864-4321
Can	Montreal, Norgay Entrps.	514-932-3233
Can	Ottawa, Norgay Entprs.	613-745-4051
Can	Toronto, Ont., Norgay Entprs.	416-234-8966
Can	Vancouver, Norgay Entprs.	604-940-8988

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Milpitas, TTI, Inc.	408-946-5577
CA	Mission Hills, TTI, Inc.	818-891-8885
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900
CA	San Diego, TTI, Inc.	619-748-2025
CA	Santa Ana, TTI, Inc.	714-641-9393
CA	Tustin, Projections Unltd.	714-544-2700
CO	Denver, TTI, Inc.	303-429-6806
CT	Wallingford, TTI, Inc.	203-284-7474
FL	Ft. Lauderdale, Bros. Elctrns. of FL	305-561-6700
FL	Melbourne, New Yorker Elctrns.	407-727-0955
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, TTI, Inc.	404-662-0911
IL	Schaumberg, TTI Inc.	708-884-6500
IN	Indianapolis, Meunier Elctrns., Supp.	317-635-3511
MD	Columbia, TTI, Inc.	301-995-1331
MA	Wilmington, TTI, Inc.	508-658-4700
MN	Minnetonka, TTI, Inc.	612-933-8555
NJ	Fairfield, Tri Start Elctrns.	201-227-3500
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NY	Ronkonkoma, TTI, Inc.	516-737-2000
OH	Dayton, TTI Inc.	513-898-8330
OH	Independence, TTI Inc.	216-328-9755
TX	Ft. Worth, TTI, Inc.	817-595-3100
TX	Garland, J & S Elctrns. Inc.	214-487-8808
WA	Redmond, TTI, Inc.	206-882-0291
WA	Seattle, Kam Elctrns.	206-382-1300
Can	Toronto, Ont., Norgay Entprs. Ltd.	416-234-8966

S-PRODUCTS INC., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-331-9546, FAX: 203-335-2723; Empl.: 4

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 708-397-2600, FAX: 708-397-8814; Empl.: 17,000; *Sls. Mgr.:* D. Pugh, Sls. VP; *Dist. Mgr.:* K. Fairleigh, Distbn. Mktg. & Sls. VP

SQUARE D COMPANY, 1700 Sunshine Drive, Clearwater, FL 34625, Tel: 813-447-2511, FAX: 813-447-4662; Empl.: 175; *Sls. Mgr.:* Nick Powers

SQUARE D. COMPANY, Control Products, Hwy 64 East, Knightdale, NC 27545, Tel: 919-266-3671, FAX: 919-266-8393; Empl.: 900

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-265-0856; FSC No.: 21441

SRT ELECTRO-OPTICS, INC., 756 Tom Martin Drive, Birmingham, AL 35211, Tel: 205-916-2929, FAX: 205-916-2903; Empl.: 35

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, FAX: 315-638-0333; Empl.: 250; *Sls. Mgr.:* D. Carroll

S SQUARED ELECTRONICS, formerly ComTech Systems, Inc., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

STACKBIN CORP., 29 Powder Hill Rd., PO Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-333-1603, FAX: 401-333-1952; Empl.: 50; *Sls. Mgr.:* Lisa Porazzo; *Dist. Mgr.:* Timothy J. O'Leary

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

STACKPOLE, MAGNET DIV., 700 Elk Ave., Kane, PA 16735, Tel: 814-837-0272, FAX: 814-837-0277; *Sls. Mgr.:* G.A. Olson, Mgr. Sls. & Mktg.

STACO, INC., See Staco Transpower Components Corp. of America

STACO ENERGY PRODUCTS CO.

FAX: 513-253-1723

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Don Ruther .... **A•2535; D•1936**

Local Sales Offices & Reps

CA	Mtn. View, Westech	415-961-1422
CO	Denver, EDS	303-871-8865
FL	Maitland, Hawkins Frederickson	407-831-2474
GA	Atlanta, Millar	404-634-3350
IL	Chicago, Saffro	708-299-7680
MA	Lexington, Hathaway	617-861-7010
MI	Detroit, R.C. Nordstrom	313-559-7373
MO	St. Louis, Dowell	314-849-4234
NY	Clarence, R.W. Mitscher	716-759-2350
NY	Northport, LSC	516-266-5020
NC	Raleigh, Millar	919-828-8840
OH	Cleveland, Depco	216-442-6200
OR	Hillsboro, Turn-A-Round	503-640-4661
PA	Philadelphia, ECSC	215-825-8610
Can	Scarborough, Decade	416-439-9921

Local Distributors

AL	Birmingham, JLS	205-322-2486
CA	San Francisco, Stevens Engrg.	415-588-9200
CO	Arvada, Denver Beta Wintronic	303-431-7161
CT	Wallingford, Sager Elctrn. Supp.	203-265-4600
FL	Miami, Elctrn. Equip.	305-526-6060
FL	Tampa, EMSCO	813-253-2684
GA	Atlanta, Cleveland Elec.	404-696-4550
HI	Honolulu, Victor Kim	808-841-6266
IL	Chicago, Newark Elctrns.	312-792-8233
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Indianapolis, Bell Inds.	317-875-8200
KY	Louisville, Peerless	502-637-7674
LA	Lafayette, Ralph's	318-234-4507
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Somerville, Electro Sls.	617-666-0500
MI	Madison Hgts., Galco	313-542-9090
MN	Minneapolis, Elctrn. Center	612-378-2442
MS	Jackson, Ellington Elctrns.	601-355-0561
MO	St. Louis, Van Sickle Ind.	314-621-5000
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Dayton, Stotts Friedman Elctrns.	513-298-5555
PA	Drexel Hill, Kass Elctrns.	215-449-2300
SC	Charleston, Wholesale Elctrns.	803-722-2634
TN	Knoxville, Indl. Elctrns.	615-573-7135
TN	Nashville, Randolph & Rice	615-255-5602
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	San Antonio, Sherman Elctrns.	210-224-1001
VA	Charlottesville, VA Elctrns.	804-296-4184
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Scarborough, Decade Elctrns.	416-439-9921

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, FAX: 714-549-0930; FSC No.: 12522;Multiple; Empl.: 80; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, Components Corp. of America, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, FAX: 618-263-3150; FSC No.: 83008; Empl.: 75; *Sls. Mgr.:* Lori Jeffries

STAFFALL INC., 1468 Elmwood Ave., Cranston, RI 02910, Tel: 401-461-5554, TWX: 710-381-6964; Empl.: 25

STAG MICROSYSTEMS INC., 1600 Wyatt Drive, Santa Clara, CA 95054, Tel: 408-988-1118, 1-800-227-8836, FAX: 408-988-1232; Empl.: 120; *Sls. Mgr.:* Bob Herriford; *Dist. Mgr.:* Bob Herriford

STAINLESS, INC., 210 S. 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Owen F. Ulmer

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STANCOR, White-Rodgers, 131 Godfrey St., Logansport, IN 46947, Tel: 219-722-2244; FSC No.: 80089; Empl.: 400; *Sls. Mgr.:* Richard K. Noel; *Dist. Mgr.:* Judi Carpenter, Prod. Mgr. ..... **A•2558-2564; B•1602-1604; D•1937**

Local Sales Offices & Reps

AL	Athens, E.M.F.	205-233-2947
AZ	Scottsdale, Suntech Sls.	602-860-8262
CA	Irvine, Groh Assocs.	714-837-9871
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Denver, West, Inc.	303-477-8180
CT	Waterbury, Cannon Assocs.	203-597-0240
FL	Tampa, Uni-Rep	813-681-3477
GA	Atlanta, E.M.F.	404-948-6023
IL	Chicago, Joel Wasserman Assocs.	708-256-3566
IN	Indianapolis, Century Tech. Sls.	219-329-0447
IA	Cedar Rapids, Lowell Kangas	319-362-9290
KS	Shawnee, Lowell Kangas	913-631-3515
MD	Sykesville, D.J.C.	301-795-7020
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Lowell Kangas	314-821-4050
NH	Nashua, Cannon Assoc.	603-598-4766
NM	Albuquerque, Marino Elec.	505-292-0007
NY	Rochester, Senntec	716-425-3954
NC	Lillington, E.M.F.	919-867-6221
OH	Beachwood, Elctrn. SalesMasters	216-831-9555
OR	Beaverton, Temper Tech.	503-292-8201
PA	Philadelphia, D.J.C.	215-334-4533
RI	Barrington, Cannon Assocs.	401-245-0850
TX	Richardson, Pro-Comp Sls.	214-669-1500

STANDARD CONDENSER CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-675-3133, FAX: 708-675-3709; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl., El Monte, CA 91731, Tel: 818-443-2121, FAX: 818-443-9049; FSC No.: 30149; Empl.: 45; *Sls. Mgr.:* Kathy Allee; *Dist. Mgr.:* Kathy Allee ..... **A•1481**

Local Sales Offices & Reps

AZ	Phoenix, Suntech	602-860-8262
CA	Fallbrook, Chilcote Assoc.	619-728-7678
CA	Huntington Beach, Force 1 Sls.	714-963-3949
CA	Sunnyvale, ESCO Assoc.	408-745-1410
FL	Winter Pk., HHP Assoc.	407-740-0320
IN	Ft. Wayne, M/S Sls.	219-436-3023
MI	Grand Rapids, R.P. Urban & Assocs.	616-245-0511
MN	Afton, Real Elctrns.	612-436-1950

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
CA	Carlsbad, Aegis Elctrn. Grp.	619-729-2026
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, Sierra West	408-945-1050
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Largo, Elctrn. Precepts of Fl.	813-544-3636
FL	Melbourne, Dove Elctrns.	407-242-6916
GA	Norcross, NRC Elctrns.	404-729-0411
IN	Indianapolis, Mar	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Wyoming, EC Elctrns.	616-530-0576
NV	Las Vegas, Kiesub Elctrns.	702-733-0024
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Fairfield, Tri Start	201-229-3500
NY	E. Setauket, Dove Elctrns.	800-232-9825
NY	Ronkonkoma, TRI Start	516-737-2200
TX	Richardson, Ewing Elctrns.	214-231-6725
VA	Vienna, Dove Elctrns.	703-893-1821

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, FAX: 201-256-2820; Empl.: 26

STANDARD GRIGSBY, INC., FLINT INDUSTRIES, See OakGrigsby, Inc.

STANDARD GRIGSBY INC., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239

STANDARD INSERT CO., Penn Engrg. & Mfg. Corp., 5190 Old Easton Rd., Danboro, PA 18916, Tel: 215-766-0960, FAX: 215-766-0962; Empl.: 7; *Sls. Mgr.:* Ed Soorikian

STANDARD MAGNETIC CORP., 7231 Garden Grove Blvd., Ste. D, Garden Grove, CA 92641, Tel: 714-379-5671, FAX: 714-379-5673; FSC No.: 51103; Empl.: 20; *Sls. Mgr.:* Satish Jain

STANDARD MICROSYSTEMS, 80 Arkay Dr., Hauppauge, NY 11788, Tel: 516-273-3100, FAX: 516-273-3123; FSC No.: 53848; Empl.: 500

STANDARD REFERENCE LABS, INC.,, See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 1959 E. Cashdan St., Rancho Dominguez, CA 90220, Tel: 310-609-1811, 800-326-0006, TELEX: 65-3423, ESYLNK: 62931655, FAX: 310-609-1862; Empl.: 50; *Sls. Mgr.:* Dan Varvais; *Dist. Mgr.:* Jerry Gaither

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Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-464-0745
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
FL	Lutz, R.W. Mitscher Co.	813-948-2351
FL	Tequesta, R.W. Mitscher Co.	407-575-4485
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Nielson Mktg.	312-437-2700
IN	Granger, Gregory Sls. Co.	219-272-9626
KS	Olathe, G.M. Brown & Assoc.	913-829-3086
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MN	Bloomington, Jay Borman Sls. Co.	612-922-7909
MO	Florissant, G.M. Brown & Assoc.	314-839-3600
NJ	Woodbridge, Jade Mktg.	201-750-2998
NY	Binghamton, R.W. Mitscher Co., Inc.	607-724-6561
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NC	Davidson, R.W. Mitscher Co., Inc.	704-896-7434
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Components Technlg.	503-292-1518
PA	Wynnewood, Metz-Jade Assocs., Inc.	215-896-7300
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
VA	Richmond, R. W. Mitscher Co., Inc.	804-222-5425
WI	Manitowoc, Brainard-Wilson Mktg.	414-682-1201

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STANDISH INDUSTRIES, Standish LCD Div., W7514 Hwy V, Lake Mills, WI 53551, Tel: 414-648-1000; FSC No.: OS145; Empl.: 250; *Sls. Mgr.:* Richard D. Barbieri ..... **B•1118**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Boulder, Design Technlg. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Tampa, Bob Dean, Inc.	813-969-2875
GA	Atlanta, Wallace Elctrn. Sls.	404-634-3159
IL	Skokie, Indl. Rep.	708-967-8430
IN	Carmel, TMC	317-844-8462
IN	Ft. Wayne, TMC	219-432-5553
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, TMC	502-245-7411
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	St. Louis, Rush & West	314-965-3322
NJ	Hackensack, Coakley, Boyd, Abbett, Metro	201-440-4114
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Centerville, Bear Mktg.	513-436-2061
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin, Procomp Sls. Co.	512-331-0800
TX	Hurst, Procomp Sls. Co.	817-589-0336
TX	Richardson, Procomp Sls. Co.	214-669-1500
WI	Brookfield, Indl. Rep.	414-789-9393
Can	Oakville, Ont., Haltronics Ltd.	416-844-2121

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Displays Plus	303-730-7333
CT	Danbury, Heilind Elctrns.	203-797-8600
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Saginaw, Shand Elctrns.	517-753-9900
MN	Minneapolis, Voyager Elctrns.	612-571-7766
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distr.	716-887-2800
NY	Rome, Rome Elctrns.	315-337-5400
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Repco	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elec.	503-232-3404
PA	McKean, Advacom	814-476-7774
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Stafford, Harrison Equip.	713-879-2700
TX	Stafford, Southwest Elctrns.	713-240-4000
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Mequon, Taylor Elec.	414-241-4321
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Ottawa, Ont., Semad Elctrns.	613-727-8325
WA	Bellevue, Testco, Inc.	206-454-7422

STANFORD RESCH. SYS., INC., 1290 D. Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-9040, FAX: 408-744-9049; *Sls. Mgr.:* Daniel R. Melick

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95056, Tel: 408-748-1010, TWX: 910-339-9531, FAX: 408-980-1066; FSC No.: 61362; Empl.: 900; *Sls. Mgr.:* Chuck Frank

STANGENES INDUSTRIES, INC., 1052 East Meadow Circle, Palo Alto, CA 94303, Tel: 415-493-0814, FAX: 415-855-9926; FSC No.: 62709; Empl.: 61; *Sls. Mgr.:* Magne Stangenes

STANLEY ELECTRONICS DIV., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000; FSC No.: 61544; Empl.: 12

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FAX: 714-222-0555

I I STANLEY CO., INC., 2660 Barranca Pkwy., Irvine, CA 92714, Tel: 1-800-LED-LCD1; Empl.: 450; *Sls. Mgr.:* Bill Roth ..... **B•1130, 1188-1189**

Local Sales Offices & Reps

AZ	Scottsdale, B.S.E.	602-483-0373
CA	Irvine, Gravley & Assoc., Inc.	714-852-9994
CA	San Jose, Signet	408-453-0611
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Pt., Jack Krutek Assoc.	305-783-2501
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Indianapolis, EMCI	317-921-3450
KS	Overland Park, Mink Assoc.	913-341-8309
MD	Highland, Penn Star Elctrns.	301-854-2308
MA	N. Reading, Alpha-Omega Sls.	508-664-1118
MO	Bridgeton, Mink Assoc.	314-291-5454
NJ	Long Valley, Paul Sweeney Co., Inc.	908-852-1434
NY	N. Syracuse, Entec Grp. Inc.	315-458-7936
NC	Greensboro, Arthur, Harris & Assoc., Inc.	919-275-3030
OH	Lexington, EMCI	414-884-3639
PA	Penn Star Elctrns.	301-854-2308

TX	Dallas, Norcom	214-386-4888
UT	Sandy, First Source	801-943-6894

Local Distributors

AL	Huntsville, Future Elctrns.	205-830-2322
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Indelco, Inc.	303-795-3431
CT	Hartford, Wesgarde Comps. Grp.	203-527-7705
FL	Lakeland, Wesgarde Comps. Grp.	813-644-7564
GA	Norcross, Milgray Elctrns.	404-446-9777
IL	Woodale, NEP Elctrns.	708-595-8500
IN	Carmel, Altex	317-848-1323
IA	Cedar Rapids, DEE Elctrns. Inc.	319-365-7551
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Columbia, Future Elctrns.	410-290-0600
MA	Bolton, Future Elctrns.	508-779-3000
MI	Livonia, Future Elctrns.	313-261-5270
MN	Roseville, Chris Elctrns.	612-631-2647
MO	St. Louis, Wesgarde Comps. Grp.	314-567-7776
NH	Nashua, Wesgarde Comps. Grp.	603-880-1971
NJ	Mt. Laurel, Wesgarde Comps. Grp.	609-778-8190
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NC	Concord, Future	704-455-9030
OH	Westerville, Wes Garde Comps.	614-885-0319
OR	Portland, Cypress Elctrns.	503-223-8900
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Houston, Kent Elctrns.	713-789-7770
UT	Murray, Milgray Elctrns.	801-261-2999
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Waukesha, Future Elctrns.	414-786-1884

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600, TELEX: 847-345; Empl.: 5000; *Sls. Mgr.:* Ernie Gitlin, Vic Joliat; *Dist. Mgr.:* Frank Casey

STANPAT PRODS., 100 Goldstein Drive, Woonsocket, RI 02895, Tel: 401-766-8400, FAX: 401-767-0244; Empl.: 35; *Sls. Mgr.:* John Howley

STANTON MAGNETICS, INC., 101 Sunnyside Blvd., Plainview, NY 11803-1511, Tel: 516-349-0235, FAX: 516-349-0230; Empl.: 300; *Sls. Mgr.:* Ed Maidel; *Dist. Mgr.:* Ed Maidel

STAR CASE MANUFACTURING CO., INC., 648 Superior Avenue, Munster, IN 46321, Tel: 219-922-4440, 800-822-STAR (outside IN), 800-782-CASE (inside IN), FAX: 219-922-4442; Empl.: 75; *Sls. Mgr.:* Veronica Stadden

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FAX: 908-572-5095

STAR MICRONICS, INC., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 908-572-9512; Empl.: 120; *Sls. Mgr.:* Georgia Lombardi; *Dist. Mgr.:* Chris Duffy **D•1068-1071, 1108-1111**

Local Sales Offices & Reps

CA	Burbank, Star Micronics	818-972-1877
IL	Arlington Hgts., Star Micronics	708-670-7222

Local Distributors

CA	Los Angeles, Elec. Switches, Inc.	213-660-1310
CA	Pasadena, MS Cash Drawer	818-792-2111
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Sunnyvale, Penstock Inc.	408-730-0300
CA	Tustin, OBI Dists.	714-258-1411
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Oldsmar, Applied Power	813-854-4004
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Wood Dale, NEP Elctrns.	708-595-8500
IL	Wheeling, Hawk Elctrns. Inc.	708-459-4030
KY	Florence, U R I Elctrns. Inc.	606-371-4423
MD	Middletown, Current Comps.	301-473-5333
MA	Mansfield, Current Comps. Inc.	508-824-7900
MI	Brighton, Applied Power	313-227-3604
MI	Grand Rapids, S. F. Elec. Supp., Inc.	616-459-0216
NJ	Sparta, Instrument & Equip. Co.	201-579-0009
OH	Cincinnati, U R I Elctrns.	513-723-8800
OH	Columbus, Applied Power	614-882-1110
TX	Channelview, R. T. Henry Elctrns.	713-452-4451
TX	Dallas, Foxfire Inc.	214-353-9543
WA	Bellevue, Penstock Inc.	206-454-2371
WI	New Berlin, NEP Elctrns. Inc.	414-785-9100
WI	Waukesha, Hawk Elctrns. Inc.	414-547-4457
EXP	Markham, Ont., Birde Mktg. Inc.	416-477-7722
EXP	Vancouver, B.C., Birde Mktg. Inc.	604-431-0426

STAR SEMICONDUCTOR CORP., 25 Independence Blvd., Warren, NJ 07059, Tel: 908-647-9400, FAX: 908-647-4755; *Sls. Mgr.:* Jim Magos, VP Sls.

STAR SEMICONDUCTOR CORP., 25 Independence Blvd., Warren, NJ 07059, Tel: 908-647-9400, FAX: 908-647-4755; *Sls. Mgr.:* Jim Magos, VP Sls.

STAR-TRON CORPORATION, 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, FAX: 401-274-3936; Empl.: 27; *Sls. Mgr.:* Joyce D'Orsi

STATEK

FAX: 714-997-1256

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, TELEX: 67-8394; FSC No.: 51791; Empl.: 130; *Sls. Mgr.:* Suzanne Ray; *Dist. Mgr.:* Suzanne Ray **A•1482-1483**

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Phoenix, Eltron	602-266-2164
CA	Long Beach, RD & D Sls.	310-988-1116
CA	Mtn. View, Disman-Bakner	415-969-3010
CO	Englewood, Comp. Sls.	303-779-8060
FL	Palm Habor, Sigma Tech	813-789-5522
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Kokomo, Skyline Sls.	317-452-6500
IA	Des Moines, SPS Assocs.	515-225-0607
KS	Olathe, SPS Assocs.	913-764-4460
MA	Woburn, Radian Assocs.	617-933-7386
MI	Brighton, AP Assoc.	313-229-6550
MN	Bloomington, Murnco Inc.	612-854-4161
MO	Earth City, SPS Assocs.	314-291-0520
NJ	Bellmawr, TAI Corp.	609-778-5353
NY	Endwel, Reagan/Compar	607-754-2171
NY	Rye Brook, Tekmar	914-632-2828
NC	Charlotte, Prime Comps.	704-522-1150
NC	Raleigh, Prime Comps.	919-850-9866
OH	Centerville, Omega Sls. Inc.	513-434-5507
OH	Cleveland, Omega Sls. Inc.	216-360-9400
OR	Oregon City, Halbar Assoc.	503-656-3714
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Midvale, Comp. Sls.	801-561-5099
WA	Redmond, Halbar Assocs.	206-882-0990

Local Distributors

AL	Huntsville, Reptron Elect.	205-722-9500
CA	Orange, Western Micro	714-637-0200
CA	San Diego, Western Micro	619-453-8430
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Littleton, Indelco	303-795-3431
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Miami, All American	305-621-8232
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Palatine, OHM Elctrns.	708-359-5500
IL	Schaumberg, Reptron Elctrns.	708-882-1700
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Maryland Hgts., RS Elctrns.	314-997-7709
NY	Buffalo, Summit Distrs.	716-887-2800
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Mt. Vernon, All American	914-699-2224
OH	Solon, Reptron Elctrns.	216-349-1415
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Redmond, Kent Elect	206-883-7200

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16803-1797, Tel: 814-355-8004, FAX: 814-355-2714; Empl.: 100; *Sls. Mgr.:* Thomas S. Hufnagel **A•2020-2027**

Local Sales Offices & Reps

AZ	Phoenix, Eltron, Inc.	602-266-2164
CA	La Miranda, Select Elctrns.	714-739-8891
CA	Saratoga, EMS	408-446-3833
CT	New Haven, Masten-Wright, Inc.	203-288-1638
FL	Melbourne, Graham Assoc., Inc.	407-773-6631
FL	Palm Bch. Gdns., Graham Assoc., Inc.	407-662-4049
IL	Glenview, Crimson Engrg. Sls., Inc.	312-470-0024
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
MA	Newton, NormellAssocs.,Inc.	617-969-5478
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
NY	Bellmore, Compar NY, Inc.	516-221-7300
NY	Lewiston, Watmet, Inc.	716-285-3595
PA	Lansdale, E.L. Assocs.	215-368-8000
TX	Dallas, Merino Sls. Co.	214-233-6002
WA	Bellevue, Mars	206-747-3292
Can	Niagara Falls, Waters Metal Prods., Ltd.	416-374-3050

Local Distributors

CA	Los Alamitos, Semi Dice, Inc.	213-594-4631
MD	Baltimore, RESCO	410-931-8200
NJ	Fairfield, Micross Comps.	201-227-8007
NJ	Red Bank, CHPS, Inc.	908-758-1200
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Port Chester, Zeus Comps.	914-937-7400

THE STAVER COMPANY INCORPORATED

FAX: 516-666-8039

STAVER CO., INC., 41 Saxon Ave./P.O. Box 220M, Bay Shore, NY 11706-9998, Tel: 516-666-8000; Empl.: 80; *Sls. Mgr.:* Pat Sullivan **B•1119-1123**

Local Sales Offices & Reps

CA	Cathedral City, R D Sls. Corp.	619-324-5044
IL	Wheaton, RMP McBride Corp.	708-462-2500
IN	Sugar Grove, The Manx Co.	708-466-4200
MN	St. Paul, Proud Inds.	612-646-9428
NH	Hancock, Eisenbeis Sls.	603-525-4417
NY	East Northport, Levison Sls. Co.	516-266-5020
NC	New Hill, Tom G. Santel	919-362-4091
OR	Beaverton, Quest Mkgt.	503-641-7377
PA	Montgomeryville, Eastern Scientific Mktg.	215-368-4570
SC	Mauldin, Carl Hart Assocs.	803-288-2323
TX	Dallas, Innovative Tech. Sls.	214-669-3485
TX	Houston, Innovative Tech. Sls.	713-443-0331
WA	Renton, Quest Mkgt.	206-228-2660
WI	Colgate, RMP McBride Sls. Corp.	414-628-4016

STEINEL AMERICA, INC., 15317 Minnetonka Ind. Rd., Minnetonka, MN 55345, Tel: 800-852-4343, FAX: 612-931-3026; *Sls. Mgr.:* Nat Reidel; *Dist. Mgr.:* Jim Stangl

Local Distributors

IL	Addison, Len's Ace Hardware	708-543-8882
MA	N. Andover, Contact East	508-682-9844
MN	Bloomington, K.L. Tannehill, Inc.	612-881-6700
ND	Grand Forks, Acme Elctrc.	701-746-6481
OH	Akron, Philcap Elctrns.	216-253-2109
TX	Ft. Worth, Connector Micro Tooling	817-283-4882
WA	Seattle, Radar Elctrc.	206-282-2511

STEINWALL, INC., 7895 Ranchers Rd. NE, Minneapolis, MN 55432, Tel: 612-571-8202, FAX: 612-572-2031; Empl.: 61; *Sls. Mgr.:* Maureen Steinwall

STENNING INSTRUMENTS, INC., 604 Via Del Oerro, Camarillo, CA 93010, Tel: 805-484-4996, FAX: 805-484-5337; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 3166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506, FAX: 408-773-1073; Empl.: 50; *Sls. Mgr.:* Darrell Wilburn

STEPHENS ANALYTICAL, INC., 2750 Brabant-Marineau, Montreal, Que., CA H4S 1L1, Tel: 514-332-1230, FAX: 514-335-6566; Empl.: 12; *Sls. Mgr.:* Mr. Alan Lee

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Local Sales Offices & Reps

AZ	Phoenix, Silver Mountain Des.	602-266-7671
CA	Chatsworth, Western Component Sls.	818-882-6226
CA	San Carlos, Western Comp. Sls.-N.	415-594-1222
CO	Denver, Manufacturers Marketing Corp.	303-985-2008
FL	Clearwater, Tech-Rep Assoc., Inc.	813-572-9900
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MD	Upperco, Imagitron Sales Co.	301-374-5600
MA	Lowell, Underwood Sales	508-256-8191
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, (Metropolitan) Sterling	516-328-3300
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	208-524-5170

STETCO, INC., 3344 Schierhorn Ct., Franklin Pk., IL 60131, Tel: 708-671-4208, FAX: 708-671-5270; FSC No.: 52763; Empl.: 45; *Sls. Mgr.:* Saul A. Gusaras

STETRON INTERNATIONAL, INC., 90 Broadway, Buffalo, NY 14203, Tel: 716-854-3443, FAX: 716-854-3448; Empl.: 70

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140, FAX: 201-672-2837; Empl.: 50; *Sls. Mgr.:* Robert Cantilina

STEWARD, INC., E 36th st., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, FAX: 615-867-4102; Empl.: 250; *Sls. Mgr.:* Don Lepard; *Dist. Mgr.:* Steve Woods

STEWART CONNECTOR SYS., INC., R.D. No. 2 Box 2020, Glen Rock, PA 17327, Tel: 717-235-7512, TELEX: 4977105, FAX: 717-235-7954; Empl.: 196; *Dist. Mgr.:* T. Meighen, Dir. Mktg.(USA) A. McDonald, Dir. Mktg.(Europe) **C•1469**

Local Sales Offices & Reps

AL	Huntsville, Comps. Mktg. Svc.	205-881-6699
CA	Dana-Point, PCA	714-493-9822
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Boulder, Component Prod. Sls. Co., Inc.	303-530-2800
IL	Prospect Hgts., Comms. Equip.	708-506-9000
IL	St. Charles, XYZ Mktg.	708-584-3001
IN	Carmel, Valentine Assocs.	317-846-0008
KS	Parker, S.W. Assocs., Inc.	913-898-6552
MA	Tauton, Focus	508-824-3840
MI	Southfield, Carl H. Schmidt	313-353-6000
MN	Brooklin Center, Combined Sls.	612-566-2724
NJ	Franklin Lakes, Atlantic Tech. Comps., Inc.	201-337-2477
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Charlotte, D.P. Riggins	704-375-7550
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-6422
PA	Boswell, B.E. Gibson	814-629-6772
PA	Glen Rock, SCS	717-235-7512
TX	Dallas, JYSCO	214-349-1650
VA	Ashland, Glassock Assocs.	804-798-2125
WA	Issquah, Elctrns. Northwest, Inc.	206-557-0851
Can	Campden, Ont., Magden	416-563-5408

Local Distributors

CA	Irvine, Kensington Elctrns.	714-588-0575
CA	Milpitas, Sierra West	408-945-1050
CA	San Jose, Spectra Elctrns.	408-452-1590
IL	Lisle, Comps., Inc.	708-852-7707
MA	Ashland, Quality Comps.	508-881-6504
NH	Atkinson, AEI Astrum	603-898-3399

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Local Sales Offices & Reps

NY	Bayport, Stimpson Co., Inc.	516-472-2000
RI	Cranston, Stimpson Co., Inc.	401-461-7720

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RI	Cranston, Stimpson Co.,Inc.	401-461-7720

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ST MICROSONICS CORP., Subsidiary of Signal Technology Corporation, 60 Winter St., Weymouth, MA 02188, Tel: 617-337-4200, FAX: 617-337-4208; FSC No.: 11869; Empl.: 80; *Sls. Mgr.:* Ken Lambert

ST MICROWAVE CORP., Sub. of Signal Technlg. Corp., 955 Benecia Ave., Sunnyvale, CA 94086, Tel: 408-730-6300, FAX: 408-245-3396,408-733-0254; FSC No.: 27338; Empl.: 208; *Sls. Mgr.:* Paul Thesing

STN INTERNATIONAL C/O CHEMICAL ABSTRACTS SERVICE, 2540 Olentangy River Road, Columbus, OH 43202-1505, Tel: 614-447-3600, TELEX: 810-482-1608, ESYLNK: 614-447-3713; Empl.: 1500; *Sls. Mgr.:* Tom Gornick

STOCK DRIVE PRODUCTS, a DSG Company, 2101 Jericho Tpke. Box 5416, New Hyde Pk., NY 11042-5416, Tel: 516-328-0200, 328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 228; *Sls. Mgr.:* Murray Ores

Local Sales Offices & Reps

AZ	Phoenix, Silver Mountain Des.	602-266-7071
CA	Chatsworth, Western Comp. Sls.	818-882-6226
CA	San Carlos, Western Comp. Sls. N.	415-594-1222
CO	Denver, Manufacturer's Mktg.	303-985-2008
FL	Clearwater, Tech-Rep Assoc., Inc.	813-572-9900
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MD	Upperco, Imagitron Sls. Co.	301-374-5600
MA	Lowell, Underwood Sls.	508-256-8191
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, SDP	516-328-3300
OH	Medina, Rockford Controls Ohio	216-725-3705
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	206-524-5170

STOCK MODEL PARTS, a DSG Company, 2101 Jericho Tpke. Box 5416, New Hyde Pk., NY 11042-5416, Tel: 516-328-3300, FAX: 516-326-8827

STOCKO CONNECTORS, Stocko Corporation, 495 Industrial Road, Carlstadt, NJ 07072, Tel: 201-933-4452, FAX: 201-933-4522; Empl.: 34; *Sls. Mgr.:* Rudolf Schindler **C•1470-1471**

Local Sales Offices & Reps

AL	Huntsville, E-Squared Mktg.	205-430-3000
CA	San Diego, Cetinske Sls. Co.	619-487-3335, FAX:619-673-0612
CA	Santa Clara, Nova-Tronix	408-729-9530
GA	Lawrenceville, E-Squared Mktg.	404-995-7206
GA	Marietta, E-Squared Mktg.	404-565-2088
KS	Olathe, G.M. Brown & Assocs.	913-829-3086, FAX:913-829-3274
MA	Norwood, Comp. Mktg. Svcs.	617-762-4339, FAX:617-769-8662
MI	Grand Rapids, J.M.J. & Assocs., Inc.	616-285-8887, FAX:616-285-7633
MO	Florissant, G.M. Brown & Assocs.	314-839-3600, FAX:314-839-3601
PA	Pittsburgh, KT Mktg.	412-367-1011, FAX:412-367-2153
TX	Burleson, Bounty Elctrns., Inc.	817-447-9775, FAX:817-447-9706

Local Distributors

MI	Wyoming, EC Elctrns.	616-530-0576, FAX:616-530-8598
MO	St. Charles, Heartland Elctrns.	314-928-6010, FAX:314-447-3416
NJ	Carlstadt, Stocko Connectors	201-933-4452, FAX:201-933-4522
OR	Beaverton, Murphy Elctrns.	503-642-2001
WA	Redmond, Murphy Elctrns.	206-881-1234

ST OLEKTRON CORPORATION, Subsidiary of Signal Technology Corp., 28 Tozer Rd., Beverly, MA 01915, Tel: 508-922-0019, FAX: 508-927-9328; FSC No.: ON8W8; Empl.: 105; *Sls. Mgr.:* Chuck Davis

All Locations for Compucon Distrs. Call 800-426-7746

ST OLEKTRON SYSTEMS, Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 508-943-7440, FAX: 508-949-1804; FSC No.: 32252; Empl.: 35; *Sls. Mgr.:* Bill Uffelman

STOLZBERG RESEARCH, INC., 3 Seabrook Court, Stony Brook, NY 11790-3305, Tel: 516-751-4277, 800-568-4634, FAX: 516-689-6671; Empl.: 4; *Sls. Mgr.:* Bruce Davis; *Dist. Mgr.:* Bruce Davis

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 708-323-9121, FAX: 708-323-9398; FSC No.: 57500; Empl.: 72; *Sls. Mgr.:* Brian J. Holland

STRATOS PRODUCT DEVELOPMENT GROUP, 2025 First Ave., Ste PH-B, Seattle, WA 98121, Tel: 206-448-1388, FAX: 206-448-7830; Empl.: 28

STRAWBERRY TREE, INC., 160 S. Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-736-8800, TELEX: 650 3172834 MCI, FAX: 408-736-1041; Empl.: 25

STRONGBOX, P.O. Box 2726, Culver City, CA 90231-2726, Tel: 310-305-8288, FAX: 310-305-1905; FSC No.: 2T043; Empl.: 5; *Sls. Mgr.:* Larry Martinek **C•1098-1099**

STRUTHERS-DUNN, INC. AND HI-G CO., INC., Lambs Rd., Pitman, NJ 08071-0901, Tel: 609-589-7500, ESYLNK: 622-87939, FAX: 609-589-2619,609-589-2094; FSC No.: 78290; Empl.: 467; *Sls. Mgr.:* Bruce E. Armstrong, V.P. **B•1606-1614**

Local Sales Offices & Reps

AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	Los Angeles, RD&D	213-666-1611
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	W. Parker, W. Howard Assoc., Inc.	303-841-5755
CT	Bloomfield, Friedman	203-242-7781
FL	Orlando, Comp. Design Mktg.	407-352-5480
GA	E. Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Downers Grove, Bob Burns & Assoc.	312-960-2046
IN	Ft. Wayne, TX Sls.	219-423-3422
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280
KS	Olathe, Advanced Tech. Sls.	913-782-8702
LA	Lafayette, Fralia	318-269-9452
MD	Monkton, Imagitron Sls.	410-374-5600
MI	Southfield, TX Sls.	313-353-8210
MN	Minneapolis, Jay Borman	612-888-2122
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, B.S.E.	505-293-2582
NY	Buffalo, Tri-Tech	716-877-3677
OH	Cincinnati, Elctrn Comps.	513-729-1969
OH	Miamisburg, Elctrn. Comps.	513-866-3340
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Bellevue, Eltech, Inc.	206-643-4330

Local Distributors

CA	Santa Ana, Norstan Elctrns., Inc.	714-540-4165
MO	Maryland Hgts., L Comp. Inc.	314-291-6200
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Plainview, A.C.I. Elctrns.	516-293-6630
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Associated Aircraft	214-331-4381

ST-SEMICONDUCTORS OF INDIANA, INC., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609, Tel: 812-332-1435, FAX: 812-331-8706; Empl.: 100; *Sls. Mgr.:* Jim Davis; *Dist. Mgr.:* Jim Davis

SUBMARINE SIGNAL DIVISION, Raytheon Company, 1847 W. Main Road, Portsmouth, RI 02871, Tel: 401-847-8000, TELEX: 71-6817111, FAX: 401-847-2364; Empl.: 2,300

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SULLINS ELECTRONICS CORP., P.O. Box 189, 801 E. Mission Rd., San Marcos, CA 92079, Tel: 619-744-0125, TWX: 910-322-1472, ESYLNK: 62912413; Empl.: 75 .... **C•1472-1473**

Local Sales Offices & Reps

AZ	Phoenix, TM Entprs.	602-759-9650
AL	Athens, Effective Mktg. Force	205-233-2947
CA	Lacanada, KCP	818-790-1365
CA	Newport Beach, Qual Conn	714-851-6465
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Wheatridge, Cluff & Assocs.	303-425-6604
FL	Palm Harbor, Bob Dean, Inc.	813-789-1233
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Mt. Prospect, Dornbrow Co.	708-253-3326
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Randallstown, Chesapeake Inds. Mktg.	410-653-0476
MA	Harvard, Cycle Sls.	508-456-6868
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Louis, M-S-B Assocs., Inc.	314-772-2166
NY	Peconic, HLJ Comp-Tech	516-734-7784
NC	Lillington, Effective Mktg. Force	919-867-6221
OH	Dublin, Sls. Plus	216-942-7811
PA	Ft. Washington, SMC Inc.	215-628-3394
TX	Richardson, Comp. Partners	214-644-1288
WA	Camas, Elctrn. Mktg. Grp.	206-834-6548
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Oconomowoc, Artmor Ltd.	414-367-8789

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	City of Industry, Ital Elect Sls. Inc.	818-968-8515
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Pasadena, Empire Elctrns.	213-681-2711
CA	San Diego, Cypress/RPS Elect.	619-535-0011
CA	San Jose, Sierra W. Elctrns.	408-945-1050
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Simi Valley, Lee Johnson Sls.	818-346-5412
CA	Woodland Hills, Cypress Elctrns.	818-710-7780
CO	Arvada, Denver Beta Wintronic	303-431-7161
CO	Engelwood, Cypress Elctrns.	303-792-5829
CO	Littleton, Indelco Inc.	303-795-3431
CT	Bridgeport, Millenium Elctrn. Sls.	203-372-2037
FL	Davie, Arco Distrs., Inc.	305-473-2550
FL	Miami, Electronic Equip. Co.	305-871-3500
FL	Winter Park, Deanco	407-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Addison, Belford Elctrns.	708-691-1100
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, DEE Electrns.	319-365-7551
MD	Beltsville, Petricko Sls.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Gaithersburg, Deanco	301-948-5444
MD	Timonium, M X 4 Elctrns., Inc.	301-252-1192
MA	Canton, Richey/Impact Elect.	508-668-8200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	St. Claire Shore, Spemco	313-771-2700
MN	Bloomington, Bergquist Co.	612-835-2322
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	St. Paul, Kent/Shelley Ragon, Inc.	612-642-2828
MN	Thief River Fls., Digi-Key Corp.	218-681-6674
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Bellmawr, Mid-Atlantic Elect.	609-931-5303
NJ	Fairfield, Deanco	201-575-7960
NM	Albuquerque, Electronic Parts	505-293-6161
NM	Las Cruces, Electronic Parts	505-523-4578
NY	Ithaca, Deanco	607-257-4444
NY	Peconic, Forejay Assocs.	516-734-7760
NY	Penn Yan, Advacom Technig., Inc.	315-536-2221
NC	Fayetteville, Southeastern Elctrns.	704-523-1122
NC	Hickory, Southeastern Elctrns., Inc.	919-828-2311
OH	Cincinnati, Schuster Elec. Co.	513-489-1400
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, Dunn Elctrns.	503-285-0214
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elctrns.	215-293-9000
RI	Warwick, Cal-Greg Comps., Inc.	401-738-6170
TN	Knoxville, Indl. Elctrns., Inc.	615-573-7135
TN	Nashville, Randolph & Rice	615-255-5601
TX	Dallas, Off The Shelf	214-247-0052
TX	Dallas, Tactic Elctrns.	214-702-6111
TX	Garland, J & S Elctrns.	214-487-8808
TX	Houston, Kent/Shelley-Ragon	713-780-7770
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Pflugerville, RSI	512-251-1161
TX	Richardson, Off The Shelf	214-238-0808
UT	Salt Lake City, S.L.C. Wintronics	801-966-0236
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Annandale, Arcade Elect. Inc.	703-256-4610
VA	Charlottesville, Virginia Radio Supp.	804-296-4184
VA	Virginia Bch., Deanco	804-499-3322
WA	Bothel, Cypress Elctrns.	206-483-1144
WA	Seattle, Radar Elec.	206-282-2611
WA	Tukwila, Carlyle	206-251-0700
WI	Grafton, Lake-View Elect. Inc.	414-377-8250
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	Oconomowoc, G.W. Elctrns., Ltd.	414-367-6003
Can	Burnaby, Intek	604-294-8100
Can	Pointe Claire, Que., A. R. Gray & Assocs.	514-694-6378
Can	Victoria, Pacific Coast Elect.	604-385-5111

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SUNBANK ELECTRONICS, 1740 Commerce Way, Paso Robles, CA 93446, Tel: 805-238-2840, FAX: 805-238-0241; FSC No.: 07418; Empl.: 260; *Sls. Mgr.:* Patrick Banakis

SUNDSTRAND DATA CONTROL, 15001 N.E. 36th St., Redmond, WA 98073-9701, Tel: 206-885-3711, TELEX: RCA 286144; Empl.: 1500; *Sls. Mgr.:* C. Friesen

SUN ELECTRONIC SYSTEMS, INC., 5307 NW 35th Terr., Ft. Lauderdale, FL 33309, Tel: 305-739-7004, FAX: 305-739-7006; Empl.: 12; *Sls. Mgr.:* Veronica L. Pasqua .... **D•1212-1213**

Local Sales Offices & Reps

CA	San Jose, Woodell Assocs.	408-732-4327

SUNON, 23362 Madero Rd. C , Mission Viejo, CA 92691, Tel: 714-583-9802, FAX: 714-583-9785; Empl.: 5; *Sls. Mgr.:* Frank Buday

SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1926, FAX: 818-914-1583; FSC No.: 64908; Empl.: 10; *Sls. Mgr.:* Joseph F. Petralia; *Dist. Mgr.:* Joseph F. Petralia

SUNSHINE INSTRUMENTS, 1810 Grant Ave., Philadelphia, PA 19115, Tel: 215-673-5600, 800-343-1199, FAX: 215-673-5609; Empl.: 30; *Sls. Mgr.:* M.L. Norton

SUNX SENSORS/IMPORTED BY RAMCO ELECT., 1207 Maple St., West Des Moines, IA 50265, Tel: 515-225-6933, FAX: 515-225-0063; Empl.: 25; *Sls. Mgr.:* Mike Reelitz; *Dist. Mgr.:* Mike Reelitz

SUPERCOMIX INC., 261 Fifth St. East, St. Paul, MN 55101, Tel: 612-222-0046, FAX: 612-222-0049; Empl.: 15; *Sls. Mgr.:* C. Gallo; *Dist. Mgr.:* C. Gallo

SUPERIOR CARBON PRODUCTS, INC., 101 HWY 35, Superior Pl., Walnut Grove, MS 39189, Tel: 601-253-2442, FAX: 601-253-2430; FSC No.: 68256; Empl.: 71

SUPERIOR ELECTRIC, Warner Electric, 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, FAX: 203-584-1483; FSC No.: 58474; Empl.: 500; *Sls. Mgr.:* John Hegel/James Hayden; *Dist. Mgr.:* Michael Miga/Michael Bonney .... **A•2557; B•1308-1309; C•1475**

Local Sales Offices & Reps

MS	Jackson, Doby Assocs.	601-981-1138

SUPERIOR FLUX & MFG. CO., 95 Alpha Park, Cleveland, OH 44143, Tel: 216-461-3315, FAX: 216-461-6846; FSC No.: 3439; Empl.: 10; *Sls. Mgr.:* Linda Cohen

SUPERTEX, INC., 1225 Bourdeaux Drive, Sunnyvale, CA 94088, Tel: 408-744-0100, TWX: 910-339-9388

SUPPORT ELECTRONICS, INC., 52 Roosevelt Ave., Butler, NJ 07405-1367, Tel: 1-201-838-2755, FAX: 1-201-838-2755

SUPPORT SYSTEMS INTL. CORP., 150 South Second St., Richmond, CA 94804, Tel: 510-234-9090, TWX: 910-382-8130, FAX: 510-233-8888; Empl.: 30; *Sls. Mgr.:* Nola Sanders; *Dist. Mgr.:* Nola Sanders

SURGEONIGS LIMITED, One Sullivan Parkway, Fort Edward, NY 12828, Tel: 518-747-2156, FAX: 518-747-2607; Empl.: 20; *Sls. Mgr.:* R. Thomas

SURON MAAGAN MICHAEL, Kibbutz Maagan-Michael, D.N. Menashe 37805, Israel, Tel: 06-394211, TELEX: 471468 SURON IL, FAX: 063-90296; Empl.: 38; *Sls. Mgr.:* Gershon Peleg

SUSCO ELCTRNS., 61A Carolyn Blvd., Farmingdale, NY 11735, Tel: 516-249-4848, FAX: 516-249-4865

SUTTON DESIGNS, INC., 215 N. Cayuga Street, Ithaca, NY 14850, Tel: 800-326-8119, FAX: 607-277-6983; FSC No.: 6625; Empl.: 24; *Sls. Mgr.:* Mark Miller

SWAN ASSOCIATES, P.O. Box 9424, New Haven, CT 06534, Tel: 203-387-3917, FAX: 203-397-5306; Empl.: 2

SWISS JEWEL COMPANY, 613 Lafayette Building, Philadelphia, PA 19106, Tel: 215-925-2867, FAX: 215-922-3055; Empl.: 8; *Sls. Mgr.:* P. N. Steel, Jr.

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SWITCHCRAFT, INC., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, Tel: 312-792-2700, TWX: 910-221-5199; FSC No.: 82389;multiple; Empl.: 600 .... **B•1813; C•1476-1482, 1810-1811**

Local Sales Offices & Reps

AL	Huntsville, New Age Electr.	205-895-9400
AZ	Phoenix, Moss Mktg.	602-433-9349
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Moss Mktg.	303-340-8535
MA	Merrimac, Switchcraft, Inc. New England Sls.	603-424-4423
FL	Clearwater, Sunland Assoc.	813-536-2955
FL	Lauderhill, Sunland Assoc.	305-748-1303
FL	Oviedo, Sunland Assoc.	407-365-9533
GA	Duluth, New Age Electr.	404-476-0079
IL	Chicago, Switchcraft Inc.	312-792-2700

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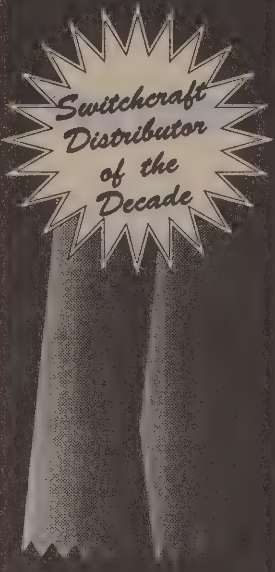

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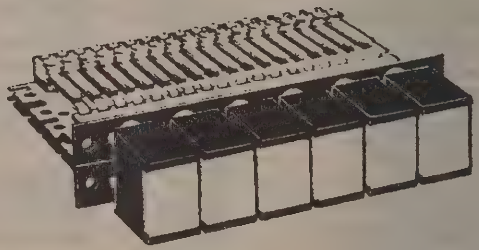

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S	Overland Park, Thomas L. Dowell & Assoc.	913-648-7373
A	Taunton, Switchcraft, Inc. New England Sls.	508-880-0027
I	Royal Oak, Switchcraft, Inc. Michigan Sls.	313-549-4848
N	Minnetonka, Switchcraft, Inc. Minnesota Sls.	612-544-7123
S	Jackson, Doby Elctrns.	601-981-1138
O	St. Louis, Thomas L. Dowell & Assoc.	314-849-4234
J	Cherry Hill, Trinkle Sls.	609-795-4200
J	Woodbridge, Jade Mktg.	908-750-2998
M	Albuquerque, Moss Mktg.	505-292-7505
Y	Centereach, Jade Mktg.	516-696-3331
Y	Rochester, Apex Assocs.	716-272-7040
C	Raleigh, New Age Electr.	919-954-1552
H	Dayton, J. C. Hofstetter Co.	513-296-1010
H	Medina, J. C. Hofstetter Co.	216-241-4880
R	Milwaukee, Comtec	503-654-6626
N	Memphis, Doby Elctrns.	901-365-9575
X	Austin, J. Y. Schoonmaker Co.	512-327-5274
X	Dallas, J. Y. Schoonmaker Co.	214-349-1650
X	Houston, J. Y. Schoonmaker Co.	713-738-2427
T	Salt Lake City, Moss Mktg.	801-562-9000
A	Bellevue, Comtec	206-453-1188
I	Burlington, Switchcraft	414-763-2100
an	Toronto, A.C. Simmonds & Sons Ltd.	416-839-8041

SWITCHES UNLIMITED, INC., 34-11 56th St, Woodside, NY 11377, Tel: 718-478-5000, 800-221-0487, FAX: 718-672-6370; Empl.: 20; *Sls. Mgr.:* Douglas King

SWITCHING POWER INC., 3601 Veterans Hwy, Ronkonkoma, NY 11779, Tel: 516-981-7231, TWX: 510-220-1528, FAX: 516-981-7266; Empl.: 200

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FAX: 714-996-2753

SWITCHING SYSTEMS INTERNATIONAL, 500 Porter Way, Placentia, CA 92670, Tel: 714-996-0909, 800-992-7740; Empl.: 85; *Sls. Mgr.:* Guy Lacerte .... **D•1938-1941**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
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CA	Placentia, Switching Sys. Intl.	714-996-0909
CA	San Diego, Power Specs.	619-586-1160
CA	San Jose, Nelson Elctrns. Sls.	408-437-9300
CO	Denver, Holder Hauer	303-427-3443
CT	Meriden, Power Conversion Sys.	203-235-4886
FL	Orlando, Hughes Assocs.	305-629-5933
GA	Atlanta, Hughes Assocs.	404-662-1587
IL	Chicago, Utronix	312-834-1100
IL	Elmhurst, Utronix	312-834-1100
MD	Randallstown, Beacon North Inc.	800-877-3747
VA	Sterling, Beacon North, Inc.	703-478-2480
MI	Ann Arbor, Lintott & Assoc.	313-662-1611
MN	Minneapolis, Electro-Serv	612-338-3475
NH	Londonderry, Power Conversion Sys.	603-434-2371
NM	Albuquerque, Holder Hauer	505-888-9614
NY	Rochester, Power Conversion Assocs.	716-426-3598
NY	Spring Valley, Powertronics	914-735-3775
NC	Raleigh, Hughes Assocs.	919-467-7029
PA	Collegeville, Beacon North	215-287-5479
TN	Nashville, Hughes Assocs.	615-871-0908
TX	Garland, Carey, McMahill & Assoc.	214-681-1414
UT	Salt Lake City, Holder Hauer	801-532-2111

Local Distributors

CA	Milpitas, Compumech	408-945-9100

SYGENEX INC., 15446 Bel-Red Rd. Ste. 450, Redmond, WA 98052, Tel: 206-881-5500, FAX: 206-869-2837; Empl.: 8; *Sls. Mgr.:* Mary J. Grubic, Business Mgr.

SYLVANIA AUTOMOTIVE AND MINIATURE LIGHTING, Osram Sylvania, 275 W. Main St., Hillsboro, NH 03244, Tel: 603-464-5533, FAX: 603-464-0259; FSC No.: 88204; Empl.: 850; *Dist. Mgr.:* Tom Izbicki, Sls. Mgr. .... **B•1190-1194**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AR	Little Rock, Cartwright & Bean	901-362-8345
CA	Irvine, English/Damco Sls. Assocs.	714-837-3801
CO	Wheatridge, Cluff & Assocs.	303-425-6604
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Apopka, Cartwright & Bean	407-889-9100
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Skokie; I.R.I	708-967-8430
IN	Ft. Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R. O. Whitesell	317-457-9127
IA	Cedar Rapids, R. W. Kunz	319-396-5386
KS	Prairie Village, R.W. Kunz	913-648-3535
KY	Versailles, R.O. Whitesell & Assocs.	606-873-1182
LA	Covington, Cartwright & Bean	504-892-1780
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell	313-352-5454
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Stoss & Assocs.	612-925-2757
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, R.W. Kunz	314-966-4977
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114
NJ	Long Valley, Paul A. Sweeney	908-852-1434
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Electronic Sources Inc.	503-627-0838
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
PA	Trevose, P.S.A. Inc.	215-245-0513
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Dallas, Erickson Sales	214-739-5833
TX	Round Rock, Erickson Sls.	512-244-3068
TX	Stafford, Erickson Sales	713-261-5031
WA	Bellevue, Electronic Sources Inc.	206-451-3500
WI	Milwaukee, F.C. DuBois & Assocs.	414-774-3100

SYLVANIA, Emissive Products/Process Heat, Portsmouth Ave., Exeter, NH 03833, Tel: 603-772-4331, FAX: 603-772-9710; Empl.: 200; *Sls. Mgr.:* Joe Stark

SYLVANIA LIGHTING, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923, Tel: 1-800-544-4828, 508-777-1900

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SYNEKTRON CORPORATION, 12000 S. W. Garden Place, Portland, OR 97223, Tel: 503-684-3090; Empl.: 100 .... **B•1310**

SYNERGY MICROWAVE CORPORATION, 483 McLean Boulevard, Paterson, NJ 07504, Tel: 201-881-8800, FAX: 201-881-8361; FSC No.: 63155; Empl.: 48; *Sls. Mgr.:* Antonio Almeida

SYNERGY SEMICONDUCTOR CORPORATION, 3450 Central Expressway, Santa Clara, CA 95051, Tel: 408-730-1313, FAX: 408-737-0831

SYNETCOM DIGITAL INCORPORATED, 1426 Aviation Blvd. Ste. 101, Redondo Bch., CA 90278, Tel: 310-379-2000; Empl.: 5; *Sls. Mgr.:* Donald Laufer

SYNOPTICS, LTD., Paragon Towers, 233 Needham St., Newton, MA 02164, Tel: 617-527-4461, FAX: 617-527-4084; Empl.: 25; *Sls. Mgr.:* Barbara Finer; *Dist. Mgr.:* Barbara Finer

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752-9973, Tel: 508-481-7827, FAX: 508-481-5769; Empl.: 26; *Sls. Mgr.:* Mitchell Corrigan .... **D•1112**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968, Fx:408-356-7249
CA	Murrieta, Mil-Com Sales, Inc.	714-677-2097, Fx:714-677-2096
CA	San Diego, Mil-Com Sales, Inc.	619-275-0641, Fx:619-275-0641
FL	Winter Pk., Carter Assocs.	407-678-5133, Fx:407-678-5251
IL	Arlington Hgts., Coombs Assocs., Inc.	708-439-9810,Fx:708-593-1746
NJ	Butler, General Technlgs.	201-492-1292, Fx:201-492-0051
OH	Aurora, EMA, Inc.	216-562-6104
OH	Aurora, Meta Tech. Sls., Inc.	216-562-8772, Fx:216-562-7129
OH	Centerville, EMA, Inc.	513-433-2800, Fx:513-433-3147
OH	Cleveland, EMA Inc.	216-562-7498
TX	Missouri City, C & L Assocs.	713-499-5541, Fx:713-499-5473
WI	Milwaukee, Coombs Assocs.	414-351-6123, Fx:414-351-6154

Local Distributors

WV	Ravenswood, Valtronics, Inc.	304-273-5356

SYSCON INTL., INC., 1108 So. High St., So. Bend, IN 46601-3796, Tel: 219-232-3900, FAX: 219-287-5916; Empl.: 80; *Sls. Mgr :* Ed Hansen

SYSTEC, INC., 3816 Chandler Dr., Minneapolis, MN 55421, Tel: 612-788-9701, FAX: 612-788-9502; Empl.: 15; *Sls. Mgr.:* Tom Thielen

SYSTEM GENERAL

FAX: 408-262-9220

SYSTEM GENERAL CORPORATION, 510 South Park Victoria Dr., Milpitas, CA 95035, Tel: 408-263-6667; Empl.: 52; *Sls. Mgr.:* Gary Delucchi; *Dist. Mgr.:* Gary Delucchi .... **A•1717**

Local Sales Offices & Reps

CA	Pleasanton, IFM, Inc.	510-846-0762
NH	Merrimack, Wilson/Reilly Assoc.	603-673-9504
PA	Philadelphia, Austek	215-924-6228
TX	Denton, System General Corp.	817-565-9944

SYSTEMS ALTERNATIVES, 1705 Indian Wood Circle, Maumee, OH 43537, Tel: 419-891-1100, FAX: 419-891-1045; *Sls. Mgr.:* Mark Weihs

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085, FAX: 216-666-7183; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS RESEARCH LABOROTORIES, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, FAX: 513-426-1984; FSC No.: 14590; Empl.: 1000; *Sls. Mgr.:* Frank Balogh, Jr.

SYSTEMS TESTING, INC., PO Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; Empl.: 4; *Sls. Mgr.:* Frank J. Ardezzone

SYSTRAN CORP., 4126 Linden Ave., Dayton, OH 45432-3068, Tel: 1-800-252-5601, FAX: 513-258-2729; Empl.: 70; *Sls. Mgr.:* Susan Chicoine

SYSTRON-DONNER INERTIAL DIV., A BEI Electronics Company, 2700 Systron Dr., Concord, CA 94518, Tel: 510-671-6400, TWX: 910-481-9478, FAX: 510-671-6590; Empl.: 370

SYSTRON-DONNER MICROWAVE DIV., 13100 Telfair Ave., Sylmar, CA 91342, Tel: 818-362-9900, FAX: 818-367-4709; Empl.: 160; *Sls. Mgr.:* Ashvin K. Sheth

SYSTRONIX INC., 555 S. 300 East, PO Box 526398, Salt Lake City, UT 84152-6398, Tel: 801-534-1017, FAX: 801-534-1019; Empl.: 4; *Sls. Mgr.:* Bruce Boyes

TABER INDUSTRIES, 455 Bryant St., N. Tonawanda, NY 14120, Tel: 716-694-4000, 800-333-5300, FAX: 716-694-1450; Empl.: 100; *Sls. Mgr.:* Bernie W. Daube

3-D VISIONS, 2780 Skypark Dr., Torrance, CA 90505, Tel: 310-325-1339, FAX: 310-325-1505; Empl.: 8

TAB/MCGRAW-HILL, McGraw-Hill Inc., Blue Ridge Summit, PA 17294-0850, Tel: 717-794-2191, TELEX: 820562, FAX: 717-794-2080; Empl.: 400; *Sls. Mgr.:* Tim Higgins

TACC INTERNATIONAL CORPORATION, Formulated Resins Grp., Air Station Inds. Pk., Rockland, MA 02370, Tel: 617-878-7015, TELEX: 952123, ESYLNK: 5106015650(TACC INTL CORP), FAX: 617-871-6727; Empl.: 70; *Sls. Mgr.:* Norman G. Harrington

TADIRAN

FAX: 516-621-4517

TADIRAN ELECTRONIC INDUSTRIES, INC., 2 Seaview Blvd., Port Washington, NY 11050, Tel: 516-621-4980; Empl.: 6300; *Dist. Mgr.:* Effie Shoval, Sls. Mgr. .... **D•1477**

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AL	Huntsville, M Squared I (M2I)	205-830-0498
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AZ	Tempe, Reptronix Ltd.	602-345-4580
CA	Nexus	415-691-1100
CA	Cameron Pk., Parsons Tech. Mktg.	916-676-2025
CA	Los Angeles, Tech. Solutions	818-704-1693
CA	Orange County, Tech. Solutions	714-707-4565
CA	San Jose, Tritech Sls.	408-925-9409
CA	Santa Ana, Technlg. Solutions	714-558-9562
CT	Bloomfield, Friedman Sls. Inc.	203-243-3122
CT	Farmington, SBX Sls. (FSI)	203-676-1880
FL	Melbourne, Photon Sls. Inc.	407-259-8999
GA	Norcross, M Squared I (M2I)	404-447-6124
IL	Palatine, Technology Sls.	708-991-6600
IA	AEM, Inc.	319-377-1129
KS	AEM, Inc.	913-888-0022
MI	Grand Rapids, Urban Assocs., Inc.	616-245-0511
MI	Livonia, Urban Assocs., Inc.	313-421-9150
MN	Tech. Solutions	612-785-9341
MN	St. Louis Pk., Elctrn. Innovators	612-922-2945
MO	AEM, Inc.	314-298-9900
MO	Florissant, G.M. Brown & Assoc.	314-839-3600
NJ	Mt. Laurel, Paragon Sls. & Mktg.	609-778-1990
NM	Albuquerque, Reptronix Ltd.	505-292-1718
NC	Raleigh, M Squared I (M2I)	919-851-0010
OH	Cleveland, Arthur H. Baier Co.	216-292-7500
OK	T-Tec Sls.	918-747-0522
OK	Broken Arrow, G.M. Brown & Assoc.	918-251-2084
OR	EE Sls.	503-639-3978
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
TX	T-Tec Sls.	817-274-9662
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	El Paso, T-Tec Sls.	915-581-7920
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Houston, T-Tec Sls.	713-578-9666
TX	Richardson, Mil-Rep Assocs.	214-644-6731
VA	Sterling, Beacon North	800-336-3747
WA	EE Sls.	206-883-3374
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374
WI	Milwaukee, Technlg. Sls.	414-964-5015
Can	Mil	403-236-2431
Can	Markham, Ont., Designtronics	416-513-8760
Can	Pt. Claire, Que., Designtronics	514-695-3124
Can	Richmond, B.C., Blakewood Elctrns.	604-273-9910

Local Distributors

AZ	Phoenix, Lynntronics	602-841-3900
CA	Canoga Pk., Powerline	818-887-3337
CA	Costa Mesa, Battery Specialties	714-755-0888
CA	Costa Mesa, House of Batteries	714-548-3968
CA	Huntington Bch., House of Batteries	714-375-0222
CA	Los Angeles, Bell Inds.(Corporate Ofc.)	213-826-3975
CA	Mountain View, Power Source	415-960-0700
CA	Palo Alto, Power Source	415-856-0700
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, JDR MicroDevices	408-559-1200
CA	San Jose, Pioneer Technlgs.	408-954-9100
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Tarzana, Battery Biz	818-774-1678
CA	Van Nuys, Cresta Corp.	818-787-3919
CO	Littleton, AVT	800-537-9602
CT	Oxford, Periphex, Inc.	203-264-3985
FL	Altamonte Springs, TNR Tech.	800-346-0601
FL	Hialeah, Pro Battery Specs.	305-884-4040
FL	Jacksonville, Sunn Battery	904-353-6452
FL	Tampa, Micro Precision, Inc.	813-854-2816
GA	Decatur, ELS	800-334-5066
GA	Marietta, Synergistics	404-973-2200
IL	Chicago, Newark Elctrns.(Corporate Ofc.)	312-784-5100
IL	Downers Grove, Telecomm. Dvcs.	708-971-3460
IL	Lisle, Jabro House of Batteries	708-964-9358
LA	Lafayette, Mark Avant Sls.	301-232-6609
MD	Gaithersburg, Pioneer Technlgs.(Corporate Ofc.)	301-921-0660
MA	Andover, Generation Elctrns.	508-683-1177
MA	Methuen, Generation Elctrns.	508-683-1177
MI	Grand Rapids, North Coast Comps.	616-452-0800
MI	Livonia, LWC Distrs.	313-464-7700
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MN	St. Paul, Shelly Ragon(Corporate Ofc.)	612-642-2820
NY	Bohemia, Battery Assemblers	516-567-8855
NY	Commack, Bren-Tronics	516-499-5155
NY	Lynbrook, Dantona Inds., Inc.	800-326-8662
NY	Plainview, Micro Connections	516-993-1400
NY	Staten Island, Yakar Sys.	800-783-8181
NC	Pilot Mountain, Progressive Tech., Inc.	919-368-1375
NC	Winston Salem, Progressive Technlgs.	919-761-1375
OH	Cleveland, Pioneer Standard(Corporate Ofc.)	216-587-3600
OH	Columbus, Promark Elctrns.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	Levittown, Aim Elctrns.	215-785-3500
PA	Richboro, Power Comps.	800-628-7029
TX	Ft. Worth, Tandy Consumer Mail	817-390-8273
TX	Houston, Bar-Tec	713-957-4717
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Elect-A-Van	214-231-5351
TX	Spring, Jabro	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
Can	Alberta, Edmonton, Cardinal Elec., Ltd.	403-484-8926
Can	Burnaby, BC, Enercell	604-435-3666
Can	Calgary, AB, Cardinal Elctrns., Ltd.	403-259-6817
Can	Markham, Ont., Semad	416-475-8500
Can	Richmond, BC, Enermax Batteries	604-270-0812
Can	Surrey, BC, Excell Battery Co.	604-591-6588

TA ENGINEERING CO., INC., 1605 School St., Moraga, CA 94556, Tel: 415-376-8500, FAX: 415-376-4977; Empl.: 12

TAIYO YUDEN (USA) INC., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493, Tel: 708-364-6104, FAX: 708-870-7828; Empl.: 63; *Sls. Mgr.:* Ken Keim

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FAX: 314-265-3350

TALEMA ELECTRONIC, INC., P.O. Box 306, Saint James, MO 65559, Tel: 314-265-5500; Empl.: 44; *Sls. Mgr.:* Jeff Goff .... **A•2566-2570**

Local Sales Offices & Reps

AL	Huntsville, Progressive Technlg.	205-551-7770
CA	Campbell, King-Way Assocs. Inc.	408-866-5010
CA	Tarzana, King-Way Assocs., Inc.	818-609-1974
CO	Grand Junction, Krebill Comp. Sls.	303-293-8220
IL	Wheaton, EMTronics, Inc.	312-665-6222
KS	Shawnee, Buckman & Assocs.	913-268-6917
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Charles, Buckman & Assocs.	314-946-6201
NH	Hampton, Primary Source	603-926-8044
NY	Commack, R.C. Engrg. Sls.	516-543-3325
OR	Beaverton, Luscombe Engrg.	503-636-6664
RI	Warwick, Circuit-Pro, Inc.	401-738-7332
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
WA	Bellevue, Luscombe Engrg.	206-643-1463
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

TALIQ CORP., 1277 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-745-0750, FAX: 408-745-1820; Empl.: 100; *Sls. Mgr.:* Bob Simpson

TALTRONICS, Dimetrics, Inc., 404 Armour St., P.O. Box 339, Davidson, NC 28036, Tel: 704-892-8872, FAX: 704-892-4713; Empl.: 3000; *Sls. Mgr.:* Gene Sokolowski; *Dist. Mgr.:* Gene Sokolowski ...... **D•1942-1943, 2313**

Local Sales Offices & Reps

CA	Sunnyvale, Peartech Ind.	408-732-1500
FL	Largo, Electrocraft	813-544-1766
NH	Nashua, Bennetron	603-880-7008
NJ	Medford, The McCoy Grp.	609-953-0770
NY	Jericho, J Squared Mktg.	516-935-3200
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TX	Dallas, Advance Tech. Sls.	214-340-1300

TAMA ELECTRIC CO., LTD., See Raltron Electronics Corp.

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FAX: 909-676-9482

TAMURA CORPORATION OF AMERICA, 43352 Business Park Dr., P.O. Box 892230, Temecula, CA 92589-2230, Tel: 909-699-1270; Empl.: 6000; *Sls. Mgr.:* Steve Fisher; *Dist. Mgr.:* Steve Fisher .... **A•1297-1299, 1610-1611, 2571-2579; D•1479, 1945-1955**

Local Sales Offices & Reps

AL	Huntsville, Electronic Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Avtec/Earl & Assoc.	602-994-3813
CA	Marina Del Rey, Macro Rep Inc.	310-827-5120
CA	San Diego, Varigon San Diego, Inc.	619-576-0100
CA	Santa Clara, Technlg. Sls.	408-727-7200
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Marlborough, Precision Sls., Inc.	203-295-0580
FL	Deerfield Bch., Micro-Elec. Comps. Corp.	305-426-8944
FL	Largo, Micro-Elec. Comps. Corp.	813-393-5011
FL	Winter Springs, Micro-Elctrn. Comps.	407-366-1379
GA	Atlanta, Electronic Mktg. Assoc.	404-448-1215
IL	Park Ridge, Metcom Assoc., Corp.	708-696-1490
IN	Huntington, Elctrn. Reps Inc.	219-356-3513
IN	Indianapolis, Elctrn. Reps Inc.	317-894-1414
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
KY	Lexington, Elctrn. Reps Inc.	606-277-0436
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg. Co.	616-791-7370
MN	Edina, Grayden & Flemmer	612-941-1120
MO	St. Louis, Rush & West	314-965-3322
NJ	Lodi, TRC Elctrns.	201-779-8282
NC	Raleigh, Elctrn. Mktg. Assoc.	919-847-8800
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Westlake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
PA	Allentown, TRC Elctrns.	215-264-4995
TX	Dallas, Marathon Assocs.	214-234-5686
TX	Freeport, Marathon Assocs.	409-233-7026
TX	Houston, Marathon Assocs.	713-495-6495
WA	Redmond, S.E.A. (Sls. & Engrg. Assoc.)	206-883-4999
WA	Vancouver, S.E.A. (Sls. & Engrg. Assoc.)	206-573-5161
WI	West Allis, Metcom Assocs. Corp.	414-476-1300
Can	Pointe Claire, Que., A.R. Gray & Assocs.	514-694-6378

Local Distributors

AL	Birmingham, American Elctrn. Supply	205-942-4656
CA	Manhattan Beach, Prime Electro Prods. Co.	213-379-3642
CA	Santa Clara, Foresight Elctrns.	408-980-9700
CA	Yorba Linda, Target Elctrns., Inc.	714-733-0384
CO	Littleton, Deltex, Inc.	303-779-1611
CO	Littleton, Displays Plus, Inc.	303-730-7333
FL	Palm Bay, Comp. Distrs., Inc.	407-724-9910
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Glendale Hgts., Mac Gregor & Co., Inc.	708-469-4080
IL	Grove Vlg., Nu-Way Elctrns., Inc.	708-437-7120
IN	Indianapolis, Meunier Elctrns.	317-635-3511
LA	Houma, Control Genl.	504-872-9002
MD	Burtonsville, U.S. Elctrns., Inc.	301-384-3300
MD	Columbia, Vantage Comps.	410-720-5100
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Acme Elctrns.	612-338-1016
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Tortec Corp.	612-866-3662
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MN	St. Paul, Power Motion	612-645-0781
MS	Jackson, Ellington Elctrn. Supp., Inc.	601-355-0561
NJ	Lodi, TRC Elctrns.	201-779-8282
NM	Albuquerque, Elctrn. Parts Co.	505-293-6161
NY	Syracuse, ADR Technlgs. Inc.	315-437-7087
OH	Centerville, Indl. Prods. Distbg., Inc.	513-435-2086
OH	Cincinnati, Schuster Elctrns., Inc.	513-489-1400
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TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Tomball, Wofford Elctrns.	713-351-2255
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	Milwaukee, Progressive Image, Inc.	414-321-4722

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TANE ALARM PRODUCTS, 247-40 Jericho Tpke., Flora Park, NY 11001, Tel: 516-328-3351, FAX: 516-326-9125 Empl.: 10; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Sam Lurie

K.L. TANNEHILL INC., 1210 W. 96th St., Bloomington, MN 55431, Tel: 612-881-6700, FAX: 612-881-0743; Empl.: 21 *Sls. Mgr.:* James Falcone

TANSITOR ELECTRONICS, West Rd., P.O. Box 230 Bennington, VT 05201, Tel: 802-442-5473, TELEX 954007, FAX: 802-447-1297; FSC No.: 030266626; Empl. 183; *Sls. Mgr.:* David Latchum; *Dist. Mgr.:* 225

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel 716-621-8400; Empl.: 120; *Sls. Mgr.:* Joseph C. Pallone

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd Farmingdale, NY 11735, Tel: 516-694-6312, FAX: 516-694-6304; Empl.: 100; *Sls. Mgr.:* Ed Duhon

TAMURA

DELIVERS AC PRODUCTS FROM STOCK

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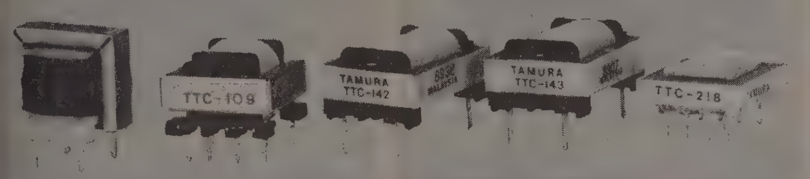
A•2575


TTC-109
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TTC-142
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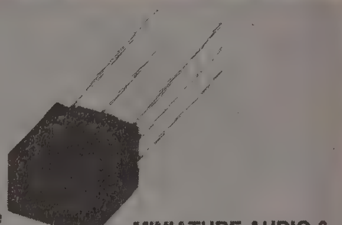
TTC-143
TTC-218

TELECOMMUNICATIONS TRANSFORMERS MEET FCC PART 68



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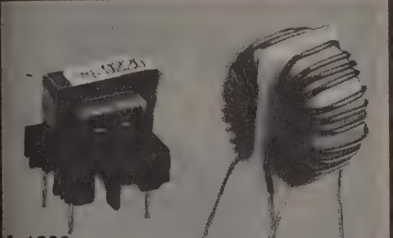
MINIATURE AUDIO & FCC PART 68 COUPLING



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A•1610

COMMON MODE COILS

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A•2578

SCR/TRIAC TRIGGER TRANSFORMERS

TAMURA
CARSON CA
3PD-320

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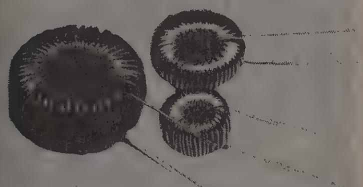
Page
A•2576

OEM PC BOARD POWER TRANSFORMERS



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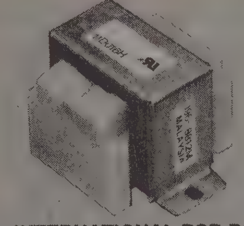
A•1297

NOISE, COMMON MODE & POWER COILS



INTERNATIONAL PCB POWER
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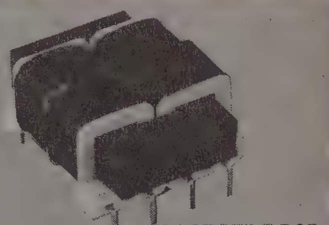
Contact Tamura



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LOW PROFILE PCB POWER TRANSFORMERS

TTC-121
8912
MALAYSIA

See
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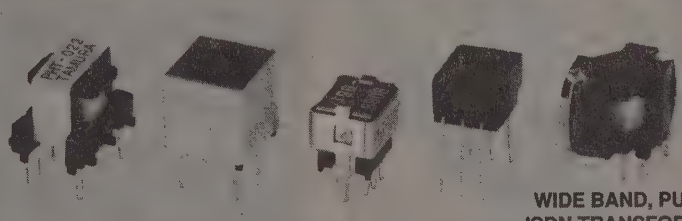
A•2574

TELCOM CENTRAL OFFICE/PBX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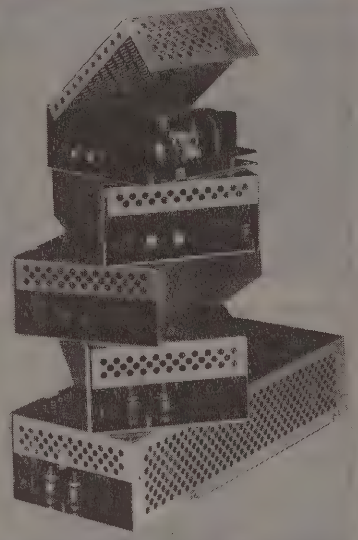
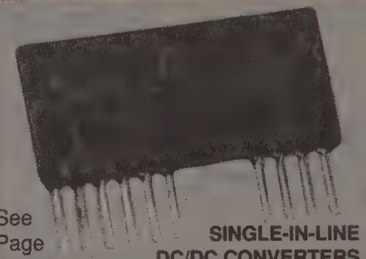


See Page D•1948

SWITCHING POWER SUPPLIES TO 400W



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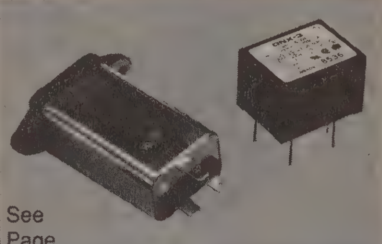
SINGLE-IN-LINE DC/DC CONVERTERS

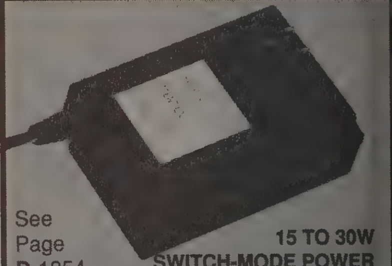
See Page D•1949

1" HIGH, 85-264VAC, 50W SWITCHING POWER SUPPLIES



See Page A•1611

EMI/RFI LINE FILTERS



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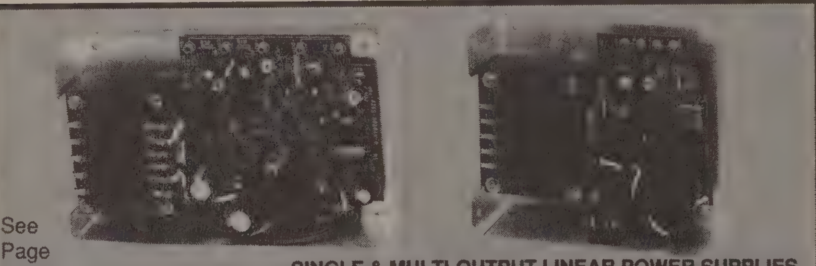
15 TO 30W SWITCH-MODE POWER



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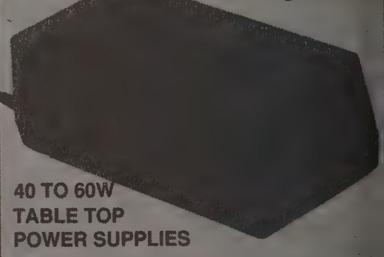
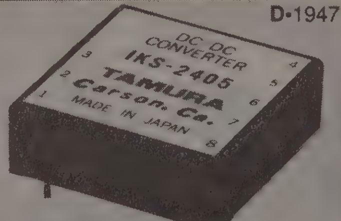
SINGLE & MULTI-OUTPUT LINEAR POWER SUPPLIES

See Page D•1954



40 TO 60W TABLE TOP POWER SUPPLIES

D•1947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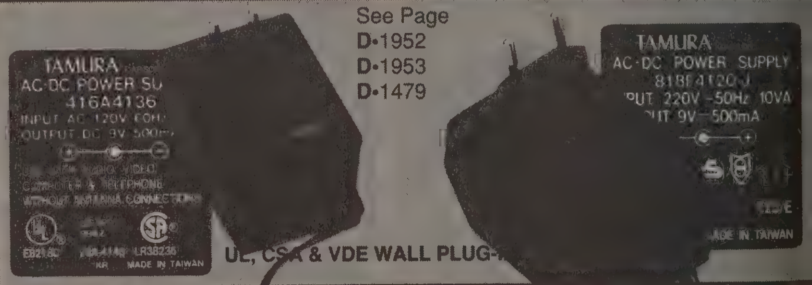
See Page D•1952 D•1953 D•1479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OUTPUT DC 9V 500mA
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TAUBER

FAX: 619-274-2220

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AL	Huntsville, Macro-Mktg.	205-883-9630
CA	Fullerton, Tauber Elctrns.	1-800-927-0004
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CA	Santa Ana, Carlos Gonzalez	1-800-927-0004
FL	Land-O-Lakes, AJ'S Power Source	813-996-2583
GA	Norcross, Marco Mktg.	404-662-5580
IL	Wheeling, Ed Joyner & Co.	708-520-1200
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MD	Laurel, Penn Star Elctrns.	301-854-2308

TAURUS CORPORATION, See Signal Research Inc.

TAURUS ELECTRONICS, INC., One Tupperware Dr., Ste. 13, N. Smithfield, RI 02895, Tel: 401-769-2625, FAX: 401-765-8455; Empl.: 10; *Sls. Mgr.:* Richard E. Schaffer

TAYLOR ELECTRONICS, INC., 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523, FAX: 602-838-7456; Empl.: 25; *Sls. Mgr.:* Sharon F. Hansen

TAYLOR INDUSTRIAL SOFTWARE, 10045 111 St., Ste. 1002, Edmonton, Alberta, Canada T5K 2M5, Tel: 403-482-7547, FAX: 403-488-8032; Empl.: 75; *Dist. Mgr.:* Carl Cooke, VP Sls. & Mktg.

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AZ	Tempe, Cantec Sls., Inc.	602-345-1276
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MD	Gaithersburg, Carwithen Assocs.	301-921-9545
NY	E. Setauket, Eastern Metro Assoc.	516-928-2726
TX	Richardson, McCoy Assocs. Co.	214-864-1838
WA	Seattle, Datacom Assocs.	206-285-2525

Local Distributors

IL	Chicago, Newark Elctrns.	312-784-5100

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TEAM VISIONICS CORPORATION, 3071 De La Cruz Blvd., Ste. 108, Santa Clara, CA 95054, Tel: 408-562-0123, FAX: 408-492-1380; Empl.: 15

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CA	San Jose, O'Donnell North	408-456-2950
CA	Torrance, O'Donnell Assocs.	310-781-2255
CO	Littleton, Harthun Assocs.	303-795-5545
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FL	Boca Raton, Perrott Assocs. Inc.	407-362-0191
FL	Casselberry, Perrott Assocs. Inc.	407-830-0094
FL	Melbourne, Perrott Assocs. Inc.	407-676-0305
FL	Tampa, Perrott Assocs. Inc.	813-985-1900
GA	Norcross, Interep Assocs. Inc.	404-449-8680
IL	Itasca, Micro Sls.(MSI)	708-285-1000
IN	Huntington, Elctrn. Rep, Inc.	219-356-3513
IN	Indianapolis, Elctrn. Rep, Inc.	317-894-1414
IA	West Des Moines, SPS Assocs. Ltd.	515-225-0607
KS	Olathe, SPS Assocs. Ltd.	913-764-4460
KY	Lexington, Elctrn. REP, Inc.	606-277-0436
MA	Medfield, JEF Components	508-359-5501
MA	Still River, JEF Comps.	508-456-3369
MA	Wenham, S-J New England (Boston)	508-468-5057
MA	Worcester, S-J Assocs. Inc.	508-799-5409
MI	Farmington Hills, Rathsburg Assocs.	313-489-1500
MN	Minneapolis, ECS (Electric Comp. Sls.)	612-933-2594
MO	Earth City, SPS Assocs. Ltd.	314-291-0520
NJ	Mt. Laurel, S-J Mid Atlantic Inc.	609-866-1234
NM	Albuquerque, Sys. Sls. of NM (SSA)	505-889-2901
NY	Canandaigua, Bensman/Upstate Assocs.	716-396-2498
NY	Lewiston, Bensman/Upstate Assocs.	716-754-9155
NY	Rockville Centre, S-J Assocs. Inc.	516-536-4242
NC	Charlotte, Godwin Assocs.	704-549-8500
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Columbus, Rathsburg Assoc.	614-457-2242
OH	Independence, Rathsburg Assoc.	216-447-8825
OH	Miamisburg, Rathsburg Assocs.	513-434-1026
TN	Greenville, Interep Assocs. Inc.	615-639-3491
TX	Irving, Amir Jabin	214-580-1515
VA	Falls Church, S-J Chesapeake	703-533-2233
WA	Bothel, Quädra Sls.	206-489-3428
WI	Wauwatosa, Larsen Assocs.	414-258-0529
Can	Concord, Ont., Astec Comps.	416-669-4022

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Hayward, Electro Comp. Distrs.	510-783-5800
CA	Santee, Mouser Elctrns.	619-449-2220
CA	Tustin, Added Value Elect. Distr. Inc.	714-259-8258
CT	Milford, Fleet Elctrns. Inc.	203-877-2577
CT	Wallingford, Greene-Shaw	203-265-3333
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
CO	Wheat Ridge, Added Value Rcky. Mtns.	303-422-1701
IL	Rosemont, Advent Elctrns. Inc.	708-298-4210
IN	Indianapolis, Advent Elctrns. Inc.	317-872-4910
IA	Cedar Rapids, Advent Elctrns. Inc.	319-363-0221
MD	Savage, Pyttronic Ind. Inc.	301-953-9650
MA	Newton, Greene-Shaw	617-969-8900
MI	Farmington Hills, Advent Elctrns. Inc.	313-477-1650
MN	Minneapolis, Stark Elctrns. Supp. Co.	612-332-1325
MN	St. Paul, Gopher Elctrns.	612-490-4907
MN	Thief River Falls, Digi-Key	800-344-4539
MO	St. Charles, Finnegan Elctrns.	314-946-6201
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Bloomfield, Solid State Inc.	201-429-8700
NJ	Randolph, Mouser Elctrns.	201-328-3322
NM	Albuquerque, Bell Inds. of NM	505-292-2700
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Penn Yan, Advacom Inc.	315-536-2221
NC	Greensboro, Hammond Elctrns.	919-275-6391
OR	Portland, Radar Elec.	503-232-3404
PA	Export, Advacom Inc.	412-325-7551
PA	McKean, Advacom Inc.	814-476-7774
PA	Montgomeryville, Pyttronic Ind. Inc.	215-643-2850
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Carrollton, Omni Pro Intl. Inc.	214-713-9000
TX	Houston, Omni Pro Elctrns.	713-270-1700
TX	Mansfield, Mouser Elctrns.	817-483-4422
UT	West Valley City, Added Value (AVED)	801-975-9500
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co. Inc.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000
WI	Mukwonago, Advent Elctrns.	414-363-3249
Can	Calgary, Alberta, Cardinal Ind Elctrns.	403-259-6817
Can	Edmonton, Alberta, Cardinal IND Elctrns.	403-483-6266
Can	Montreal, Que, Electronic Wholesalers	514-769-8861
Can	Richmond, B C, Electro Sonic Inc.	604-273-2911
Can	Saskatoon, Sask., Cardinal Ind. Elctrns.	306-934-3443
Can	Willowdale, Ont., Electro Sonic Inc.	416-494-1666

TECH-ETCH, INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 508-747-0300, TELEX: 989997, FAX: 508-746-9639; Empl.: 280; *Sls. Mgr.:* P. A. Thomas

TECH LABORATORIES INC., 500 10th St., Palisades Pk., NJ 07650, Tel: 201-944-2221, FAX: 201-944-1653; FSC No.: 83332; Empl.: 25; *Sls. Mgr.:* Nino M. Vlacich **B•1815**

Local Sales Offices & Reps

CA	Canoga Park, C & W Compents Sls.	818-700-2684
CA	Mtn. View, Bridge Mktg.	415-965-8045
IL	Glenview, Crimson Engrg. Co.	312-470-0024
KS	Lenexa, Midtec Assocs.	913-541-0505
MI	Jackson, N. Scroggs Co.	517-750-1170
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Whippany, Ken L. Love Assocs.	201-540-0204
NY	Hempstead, Ken L. Love Assocs.	516-681-3155
OH	Cincinnati, Patco	513-931-3311
SC	Myrtle Beach, Candor Co. Inc.	803-448-8361
TX	Dallas, Southwest Elctrns.	214-690-9881
TX	Houston, Southwest Elctrns.	713-729-1670

FAX: 310-827-2572

TECHMAR CORP., 4150-A Glencoe Ave., Marina Del Rey, CA 90292, Tel: 310-827-8897; FSC No.: 32597; Empl.: 8; *Sls. Mgr.:* Jeff Wilson **C•1102-1104**

TECHMATION, INC., 2730 South Hardy, Ste. 5, Tempe, AZ 85282, Tel: 602-968-9946, FAX: 602-968-1849

TECHNAR, INC., See TRW Technar, Inc.

TECHNETICS CORPORATION, 6408 Castleplace Dr., Indianapolis, IN 46250, Tel: 317-842-5377, 800-467-8324; Empl.: 120; *Sls. Mgr.:* Michael L. Scherer

TECHNIC, INC., Box 9650, Providence, RI 02940-9650, Tel: 401-781-6100, TELEX: 927514, FAX: 401-781-2890; Empl.: 225; *Sls. Mgr.:* Andrew T. Ferris

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 310-618-8437, FAX: 310-618-1543; FSC No.: 04772; Empl.: 45; *Sls. Mgr.:* D. Murrin; *Dist. Mgr.:* D. Murrin

TECHNICAL DEVICES, 9181 N. Dixie Dr., Dayton, OH 45414, Tel: 513-890-7881, FAX: 513-890-5136; Empl.: 12 .... **C•1813; D•1956-1957**

Local Sales Offices & Reps

AL	Huntsville, CMS	205-881-6699
AZ	Scottsdale, Western Region Mktg.	602-661-0093
CO	Westminister, Western Region Mktg.	303-428-8088
FL	Longwood, Larry Wood Sls. Agy. Inc.	407-774-2554
GA	Newman, CMS	404-304-0814
IL	Western Springs, Corlinear Reps.	708-784-1100
MI	Grand Rapids, J.M.J. & Assocs.	616-285-8887
MN	New Hope, Customer First	612-533-5604
NC	Durham, CMS	919-383-9448
OH	Cleveland, Tech. Dvcs.	216-975-1985
OH	Dayton, Tech. Dvcs.	513-890-6811
TX	Austin, Component Technlg.	512-288-7382
TX	Dallas, Component Technlg.	214-783-8831
TX	Houston, Component Technlg.	713-690-3011
UT	Salt Lake City, Western Reg. Mktg.	801-268-9768

TECHNICAL HEATERS, INC./THERMOLAB, 710 Jessie St., San Fernando, CA 91340, Tel: 818-365-9435, FAX: 818-361-2788; FSC No.: 09152

TECHNICAL MARKING SYS., See Autoroll Machine Corp.

TECHNICAL PANELS, INC., 1600 W. Acoma Blvd., 60, Lake Havasu City, AZ 86403, Tel: 602-680-9191, FAX: 602-680-9101; Empl.: 14

TECHNICAL RESEARCH & MFG., INC., See TRM, Inc.

TECHNICAL SERVICES FOR ELECTRONICS, INC., 108 5th Ave. N.W., P.O. Box 616, Arlington, MN 55307, Tel: 612-964-2237, FAX: 612-964-2465; Empl.: 300

TECHNICAL SERVICES LABORATORY INC., 95 Ready Ave., Ft. Walton Beach, FL 32548, Tel: 904-243-3722, FAX: 904-244-6653; FSC No.: 51283; Empl.: 12; *Sls. Mgr.:* Andrew J. Corbin

TECHNICAL WITTS, INC., 6319 W. Villa Theresa Dr., Glendale, AZ 85308, Tel: 602-439-1833, FAX: 602-439-1833; Empl.: 2; *Sls. Mgr.:* Ernest H. Wittenbreder

TECHNIPOWER

A SUBSIDIARY OF **Penril** DATACOMM NETWORKS INC

FAX: 203-797-9285

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06813, Tel: 203-748-7001; FSC No.: 13850; Empl.: 85; *Sls. Mgr.:* Jack Schramm .... **A•2565; D•1958-1959**

Local Sales Offices & Reps

AL	Huntsville, Rakes Engrg. & Mktg.	205-533-3763
CA	La Habra, Cygnus Sls. Engrg. Corp.	213-691-2993
CO	Parker, Technlg. Mktg. Assoc.	303-841-3435
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MN	Minneapolis, Intertec Assocs.	612-921-8443
MO	St. Louis, AEM Inc.	314-298-9900
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Irving, Kite Elctrn.	214-986-0321
WA	Kirkland, NorthWest Comp. Sls.	206-828-2104
Can	Guelph, Ont., Victrix, Ltd.	518-836-1480
Can	Ontario, Cana Rep. Grp. Inc.	416-250-6683

Local Distributors

CA	Los Angeles, Cal-State Elctrns.	213-933-8187
CA	Oakland, N. A. D'Arcy	415-638-7773
CT	Bristol, M.L. Assocs., Inc.	203-589-2856
GA	Atlanta, Motion Elctrns.	404-455-8262
IL	Des Plaines, Delta Tech.Prods.	708-803-6070
IN	South Bend, PEI/Genesis	800-523-0727
MD	Baltimore, PEI/Genesis	301-529-2200
MA	Woburn, Abbott Elctrns. Co.	617-935-2040
MI	Dearborn, Industrial Temp. & Control	313-278-2210
MN	St. Paul, Gopher Elctrns. Co.	612-494-4900
NY	Albany, Adirondack Elctrns., Inc.	518-456-0203
NC	Charlotte, Jenkins Elec. Co.	704-392-7371
OH	Dayton, Wright Source	513-293-1341
OK	Tulsa, Inotek Corp.	918-627-1500
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Inotek Corp.	214-243-7000
TX	Houston, Inotek Corp.	713-688-4494
Can	Guelph, Ont., Victrix Ltd.	519-836-1480

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900, FAX: 201-569-5615; Empl.: 60

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, TELEX: 834-763, FAX: 215-828-5623; FSC No.: 30239; Empl.: 80; *Sls. Mgr.:* W. Bezar

Local Sales Offices & Reps

AZ	Mesa, Techni-Tool West	602-345-2700
CA	W. Covina, Electra-Tec	818-964-9772
FL	Ft. Pierce, Hyber-Sem	305-464-0461
NJ	Butler, Genl. Techn.	201-492-1292

TECHNITROL, 1952 E. Allegheny Ave., Philadelphia, PA 19134, Tel: 215-426-9105, FAX: 215-426-2836; FSC No.: 90095; Empl.: 900; *Sls. Mgr.:* G. Shilling ... **A•1580-1583**

Local Sales Offices & Reps

CA	Livermore, United Techn. Mktg.	415-449-7644
AZ	Phoenix, Detomasi & Grupp	602-947-3724
CA	Mission Hills, Detomasi & Grupp	818-365-8285
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
CO	Grand Juction, Krebill Comp. Sls.	303-243-8220
AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
GA	Norcross, Advanced Comps.Mktg.	404-448-7025
IL	Wauconda, Cudahy Sls.	708-526-2484
KS	Parker, S.W. Assocs.	913-898-6552
MD	Baltimore, Callas Elctrns.	301-744-7711
MO	St. Louis, S.W. Assocs., Inc.	314-576-4650
NM	Albuquerque, Quatra Assocs., Inc.	505-296-6781
NY	Jericho, J. Square Mktg.	516-935-3200
NY	Mendon, Tech-Mark, Inc.	716-624-3840
OH	Dayton, The Lyons Corp.	513-278-0714
FL	Seminole, Q-Rep	813-397-8431
OR	Tigard, Vantage Corp.	503-684-0422
PA	Easton, The Kendon Co.	215-253-3100
TX	Dallas, M-Rep	214-484-5711
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Bellevue, Vantage Corp.	206-455-3460

TECHNO DIVISION, DALE ELECTRONICS, 7803 Lemona Avenue, Van Nuys, CA 91405-1139, Tel: 818-781-1642, FAX: 818-781-8647; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Pete Huber; *Dist. Mgr.:* Jon Trabert .... **A•1916, 1925**

TECHNO-ISEL USA DIVISION, Designatronics, 2101 Jericho Tpke. - Box 5416, New Hyde Park, NY 11042-5416, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85; *Sls. Mgr.:* Dr. George Klein; *Dist. Mgr.:* Dr. George Klein

TECHNOLOGY DESIGN INC., 10838 Main St., Bellevue, WA 98006, Tel: 206-455-9822, FAX: 206-455-3449; Empl.: 16; *Sls. Mgr.:* Larry Stapleton

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70; *Sls. Mgr.:* Mark S.Jacobus .... **D•1574-1578, 2056-2057, 2070**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
CA	San Diego, Cirolia Elctrns. Sls.	619-743-3015
CA	Santa Clara, W. J. Elect Sls.	408-982-9222
FL	Clearwater, Tech-Rep Assoc.	813-872-9900
GA	Lawrenceville, BCI	404-962-6826
IL	Arlington Heights, Greenslade	708-593-3450
MD	Columbia, Delta III Assoc.	410-730-4700
MA	Topsfield, Whitehead Assoc.	508-887-8050
MN	Minneapolis, Tec Teams Sls.	612-854-6616
NM	Albuquerque, IMEC	505-275-0936
NY	Elmont, Crane & Egert	516-872-0800
NY	Fayetteville, Tri-Tech	315-446-2881
OH	Chagrin, J. J. Bair	216-543-8617
TX	Dallas, Tesco	214-553-1200
UT	Midvale, Christee	801-566-3694
WI	Wauwatosa, Greenslade Sls.	414-258-2727

TECHNOLOGY 80, INC., 658 Mendelssohn Ave. N., Minneapolis, MN 55427, Tel: 612-542-9545, FAX: 612-542-9785; Empl.: 25; *Sls. Mgr.:* Dennis Sherwood

TECHNO SCIENTIFIC INC., 60 Caster Ave., Woodbridge, Ont., Canada L4L 5Y9, Tel: 905-851-9958, FAX: 905-851-6314; FSC No.: 6635; Empl.: 20; *Sls. Mgr.:* Victoria McDonald

TECHRAND CORP. OF AMERICA, 6520 Schamber Dr., Muskegon, MI 49444, Tel: 616-798-2930, FAX: 616-798-2934; Empl.: 40; *Sls. Mgr.:* James Arter

TECHRON.

FAX: 1-219-294-8329

TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 600 .... **D•1019-1021**

Local Sales Offices & Reps

CA	Laguna Hills, Elotek Sys., Inc.	714-830-4856
CA	Pleasanton, IFM Inc.	510-846-0762
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
IL	Arlington Hgts., Berndt Assocs., Inc.	708-632-0900
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	Montgomeryville, Eastern Sci-Mktg.	215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 70; *Sls. Mgr.:* Gerald Winters

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, FAX: 717-774-6799; FSC No.: 58792; Empl.: 15; *Sls. Mgr.:* James M. Griffith

TECKNIT, 129 Dermody St., Cranford, NJ 07016, Tel: 908-272-5500, TELEX: 6853079 TCKNT, FAX: 908-272-2741; FSC No.: 07700; Empl.: 225; *Sls. Mgr.:* Joseph Barbuto

TECLAB, Kalamazoo Technical Furniture, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-372-6000, 800-832-5227, FAX: 616-372-6116; Empl.: 35; *Sls. Mgr.:* B. Smith .... **C•1105**

TECNETICS, See Computer Products, Inc.

TECNETICS INC., 6287 Arapahoe Ave., Boulder, CO 80303, Tel: 303-442-3837, FAX: 303-444-9437; Empl.: 120; *Sls. Mgr.:* Paula Guadiana

Refer to Tecnetics Inc. 6287 Arapaho Ave. Boulder, CO 80303

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 30; *Sls. Mgr.:* Sandra Murphy

TECTROL INC

SWITCHING POWER PRODUCTS

FAX: 416-638-0553

TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108; Empl.: 450; *Sls. Mgr.:* Paul Carroll .... **D•1960-1964**

Local Sales Offices & Reps

CA	Granada Hills, Plustronics	818-995-8908
CA	Newport Beach, Plustronics	714-476-8009
CA	San Diego, Mesa Comps.	619-278-8021
CO	Denver, Seale & Assoc., Inc.	303-695-1980
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
IN	Columbus, High-Tech Assocs.	812-378-4835
CT	Bloomfield, Zaslow Sls.	203-242-7781
MA	Natick, Zaslow Sls.	508-393-8150
MN	S.St. Paul, Northport Engrg., Inc.	612-457-8000

Y	Albany, Lynn Assocs.	518-459-1239
Y	Buffalo, Lynn Assocs.	716-631-0054
Y	Ronkonkoma, PMR	516-467-8200
C	Raleigh, VMI	919-870-7123
H	Dayton, Tech. Dvcs.	513-890-6811
K	Tulsa, Tectrol Inc.	918-234-2440
R	Tigard, Rep-West	503-639-0325
A	Pittsburgh, Lynn Assocs.	412-443-3670
X	Arlington, T-Tech Sls.	817-274-0505
A	Seattle, Rep-West	206-283-8351
an	Downsview, Ont., Tectrol Inc.	416-630-8108

Local Distributors

A	Santa Clara, Foresight Elctrns.	408-980-9700

EGAM, INC., 7230 North Ridge Rd., Madison, OH 44057, Tel: 800-666-1010, FAX: 216-428-1068; Empl.: 50; *Sls. Mgr.:* Terry Gambill

TEKA

an Interplex Industries company

FAX: 401-461-2310

EKA INTERCONNECTION SYSTEMS, Interplex Industries, 45 Salem Dr., Providence, RI 02907, Tel: 401-785-4110; Empl.: 89; *Sls. Mgr.:* Barry Manchester; *Dist. Mgr.:* Barry Manchester .... **C•1484-1489**

Local Sales Offices & Reps

Z	Tempe, Spectrum Assocs. S.W. Inc.	602-966-1788
A	Downey, Management Mktg. & Sls.	213-560-5584
A	Fullerton, Kent Elctrns.	714-773-0781
A	Pleasanton, Leddy Assocs., Inc.	510-417-1033
A	San Diego, Kent Elctrns.	619-271-5404
A	San Diego, Qualtronics	619-695-0118
O	Boulder, R.G. Entprs., Inc.	303-447-9211
L	Orlando, Werndli & Assocs.	407-851-1923
A	Marietta, Quality Mktg.	404-565-5578
L	Barrington, Bill Walthall & Assocs.	708-381-3177
N	Wayzata, Cardinal Sls.	612-475-0041
Y	Hauppauge, Sticom Sls. & Mktg.	516-366-4221
J	Mt. Laurel, WYCK Mktg.	609-727-1070
H	Cincinnati, Century Tech. Sls.	513-677-5088
R	Beaverton, Norwest Inteconnect Sys.	503-690-7120
I	Lincoln, Global Technical Sls. Inc.	401-334-3830
X	Austin, Mil-Rep Assocs.	512-346-6331
X	Houston, Mil-Rep Assocs.	713-444-2557
X	Richardson, Mil-Rep Assocs.	214-644-6731
XP	Huntington Beach, Intercation Inc.	714-636-3722
an	St. Laurent, Que., HHR Electro	514-739-7054

Local Distributors

A	Hayward, KEA Elctrns.	415-887-2900
A	Irvine, Mann Southwest	714-380-4170
A	San Diego, Deco	619-693-1595
A	San Jose, Compass Comp.	408-432-7575
A	San Jose, Spectra Elec.	1-800-252-1590
A	San Jose, Turbo Elctrns.	408-441-6616
A	Santa Ana, Norstan Elctrns.	714-540-4165
A	Santa Clara, Kent Elec.	408-727-9810
A	Sunnyvale, PSC Elctrns.	408-737-1333
L	Largo, Elctrn. Precepts of FL.	1-800-367-4649, 813-544-3636
A	Methuen, Aved Elctrns.	508-688-3800
I	Fraser, Madison Elctrns.	313-294-8300
N	St. Paul, Kent Elctrns.	612-642-2844
J	Cherry Hill, Jetta Corp.	609-663-7272
J	Whippany, American Distrs. Inc.	201-428-0510
Y	Farmingdale, Pride Elctrns.	516-293-4020
Y	Ronkonkoma, Conco Elctrns.	516-467-8200
C	Raleigh, Resco Raleigh	919-781-5700
H	Centerville, I.P.D., Inc.	513-435-2086
I	Warwick, Cal-Greg-Comps.	401-738-6170
X	Allen, Prime Distbn.	214-231-0170
A	Redmond, Kent Elctrns.	206-241-1980
an	Burlington, Ont., Alternate Source Comp.	416-335-6385

EKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620-1103, Tel: 716-232-1291, FAX: 716-232-1295; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

EKNOR MICROSYSTEMS INC., 31 Blvd. de la Seigneurie Est., Ste. 107, Blainville, Que., CAN J7G 4G6, Tel: 514-437-5682, 800-387-4222, FAX: 514-437-8053; Empl.: 32; *Sls. Mgr.:* Pierre McMaster

EKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 407-844-2383, FAX: 407-845-1587; FSC No.: 59-1500771; Empl.: 70; *Sls. Mgr.:* David Duelfer; *Dist. Mgr.:* David Duelfer

TEKTRONIX, INC., P.O. Box 1000, Wilsonville, OR 97070, Tel: 800-835-9433, TWX: 910-467-8708; FSC No.: 80009; Empl.: 12,500

TEKTRONIX, INC., Display Products, P.O. Box 500 M/S 46-943, Beaverton, OR 97077, Tel: 503-627-5000, FAX: 503-627-1070

TEKTRONIX-SIGNAL ANALYSIS UNIT, 3003 Bunker Hill Ln, PO Box 58086, Santa Clara, CA 95052-8086, Tel: 408-496-0960, FAX: 408-496-6108

TELCO

TELCO INTERCONTINENTAL CORPORATION

FAX: 713-859-8825

TELCO INTERCONTINENTAL CORP., TECO, 9812 Whithorn Dr., Houston, TX 77095, Tel: 713-855-2218; Empl.: 13; *Sls. Mgr.:* Ruth Haber .... **B•1311; C•1490-1491**

Local Sales Offices & Reps

CA	Lomita, Tech Rep Comps.	310-539-9070, FAX:310-539-0434
CA	Mountain View, Bridge Mktg.	415-965-8045
CA	San Jose, Mc Farland Assoc.	408-993-0200, FAX:408-993-0123
CA	Santa Clara, Suneical Mktg. Co.	408-244-9900
CA	Solana Bch., Carco	619-792-5555
CO	Denver, Motion Technlg.	303-757-3003, FAX:303-757-0616
CO	Erie, ROKC Comps.	303-828-3872
FL	Ft. Lauderdale, Motion Controls	305-434-4197, FAX:305-434-5682
GA	Atlanta, Industrial Apparatus	404-875-8086, FAX:404-875-1506
GA	Kernersville, Wallace Elctrns., Sls.	919-996-2742
IL	Addison, Vikeland Sls.	708-832-8425, FAX:708-832-7251
IL	Chicago, Rendell Sls.	312-539-1820
KS	Overland Pk., Singer Inds. Sls.	913-897-2008
MA	Northborough, Easterly Sls.	508-393-7399
NH	Dover, Pfall Assoc.	603-742-0966, FAX:603-743-3347
NJ	Sussex, Carbone Assoc.	201-875-1882, FAX:201-875-2685
NY	Glen Cove, DynoRep	516-676-1598
OH	Worthington, R J Mktg.	614-888-7638
PA	Willow Grove, Tech Sls. Assocs.	215-784-0170
TX	Austin, Sunbelt Comps.	512-335-0499, FAX:512-331-1351
TX	Burleson, Bounty Elctrns.	817-447-9775
TX	Dallas, Sunbelt Comps.	214-248-8000, FAX:214-248-8100

TELEBYTE TECHNOLOGY, INC., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, 800-835-3298, FAX: 516-385-8184; Empl.: 48; *Sls. Mgr.:* J. Kramer; *Dist. Mgr.:* R. Nazario

TELECOMMUNICATIONS TECHNIQUES CORP., 20410 Observation Drive, Germantown, MD 20876, Tel: 301-353-1550, FAX: 301-353-0734

TELECTRO SYSTEMS CORP., 96-18 43rd Ave., Corona, NY 11368, Tel: 718-651-8900, TWX: 510-601-8607 TELECTRO, FAX: 718-651-4103; FSC No.: 30040; Empl.: 50; *Sls. Mgr.:* Harry Sussman

TELE-DENKEN RESOURCES, INC., 7702 FM 1960 East, Humble, TX 77346, Tel: 713-852-5366, TELEX: 4949653, FAX: 713-852-3869; *Sls. Mgr.:* Gary Killian; *Dist. Mgr.:* Gary Killian

TELEDYNE COMPONENTS, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267, Tel: 415-968-9241, FAX: 415-967-1590; FSC No.: 15818; Empl.: 200; *Sls. Mgr.:* Robbie Izat; *Dist. Mgr.:* Nancye R. Beck, Worldwide Distr. Sls. Mgr.

TELEDYNE GURLEY, 514 Fulton St., P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, 800-759-1844, TWX: 710-443-8156, FAX: 518-274-3660; *Sls. Mgr.:* G. S. Gordon

TELEDYNE KINETICS, Div. of Teledyne, Inc., 8650 Balboa Ave., San Diego, CA 92123-1502, Tel: 619-576-1005, FAX: 619-576-0607; FSC No.: 06928; Empl.: 100; *Sls. Mgr.:* Peter Kurbikoff

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 310-822-8229, 310-305-0248, TWX: 910-343-7436, FAX: 213-305-0248; FSC No.: 16170; Empl.: 912; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, FAX: 415-966-1521; FSC No.: 24022; Empl.: 200; *Sls. Mgr.:* M. Lee

TELEDYNE PENN-UNION, Solderless Connector Div., One Riverside Dr., Ansonia, CT 06401, Tel: 203-732-7025, TELEX: 963408, ESYLNK: 62877180, FAX: 203-732-0831; FSC No.: 19724; *Sls. Mgr.:* Bob O'Keefe

TELEDYNE PENN-UNION, 229 Waterford St., Edinboro, PA 16412, Tel: 814-734-1631 Ext. 382, FAX: 814-734-4946; *Sls. Mgr.:* Chuck Malay

TELEDYNE RELAYS

FAX: 213-779-9161

TELEDYNE RELAYS, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077; FSC No.: 11532; *Sls. Mgr.:* Tom Garland .... **B•1616-1623**

Local Sales Offices & Reps

AL	Huntsville, Elcom	205-830-4001, FAX:205-830-4058
AZ	Scottsdale, Arcom Sls.	602-947-5745, FAX:602-990-1765
CA	Anaheim, Westrep	714-527-2822, FAX:714-527-3868
CA	San Diego, Westrep	619-674-1880, FAX:619-674-1878
CA	San Jose, Meridian-West	408-927-6377, FAX:408-927-6378
CO	Englewood, Thorson Rocky Mtn., Inc.	303-773-6300,FAX:303-773-6302
CT	Stratford, VISTAssociates, Inc.	203-375-5456, FAX:203-375-6907
FL	Longwood, Teledyne Relays	407-682-9044, FAX:407-682-7644
FL	Winter Pk., HHP Assocs., Inc.	407-740-0320, FAX:407-740-0319
GA	Norcross, Elcom	404-447-8200,FAX:404-447-8340
IL	Bloomingdale, Teledyne Relays	708-529-1060, FAX:708-529-1120
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245, FAX:317-845-8440
IA	Cedar Rapids, Stan Clothier Co.	319-393-1576, FAX:319-393-7317
KS	Olathe, C-Tron	913-780-3796,FAX:913-780-3007
MD	Towson, Arbotek Assocs., Inc.	410-825-0775, FAX:410-337-2781
MA	Marlborough, VISTAssociates, Inc.	508-481-9277, FAX:508-460-1869
MN	Eden Prairie, Stan Clothier Co.	612-944-3456, FAX:612-944-6904
MO	St. Louis, Rothkopf & Assocs., Inc.	314-961-4485, FAX:314-961-4736
NJ	Cherry Hill, Vantage Sls.	609-424-6777, FAX:609-424-8909
NJ	Montville, Teledyne Relays	201-299-7667, FAX:201-299-6998
NM	Albuquerque, Reptronix	505-292-1718, FAX:505-299-1611
NY	Mount Vernon, Friedman-Smith Elctrns.	914-664-4866,FAX:914-664-4928
NY	Syracuse, Hotze & Murcan Assocs.	315-455-8807, FAX:315-455-8810
NC	Asheville, Elcom	704-298-8709,FAX:404-447-834
OH	Dayton, J.C. Hofstetter Co.	513-296-1010, FAX:513-296-1274
OH	Medina, J.C. Hofstetter Co.	216-241-4880, FAX:216-725-4471
OR	Beaverton, Tekrep Inc.	503-626-3759, FAX:503-626-3759
PA	Hickory, J. C. Hofstetter Co.	412-356-2305, FAX:412-356-7303
TX	Austin, Kruvand Assocs., Inc.	512-219-9441, FAX:512-219-1932
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355, FAX:214-680-8854
UT	Salt Lake City, Thorson Rocky Mtn.	801-942-1683, FAX:801-942-1694
VA	Hawthorne, Teledyne Relays	213-777-0077, FAX:213-779-9161
WA	Gig Harbor, Tekrep, Inc.	206-884-5050, FAX:206-884-3170
Can	Mississauga, Ont., G.M.A.	416-671-8111, FAX:416-671-2422

Local Distributors

AL	Huntsville, Pioneer/Alabama	205-837-9300, FAX:205-837-9358
AL	Huntsville, Time Elctrns.	205-721-1133

AZ Tempe, Time Elctrns. ... 602-967-2000, FAX:602-967-5923
CA Camarillo, Milgray/Los Angeles ... 805-484-4055, FAX:805-388-8169
CA Hawthorne, Teledyne Relays ... 213-777-0077, FAX:213-779-9161
CA Irvine, Milgray/Orange County ... 714-753-1282, FAX:714-753-1682
CA San Diego, Time Elctrns. ... 619-586-0129, FAX:714-544-2526
CA San Jose, Milgray/San Jose ... 408-456-0900, FAX:408-456-0300
CA Sunnyvale, Time Elctrns. ... 408-734-9888, FAX:408-734-1719
CA Tustin, Time Elctrns. ... 714-669-0100, FAX:714-544-2526
CA Woodland Hills, Time Elctrns. ... 818-593-8400, FAX:818-593-8484
CO Englewood, Time Elctrns. ... 303-721-8882, FAX:303-796-0324
CT Milford, Milgray/Conn. ... 203-878-5538, FAX:203-878-6970
CT Norwalk, Pioneer/Connecticut ... 203-853-1515, FAX:203-838-9901
FL Altamonte Springs, Pioneer/Altamonte Spgs. ... 407-834-9090,FAX:407-834-0865
FL Clearwater, Pioneer/Clearwater ... 813-536-0445, FAX:813-531-5037
FL Deerfield Beach, Pioneer/Deerfield Beach ... 305-428-8877,FAX:305-481-2950
FL Ft. Lauderdale, Time Elctrns. ... 305-484-7778, FAX:305-484-7880
FL Orlando, Time Elctrns. ... 407-841-6565, FAX:407-648-0814
FL Winter Pk., Milgray/Fla. ... 407-647-5747, FAX:407-629-0757
GA Atlanta, Electro-Air Corp. ... 404-351-3545, FAX:404-351-9081
GA Duluth, Pioneer/Duluth ... 404-623-1003, FAX:404-623-0665
GA Norcross, Milgray/Atlanta ... 404-446-9777, FAX:404-446-1186
GA Norcross, Time Elctrns. ... 404-368-0969, FAX:404-368-0970
IL Addison, Pioneer/Chicago ... 708-495-9680, FAX:708-495-9831
IL Bloomingdale, Teledyne Relays ... 708-529-1060, FAX:708-529-1120
IL Palatine, Milgray/Chicago ... 708-202-1900, FAX:708-202-1985
IL Schaumburg, Time Elctrns. ... 708-303-3000, FAX:708-303-3030
IN Indianapolis, Pioneer/Indiana ... 317-573-0880, FAX:317-573-0979
KS Overland Pk., Milgray/Kansas City ... 913-236-8800, FAX:913-384-6825
MD Columbia, Milgray/Wash. ... 301-621-8169, FAX:301-381-3066
MD Columbia, Time Elctrns. ... 301-964-3090, FAX:301-964-9274
MD Gaithersburg, Pioneer/Gaithersburg ... 301-921-0660,FAX:301-921-4255
MA Lexington, Pioneer/Mass. ... 617-861-9200, FAX:617-863-1547
MA Peabody, Time Elctrns. ... 508-532-9900, FAX:508-532-9989
MA Wilmington, Milgray/New England ... 508-657-5900, FAX:508-658-7989
MI Grand Rapids, Pioneer Western Mich. ... 616-698-1800,FAX:616-698-1831
MI Livonia, Pioneer/Mich. ... 313-525-1800, FAX:313-427-3720
MN Eden Prairie, Pioneer/Twin Cities ... 612-944-3355, FAX:612-944-3794
MN Edina, Time Elctrns. ... 612-830-1252, FAX:708-303-3030
MO Manchester, Time Elctrns. ... 314-230-7500, FAX:314-391-8603
MO St. Louis, Pioneer/St. Louis ... 314-432-4350, FAX:314-432-4854
NJ Fairfield, Pioneer/NJ ... 201-575-3510, FAX:201-575-3454
NJ Marlton, Milgray/Delaware Valley ... 609-983-5010, FAX:609-985-1607
NJ Marlton, Time Elctrns. ... 609-596-6700, FAX:609-596-4555
NJ Montville, Teledyne Relays ... 201-299-7667, FAX:201-299-6998
NJ Parsippany, Milgray/New Jersey ... 201-335-1766, FAX:201-335-2110
NY Binghamton, Pioneer/Binghamton ... 607-722-9300, FAX:607-722-9562
NY Buffalo, Summit Distrs. Inc. ... 716-887-2800, FAX:716-887-2866
NY E. Syracuse, Time Elctrns. ... 315-432-0355, FAX:315-432-8147
NY Fairport, Pioneer/Rochester ... 716-381-7070, FAX:716-381-5955
NY Farmingdale, Milgray/NY ... 516-391-3000, FAX:516-420-0685
NY Hauppauge, Time Elctrns. ... 516-273-0100, FAX:516-273-0037
NY Pittsford, Milgray/Upstate NY ... 716-381-9700, FAX:716-381-9495
NY Rochester, Summit Distrs. Inc. ... 716-334-8110
NY Woodbury, Pioneer/Woodbury ... 516-921-8700, FAX:516-921-2143
NC Charlotte, Pioneer/Charlotte ... 704-527-8188, FAX:704-522-8564
NC Durham, Pioneer/Durham ... 919-544-5400, FAX:919-544-5885
NC Raleigh, Milgray/Raleigh ... 919-790-8094, FAX:919-872-8851
OH Cleveland, Milgray/Cleveland ... 216-447-1520, FAX:216-447-1761
OH Cleveland, Pioneer/Cleveland ... 216-587-3600, FAX:216-663-1004
OH Columbus, Time Elctrns. ... 614-794-3301, FAX:708-303-3030
OH Dayton, Pioneer/Dayton ... 513-236-9900, FAX:513-236-8133
OR Beaverton, Time Elctrns. ... 503-626-2979, FAX:206-820-1088
PA Horsham, Pioneer/Horsham ... 215-674-4000, FAX:215-674-3107
PA Pittsburgh, Pioneer/Pittsburgh ... 412-782-2300, FAX:412-963-8255
TX Austin, Pioneer/Austin ... 512-835-4000, FAX:512-835-9829
TX Austin, Time Elctrns. ... 512-346-7346, FAX:512-346-7527
TX Dallas, Milgray/Dallas ... 214-248-1603, FAX:214-248-0218
TX Dallas, Pioneer/Dallas ... 214-386-7300, FAX:214-490-6419
TX Houston, Pioneer/Houston ... 713-495-4700, FAX:713-495-5642
TX Richardson, Time Elctrns. ... 214-644-4644, FAX:214-644-6668
TX Stafford, Milgray/Houston ... 713-240-5360, FAX:713-240-5404
UT Murray, Milgray/Utah ... 801-261-2999, FAX:801-261-0880
UT W. Valley, Time Elctrns. ... 801-973-8494, FAX:801-973-7418
WA Kirkland, Time Elctrns. ... 206-820-1525, FAX:206-820-1088
WI Brookfield, Pioneer/Wisconsin ... 414-784-3480, FAX:414-784-8207
Can Mississauga, Ont., Milgray/Toronto ... 416-678-0958, FAX:416-678-1213
Can Mississauga, Ont., Time Elctrns. ... 416-672-5300, FAX:416-672-5304
Can Pointe Claire, Milgray/Montreal ... 514-426-5900, FAX:514-426-5836

TELEDYNE ROTOLITE, P.O. Box 398, Owen, WI 54460, Tel: 800-524-0105, FAX: 715-229-2124; *Sls. Mgr.:* Harry Brebaugh

TELEDYNE RYAN ELECTRONICS, 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-560-6400, TELEX: 695-028, TWX: 910-335-1174, FAX: 619-560-1147; Empl.: 250; *Sls. Mgr.:* J.E. Wallin

TELEDYNE SOLID STATE

FAX: 213-779-9161

TELEDYNE SOLID STATE, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077; FSC No.: 63745; *Sls. Mgr.:* Tom Garland ... **B•1616-1623**

Local Sales Offices & Reps

AL Huntsville, Elcom ... 205-830-4001, FAX:205-830-4058
AZ Scottsdale, Arcom Sls. ... 602-947-5745; FAX:602-990-1765
CA Anaheim, Westrep ... 714-527-2822, FAX:714-527-3868
CA Hawthorne, Teledyne Solid State ... 213-777-0077, FAX:213-779-9161
CA San Diego, Westrep ... 619-674-1880, FAX:619-674-1878
CA San Jose, Meridian-West ... 408-927-6377, FAX:408-927-6378
CT Stratford, VISTAssociates, Inc. ... 203-375-5456, FAX:203-375-6907
FL Winter Pk., HHP Assocs., Inc. ... 407-740-0320, FAX:407-740-0319
GA Norcross, Elcom ... 404-447-8200,FAX:404-447-8340
IL Bloomingdale, Teledyne Solid State ... 708-529-1060 FAX:708-529-1120
IN Indianapolis, Leslie M. Devoe Co. ... 317-842-3245 FAX:317-845-8440
IA Cedar Rapids, Stan Clothier Co. ... 319-393-1576 FAX:319-393-7317
KS Olathe, C-Tron ... 913-780-3796,FAX:913-780-3007
MD Towson, Arbotek Assocs., Inc. ... 410-825-0775 FAX:410-337-2781
MA Marlborough, VISTAssociates, Inc. ... 508-481-9277 FAX:508-460-1869
MN Eden Prairie, Stan Clothier Co. ... 612-944-3456:FAX:612-944-6904
MO St. Louis, Rothkopf & Assocs. ... 314-961-4485 FAX:314-961-4736
NJ Cherry Hill, Vantage Sls. Co. ... 609-424-6777 FAX:609-424-8909
NJ Montville, Teledyne Solid State ... 201-299-7667 FAX:201-299-6998
NM Albuquerque, Reptronix ... 505-292-1718 FAX:505-299-1611
NY Mount Vernon, Friedman-Smith Elctrns. ... 914-664-4866,FAX:914-664-4928
NY Syracuse, Hotze & Murcan Associates ... 315-455-8807,FAX:315-455-8810
NC Asheville, Elcom ... 704-298-8709,FAX:404-447-8340
OH Dayton, J. C. Hofstetter Co. ... 513-296-1010 FAX:513-296-1274
OH Medina, J. C. Hofstetter Co. ... 216-241-4880 FAX:216-725-4471
OR Beaverton, Tekrep, Inc. ... 503-626-3759 FAX:503-626-3759
PA Hickory, J. C. Hofstetter Co. ... 412-356-2305 FAX:412-356-7303
TX Austin, Kruvand Assocs., Inc. ... 512-219-9441 FAX:512-219-1932
TX Dallas, Kruvand Assocs., Inc. ... 214-437-3355,FX 214-680-8854
WA Gig Harbor, Tekrep Inc. ... 206-884-5050 FAX:206-884-3170

Local Distributors

AL Huntsville, Pioneer/Alabama ... 205-837-9300 FAX:205-837-9358
AL Huntsville, Time Elctrns. ... 205-721-1133
AZ Tempe, Time Elctrns. ... 602-967-2000 FAX:602-967-5923
CA Camarillo, Milgray/Los Angeles ... 805-484-4055 FAX:805-388-8169
CA Hawthrone, Teledyne Solid State ... 213-777-0077 FAX:213-779-9161
CA Irvine, Milgray/Orange Ctny ... 714-753-1282 FAX:714-753-1682
CA San Diego, Time Elctrns. ... 619-586-0129 FAX:714-544-2526
CA San Jose, Milgray/San Jose ... 408-456-0900 FAX:408-456-0300
CA Sunnyvale, Time Elctrns. ... 408-734-9888 FAX:408-734-1719
CA Tustin, Time Elctrns. ... 714-669-0100 FAX:714-544-2526
CA Woodland Hills, Time Electronics ... 818-593-8400 FAX:818-593-8484
CO Englewood, Time Elctrns. ... 303-721-8882 FAX:303-796-0324
CT Milford, Milgray/Conn. ... 203-878-5538 FAX:203-878-6970
CT Norwalk, Pioneer/CT ... 203-853-1515 FAX:203-838-9901
FL Altamonte Spgs., Pioneer/Altamonte Spgs. ... 407-834-9090,FAX:407-834-0865
FL Clearwater, Pioneer/Clearwater ... 813-536-0445 FAX:813-531-5037
FL Deerfield Bch., Pioneer/Deerfield Bch. ... 305-428-8877,FAX:305-481-2950
FL Ft. Lauderdale, Time Elctrns. ... 305-484-7778 FAX:305-484-7880
FL Orlando, Time Elctrns. ... 407-841-6565 FAX:407-648-0814
FL Winter Pk., Milgray/Fla. ... 407-647-5747 FAX:407-629-0757
GA Atlanta, Electro-Air Corp. ... 404-351-3545 FAX:404-351-9081
GA Duluth, Pioneer/Duluth ... 404-623-1003 FAX:404-623-0665
GA Norcross, Milgray/Atlanta ... 404-446-9777 FAX:404-446-1186
GA Norcross, Time Elctrns. ... 404-368-0969 FAX:404-368-0970
IL Addison, Pioneer/Chicago ... 708-495-9680 FAX:708-495-9831
IL Bloomingdale, Teledyne Solid State ... 708-529-1060 FAX:708-529-1120
IL Palatine, Milgray/Chicago ... 708-202-1900 FAX:708-202-1985
IL Schaumburg, Time Elctrns. ... 708-303-3000 FAX:708-303-3030

N	Indianapolis, Pioneer/Indiana	317-573-0880,	FAX:317-573-0979
S	Overland Pk, Milgray/Kansas City	913-236-8800,	FAX:913-384-6825
MD	Columbia, Milgray/Wash.	301-621-8169,	FAX:301-381-3066
MD	Columbia, Time Elctrns.	301-964-3090,	FAX:301-964-9274
MD	Gaithersburg, Pioneer/Gaithersburg	301-921-0660,	FAX:301-921-4255
MA	Lexington, Pioneer/Mass.	617-861-9200,	FAX:617-863-1547
MA	Peabody, Time Elctrns.	508-532-9900,	FAX:508-532-9989
MA	Wilmington, Milgray/New England	508-657-5900,	FAX:508-658-7989
MI	Grand Rapids, Pioneer/Western Michigan	616-698-1800,	FAX:616-698-1831
MI	Livonia, Pioneer/Mich.	313-525-1800,	FAX:313-427-3720
MN	Eden Prairie, Pioneer/Twin Cities	612-944-3355,	FAX:612-944-3794
MN	Edina, Time Elctrns.	612-830-1252,	FAX:708-303-3030
MO	Manchester, Time Elctrns.	314-230-7500,	FAX:314-391-8603
MO	St.Louis, Pioneer/St. Louis	314-432-4350,	FAX:314-432-4854
NJ	Fairfield, Pioneer/New Jersey	201-575-3510,	FAX:201-575-3454
NJ	Marlton, Milgray/Delaware Valley	609-983-5010,	FAX:609-985-1607
NJ	Marlton, Time Elctrns.	609-596-6700,	FAX:609-596-4555
NJ	Montville, Teledyne Solid State	201-299-7667,	FAX:201-299-6998
NJ	Parsippany, Milgray/New Jersey	201-335-1766,	FAX:201-335-2110
NY	Binghamton, Pioneer/Binghamton	607-722-9300,	FAX:607-722-9562
NY	Buffalo, Summit Distrs. Inc.	716-887-2800,	FAX:716-887-2866
NY	E. Syracuse, Time Elctrns.	315-432-0355,	FAX:315-432-8147
NY	Fairport, Pioneer/Rochester	716-381-7070,	FAX:716-381-5955
NY	Farmingdale, Milgray/New York	516-391-3000,	FAX:516-420-0685
NY	Haupauge, Time Elctrns.	516-273-0100,	FAX:516-273-0037
NY	Pittsford, Milgray/Upstate New York	716-381-9700,	FAX:716-381-9495
NY	Rochester, Summit Distrs. Inc.	716-334-8110	
NY	Woodbury, Pioneer/Woodbury	516-921-8700,	FAX:516-921-2143
NC	Charlotte, Pioneer/Charlotte	704-527-8188,	FAX:704-522-8564
NC	Durham, Pioneer/Durham	919-544-5400,	FAX:919-544-5885
NC	Raleigh, Milgray/Raleigh	919-790-8094,	FAX:919-872-8851
OH	Cleveland, Milgray/Cleveland	216-447-1520,	FAX:216-447-1761
OH	Cleveland, Pioneer/Cleveland	216-587-3600,	FAX:216-663-1004
OH	Columbus, Time Elctrns.	614-794-3301,	FAX:708-303-3030
OH	Dayton, Pioneer/Dayton	513-236-9900,	FAX:513-236-8133
OR	Beaverton, Time Elctrns.	503-626-2979,	FAX:206-820-1088
PA	Horsham, Pioneer/Horsham	215-674-4000,	FAX:215-674-3107
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300,	FAX:412-963-8255
TX	Austin, Pioneer/Austin	512-835-4000,	FAX:512-835-9829
TX	Austin, Time Elctrns.	512-346-7346,	FAX:512-346-7527
TX	Dallas, Milgray/Dallas	214-248-1603,	FAX:214-248-0218
TX	Dallas, Pioneer/Dallas	214-386-7300,	FAX:214-490-6419
TX	Houston, Pioneer/Houston	713-495-4700,	FAX:713-495-5642
TX	Richardson, Time Elctrns.	214-644-4644,	FAX:214-644-6668
TX	Stafford, Milgray/Houston	713-240-5360,	FAX:713-240-5404
UT	Murray, Milgray/Utah	801-261-2999,	FAX:801-261-0880
UT	West Valley, Time Elctrns.	801-973-8494,	FAX:801-973-7418
WA	Kirkland, Time Elctrns.	206-820-1525,	FAX:206-820-1088
WI	Brookfield, Pioneer/Wisconsin	414-784-3480,	FAX:414-784-8207
Can	Mississauga, Ont., Milgray/Toronto	416-678-0958,	FAX:416-678-1213
Can	Mississauga, Ont., Time Elctrns.	416-672-5300,	FAX:416-672-5304
Can	Pointe Claire, Que., Milgray/Montreal	514-426-5900,	FAX:514-426-5836

TELEDYNE THERMATICS, Teledyne Inds., Inc., P O Box 909, Elm City, NC 27822, Tel: 919-236-4311, ESYLNK: 62877220, FAX: 919-236-3613; FSC No.: 12515; Empl.: 400; *Sls. Mgr.:* Harry Helmer; *Dist. Mgr.:* Ed Rattie

TELEFUNKEN, See AEG Corp.

TELEGENIX/GRIM

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TELEGENIX/GRIM CORP., P.O. Box 5550, Cherry Hill, NJ 08034, Tel: 609-424-5220; Empl.: 125; *Dist. Mgr.:* Ray Madonna .... **D•1074-1075**

Local Sales Offices & Reps

VA	Fairfax, GRIM Corp., Govt. Sls.	703-934-4615

Local Distributors

NJ	Cherry Hill, Telegenix/GRIM Corp.	800-933-4746

TELEMET, Geotel, Inc., 25 Davids Dr., Hauppauge, NY 11788, Tel: 516-436-7260, TWX: 510-227-9850, FAX: 516-436-7257; Empl.: 35; *Sls. Mgr.:* Paul H. Paulson III

TELENEX CORPORATION, A Unit of General Signal Corp., 13000 Midlantic Dr., Mt. Laurel, NJ 08054, Tel: 609-234-7900, FAX: 609-778-8700; Empl.: 400; *Sls. Mgr.:* Kirby Holmes, EVP-Mktg. & Sls.

TELEPHONICS CORPORATION/PRD INSTRUMENTS, 770 Park Avenue, Huntington, NY 11743, Tel: 516-549-6415/6428, TELEX: 510-222-4494, FAX: 516-549-6100; FSC No.: 78711, 9N770; Empl.: 22; *Sls. Mgr.:* Jacob Levy

TELEPLEX, INC., Alford Division, 32 Sixth Rd., Woburn, MA 01801, Tel: 617-935-8610, FAX: 617-933-4512; FSC No.: OL1H4; Empl.: 20; *Sls. Mgr.:* Lois Clark, V.P.

TELE QUARZ, USA, 2427 Twilight Rd., P.O. Box 240392, Charlotte, NC 28224-0392, Tel: 704-553-0300, FAX: 704-552-6044

TELEQUARZ-GMBH, See Raltron Electronics Corp.

TELESIS MARKING SYSTEMS, INC., Box 5000, Chillicothe, OH 45601, Tel: 614-642-3200, FAX: 614-642-2037; Empl.: 75; *Sls. Mgr.:* Larry Holt; *Dist. Mgr.:* Larry Holt

TELE-TECH CORPORATION, P.O. Box 790, Bozeman, MT 59715, Tel: 406-586-0291, FAX: 406-587-0653; FSC No.: 62759; Empl.: 75; *Sls. Mgr.:* Al Zoller

TELETERMINAL CORP., Greenland, NH 03840, Tel: 603-431-1200; Empl.: 13

TELEVISION EQUIPMENT ASSOCS., Box 393, So. Salem, NY 10590-0393, Tel: 914-763-8893, FAX: 914-763-9158; Empl.: 10

TELLUREX CORP., 1248 Hastings, Traverse City, MI 49684, Tel: 616-947-0110, FAX: 616-947-5821; Empl.: 16; *Sls. Mgr.:* Gregg Smith

TELONIC/BERKELEY, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652, Tel: 714-494-9401, FAX: 714-497-7331; FSC No.: 04423; Empl.: 50; *Sls. Mgr.:* Richard Aaron

TELPAR, INC., 4137 Billy Mitchell Rd., Box 796, Addison, TX 75001, Tel: 214-233-6631, TELEX: 73-2561, FAX: 214-233-8947; Empl.: 28; *Sls. Mgr.:* Bob Reynolds .... **D•1113-1115**

TELTEC, INC., 7890 12th Ave. S., Minneapolis, MN 55425, Tel: 612-854-9177, FAX: 612-854-8601; FSC No.: 57856; Empl.: 7; *Sls. Mgr.:* Victor Vachhani; *Dist. Mgr.:* Victor Vachhani

TELTRON, INC., 2 Riga Lane, Birdsboro, PA 19508, Tel: 610-582-2711, TELEX: 4990805, FAX: 610-582-0851; FSC No.: 28287; Empl.: 35; *Sls. Mgr.:* Clyde Mock

TEMESCAL/AIRCO COATING TECHNOLOGY, The BOC Group, Inc., 2700 Maxwell Way, PO Box 2529, Fairfield, CA 94533-0252, Tel: 707-423-2100, FAX: 707-425-1706; *Sls. Mgr.:* Brian Kaemmer

TEMP-FLEX CABLE, INC., 11 Depot Street, S. Grafton, MA 01560, Tel: 508-839-5987, FAX: 508-839-4128; FSC No.: 0CGL7; Empl.: 48; *Sls. Mgr.:* Warren Persak

TEMPIL DIV., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080, Tel: 908-757-8300, TELEX: 138-662, FAX: 908-757-9273; Empl.: 38; *Sls. Mgr.:* A. P. Jeanguenin

TEMPO INSTRUMENT, INC., 87 Modular Ave., Commack, NY 11725, Tel: 516-864-3700, TWX: 510-226-3787, FAX: 516-864-4972; FSC No.: 07031; Empl.: 205; *Sls. Mgr.:* Steven Waite

TEMPOSONICS SENSORS DIVISION, MTS Sys. Corp., PO Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200; *Sls. Mgr.:* David Miller

TEMPTRONIC CORPORATION, 55 Chapel St., Newton, MA 02158, Tel: 617-969-2501, FAX: 617-969-2475; Empl.: 750; *Sls. Mgr.:* R. Himmel, R. DiFilippo, E. Lowerre

TEMPUSTECH, INC., 295 Airport Rd., Naples, FL 33942, Tel: 813-643-2424, FAX: 813-643-4981; Empl.: 13 .... **D•1144**

TENNEY ENGINEERING, 109 Springfield Rd., Union, NJ 07083, Tel: 908-686-7870, TWX: 710-985-4725, FAX: 908-686-7971; Empl.: 175; *Sls. Mgr.:* Jerome A. Perlstein, Mgr. Application Engr.

TENOR CONTROLS COMP, 17020 W. Rogers Dr., New Berlin, WI 53151, Tel: 414-782-3800, FAX: 414-782-0005; Empl.: 30; *Sls. Mgr.:* Ted James

TENSOLITE COMPANY, Subsidiary of Carlisle Corp., 100 Tensolite Drive, St. Augustine, FL 32092, Tel: 904-829-5600, FAX: 904-829-3447; Empl.: 210; *Sls. Mgr.:* William Dungan; *Dist. Mgr.:* John Berlin

TENSOR, Box 14843, Austin, TX 78761, Tel: 512-251-4131, TELEX: ITT 4940124, FAX: 512-251-5798; Empl.: 36

TEN-TEC, INC., Industrial Park, Sevierville, TN 37862, Tel: 615-453-7172, FAX: 615-428-4483; Empl.: 100

TEPRO OF FLORIDA, 2608 Enterprise Rd., Clearwater, FL 34623, Tel: 813-796-1044, FAX: 813-791-7425; FSC No.: 15915; Empl.: 97; *Sls. Mgr.:* Pat Tesi .... **A•2028-2035**

Local Sales Offices & Reps

CA	Bridge Mktg.	415-965-8045
FL	APM Assocs.	813-886-2457
MA	Berkshire Elctrns.	508-435-9356
NY	R.P. Luce	516-754-5064
OH	Comps. Inc.	216-243-9200
TX	Miles J. Cooley Co.	214-262-5893
VA	Absco	804-674-8939

Local Distributors

FL	NRC	407-241-8600
NY	Sherburn Elctrns.	516-231-4300
NY	Tri-Start Elctrns.	516-737-2200

TERADYNE CONNECTION SYS., Teradyne, Inc., 44 Simon St., Nashua, NH 03060, Tel: 603-889-5156, FAX: 603-889-2128; FSC No.: 31413; Empl.: 1000; *Sls. Mgr.:* D. Murphy

Local Sales Offices & Reps

CA	Irvine, Teradyne Connection Sys.	714-757-2600
CA	Sunnyvale, Teradyne Connection Sys.	408-732-8770
CO	Longmont, Teradyne Connection Sys.	303-651-3737
CT	Cromwell, Teradyne Connection Sys.	203-635-3360
FL	Altamonte Springs, Teradyne Connection Sys.	407-332-6555
NC	Raleigh, Teradyne Connection Sys.	919-872-0392
MD	Columbia, Teradyne Connection Sys.	410-290-9189
MN	Columbia Heights, Teradyne Connection Sys.	612-636-1770
NH	Nashua, Teradyne Connection Sys.	603-889-5156
PA	Trevose, Teradyne Connection Sys.	215-638-2829
TX	Richardson, Teradyne Connection Sys.	214-231-5384

Can	Mississauga, Ont., Teradyne Canada, Ltd.	416-602-6999

TERADYNE INC., Assembly Test Group, 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 510-932-6900, FAX: 510-934-0540; Empl.: 350; *Sls. Mgr.:* David Bernstein

TERMINAL DATA CORP., 15733 Crabbs Branch Way, Rockville, MD 20855, Tel: 301-921-8282, FAX: 301-921-8353; Empl.: 18; *Sls. Mgr.:* Mark Teitelbaum

TERRA TECHNLG. CORP., 3854 148th Ave. N.E., Redmond, WA 98052, Tel: 206-883-7300, FAX: 206-882-1412; *Sls. Mgr.:* Greg Hoyle, Sls. Mgr.

THE TEST CONNECTION, INC., 130 Lakefront Dr., Hunt Valley, MD 21030, Tel: 410-584-2500, FAX: 410-584-9556; Empl.: 15; *Sls. Mgr.:* Ronnie Ronnenburg; *Dist. Mgr.:* Steve Sowa

THE TEST GRP., INC., 4025 Sorrento Valley Blvd., San Diego, CA 92121, Tel: 619-452-4160, FAX: 619-450-9639; Empl.: 15; *Sls. Mgr.:* D. Sorlie

TESTONE INC., Rt. 113 & Mensch Rd., P.O. Box 1589, Skippack, PA 19474-1589, Tel: 215-584-9658, FAX: 215-584-9166; Empl.: 36; *Sls. Mgr.:* Harold Schweriner; *Dist. Mgr.:* Harold Schweriner

TEST PROBES, INC., 9178 Brown Deer Rd., San Diego, CA 92121, Tel: 619-552-2090, FAX: 619-535-1260; FSC No.: FK95-3136706; *Sls. Mgr.:* Hal Wardein

TESTRONICS, 1320 Millwood Rd., McKinney, TX 75069, Tel: 214-542-3111, FAX: 214-542-2131; FSC No.: 62236; Empl.: 30

TEST SYSTEMS, INC., 217 W. Palmaire, Phoenix, AZ 85021, Tel: 602-861-1010; FSC No.: 6625; *Sls. Mgr.:* Mike Milburn

TEXAS INSTRUMENTS

FAX: 508-699-5200

TEXAS INSTRUMENTS, Connector Systems, 34 Forest St., MS 14-01, Attleboro, MA 02703, Tel: 508-699-5269, 508-699-3450, TELEX: 92-7708, TWX: 710-346-0566; FSC No.: 59350; *Sls. Mgr.:* Dom Archino, Sls. Mgr.-; *Dist. Mgr.:* Dom Archino, Distr. Sls. Mgr. .... **C•1493-1498**

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CA	Irvine, Gleta Main	714-660-8201
CA	Irvine, Steve Morris	714-660-8111
CA	Santa Clara, Gene Whetstone	408-748-2325
CT	Hamden, Wray Johnson	203-269-0074
IL	Arlington Heights, Chuck Young	708-640-3185
IL	Arlington Heights, Gerald Rosenthal	708-640-2976
MD	Baltimore, Rick Gesue	301-964-2003
MA	Attleboro, Jim Palombo	508-699-5206
NC	Charlotte, Don King	704-522-5485
OH	Beachwood, Eric Schriver	216-765-7257
PA	Blue Bell, Jay Burnett	215-941-7577
TX	Dallas, Bob Anderson	214-917-7549
TX	Dallas, Kay Houston	214-917-7548

TEXAS INSTRS., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703, Tel: 508-699-3800, TELEX: 92-7708, TWX: 710-346-0566, FAX: 508-699-1819

TEXAS INSTRUMENTS, Data/Image Sensing (Opto), 13532 N. Central Expressway M/S 93, Dallas, TX 75265, Tel: 214-995-6611, TWX: 910-867-4702; Empl.: 80,000 Worldwide

TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP, P.O. Box 655303, Dallas, TX 75265, Tel: 214-995-2011, TWX: 910-867-4702

TEXAS OPTOELECTRONICS, INC., 714 Shepherd Dr., Garland, TX 75042, Tel: 214-487-0085, FAX: 214-276-8059; FSC No.: 63034; Empl.: 102; *Sls. Mgr.:* Jim Thompson

TEXAS TRANSFORMER CORP., PO Box 860220, Plano, TX 75086, Tel: 214-424-1581, FAX: 214-424-1586; FSC No.: 1181; Empl.: 70; *Sls. Mgr.:* Felix Smith

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FAX: 800-394-8344
(USA Toll Free)

TEXMATE, INC., 995 Park Center Dr., Vista, CA 92083-8397, Tel: 619-598-9899; Empl.: 36; *Sls. Mgr.:* Earl Chafin .... **D•1145, 1204-1205, 1372-1387, 1965**

Local Sales Offices & Reps

Intl	Bangkok, Thailand, Texmate(Thailand Branch)	(662) 391-5990
Intl	Brighton, UK, Texmate/Amplicon Live Line	(0273)-570220
Intl	Taiwan/Taipei, Texmate (Taiwan Branch)	886-2-591-7865

Local Distributors

CA	Duarte, Pathfinder	818-357-1890
CA	Laguna Hills, Hill House	714-951-1048
CA	Palo Alto, Priz-Co.	415-493-8600
CA	San Bruno, Control Tech.	415-593-2111
CO	R & R Instrmn.	303-340-8728
GA	Algonquin, Marshall Wolf	708-658-8130
IN	Fishers, Couchman-Conant	317-849-9890
LA	New Orleans, Currier & Roser Inc.	504-734-1147
MI	Highland Park, Marsh Instrs.	313-869-9200
MN	New Brighton, J & W Instrs.	612-784-5708
MT	Billings, Kirst Engrg.	406-656-9570
NJ	Landing, PC & S	201-398-5843
NJ	Marmora, Brooks Tech., Inc.	609-390-2380
NY	East Syracuse, Liberty Elctrns.	315-437-8100
NC	Statesville, Statesville Process Instr.	704-873-1835
OR	Portland, HIS Elctrns.	503-643-5648
PA	Bridgeville, Norton Equip.	412-221-3131
PA	Wayne, Mainline Instrs.	215-687-5307
TN	Knoxville, Southeastern Automation	615-675-3080
TX	Houston, Talon Tech. Sls.	713-999-8588
TX	Houston, The Meter Shop of Texas	713-957-8586
TX	Lewisville, KSE-Texas	800-594-2121
TX	Odessa, Whitlock Instrs.	915-337-3412
UT	Sandy, Indl. Instrs.	801-566-2980
WA	Belleville, Eustis Corp.	206-451-0700
WI	Milwaukee, Gordon Hatch Co.	414-671-6550
EXP	San Juan, PR, Tomas Cuerda, Inc.	809-758-7830
Intl	Australia, Braemac Pty. Ltd.	858-5966
Intl	New Zealand, Auckland, Metermaster NZ Ltd.	(649) 579-5120
Intl	Sweden, Amerikanska Teleprod	87 100620/109950
Can	Montreal, R. H. Nichols Co. Ltd.	514-337-0425
Can	Ottawa, R.H.Nichols Co. Ltd.	613-727-3974
Can	Toronto, R. H. Nichols Co. Ltd.	416-851-8871

TEX-TECHS CONNECTROS, See Norwesco Interconnect Devices

TFD INC. (DBA THIN FILM DEVICES INC.), 1180 N. Tustin Ave., Anaheim, CA 92807, Tel: 714-630-7127, FAX: 714-630-7119; FSC No.: OHWH8; Empl.: 27; *Sls. Mgr.:* Denise Beeson

THALER CORP., 10940 N. Stallard Pl., Tucson, AZ 85737, Tel: 602-742-5572, FAX: 602-742-9826; FSC No.: 70770; Empl.: 6; *Sls. Mgr.:* Leslie Ehney

TH ELECTRONICS, Tong Hsing Electronic Ind., Ltd., 2155 N. Forbes Blvd., 106, Tucson, AZ 85745-1443, Tel: 602-791-7825, FAX: 602-791-7938; *Sls. Mgr.:* Frederick R. Hyatt .... **B•1624**

THERMACORE INC., 780 Eden Road, Lancaster, PA 17601, Tel: 717-569-6551, FAX: 717-569-4797; Empl.: 52; *Sls. Mgr.:* George Meyer

THERMAGON, INC., 3256 West 25th St., Cleveland, OH 44109, Tel: 216-741-7659, FAX: 216-741-2469; Empl.: 5

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Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
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CA	Woodland Hills, Interstate Mktg. Assocs.	818-883-7606
CO	Denver, Lindberg Co.	303-758-9033
FL	Maitland, EIR, Inc.	407-660-9600
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Elk Grove Village, Oasis Sls. Corp.	708-640-1850
IN	Ft. Wayne, R.O. Whitesell & Assocs.	219-489-0588
IN	Indianapolis, R.O. Whitesell & Assocs.	317-876-9000
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
KY	Versailles, R.O. Whitesell & Assocs.	606-873-1182
MI	Grand Blanc, R.O Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R.O. Whitesell & Assocs.	313-352-5454
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Comstrand, Inc.	612-574-9480
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Salem, Sales Engrg. Co., Inc.	603-893-5521
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Raleigh, Montgomery Mktg., Inc.	919-851-0010
OH	Cincinnati, R.O. Whitesell & Assocs.	513-528-5644
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, UniComp, Inc.	503-643-1645
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Arlington, Ion Assocs.	817-695-8000
TX	Austin, Ion Assocs.	512-794-9006
TX	Houston, Ion Assocs.	713-537-7717
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Snohomish, UniComp, Inc.	206-568-0511
WA	Spokane, UniComp, Inc.	509-922-4883
WI	Brookfield, Oasis Sls. Corp.	414-782-6660
PR	San Juan, Electronic Tech. Sls., Inc.	809-798-1300
Can	Calgary, Tech-Trek, Ltd.	403-241-1719
Can	Kanata, Tech-Trek, Ltd.	613-599-8787
Can	Mississauga, Ont., Tech-Trek Ltd.	416-238-0366
Can	Richmond, Tech-Trek, Ltd.	604-276-8735
Can	St. Laurent, Tech-Trek, Ltd.	514-337-7540

THERMAX WIRE CORP., 32-02 Linden Pl., Flushing, NY 11354-2897, Tel: 718-939-8300, TELEX: 645587, TWX: 710-582-2551, FAX: 718-886-3704; FSC No.: 12814; Empl.: 220; *Sls. Mgr.:* Joseph A. Cardello

THERMIK CORP., Thermik Sensor Technics, GmbH, 100 Industrial Drive, New Bern, NC 28562, Tel: 919-636-5720, FAX: 919-636-5737; Empl.: 13

THERMODISC

FAX: 419-525-8344

THERM-O-DISC, INC., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907-0538, Tel: 419-525-8500, TELEX: 987455; FSC No.: 81439; *Sls. Mgr.:* L.R. Clark .... **B•1389, 1903**

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IL	Arlington Hghts., Therm-O-Disc	708-394-8858
IN	Floyd Knobs, Therm-O-Disc	812-923-5974
MI	Wayland, Therm-O-Disc	616-795-9958
MO	Lake St. Louis, Therm-O-Disc	314-625-3632
NY	Youngstown, Therm-O-Disc	716-745-3550
NC	Charlotte, Therm-O-Disc	704-875-3994
TN	Nashville, Therm-O-Disc	615-646-6542
TX	The Colony, Therm-O-Disc	214-370-2744

Local Distributors

CA	Saratoga, Testco	408-253-1900
MA	Burlington, Atcom	800-433-6600
OH	Mansfield, Therm-O-Disc	419-525-8500

THERM-O-DISC, INC., Midwest Components Product Grp., 1320 S. Main St. P.O. Box 3538, Mansfield, OH 44907-0538, Tel: 419-525-8450, FAX: 419-525-8344; FSC No.: 50157; Empl.: 5000; *Sls. Mgr.:* Lanny Clark
.... **B•1904-1907**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Fountain Valley, Therm-O-Disc	714-839-4465
CA	San Diego, Hadden Assocs.	619-565-9444
CA	Saratoga, Testo, Inc.	408-253-1900
CO	Wheat Ridge, Trembly Assocs.	303-279-3019
CT	Middletown, Gerber Sls.	800-843-7377
CT	Shelton, Therm-O-Disc	203-929-4268
FL	Sanford, Glen White Assoc.	407-322-4875
GA	Norcross, Glen White Assoc.	404-441-1447
IL	Arlington Heights, Therm-O-Disc	708-394-8858
IL	Chicago, Dolin Sales Co.	312-498-6770
IN	Floyd Knobs, Therm-O-Disc	812-923-5974
IN	Indianapolis, Wilson Tech. Sls.	317-872-2513
MA	Waltham, Gerber Sls.	800-843-7377
MI	Grand Rapids, William Moses	616-795-9958
MI	Wayland, Therm-O-Disc	616-795-9958
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MO	Lake Saint Louis, Therm-O-Disc	314-625-3632
MO	St. Louis, Smith-Bollinger & Co.	314-343-2221
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	W. Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
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NC	Charlotte, Therm-O-Disc	704-875-3994
NC	Huntersville, Glen White Assocs.	704-875-3737
OH	Dayton, Jay Engrg.	513-253-2151
OH	Mansfield, Therm-O-Disc	419-525-8315
TN	Gray, Glen White Assocs.	615-477-8850
TN	Nashville, Therm-O-Disc	615-646-6542
TX	Dallas, Norcom	214-386-4888
TX	The Colony, Therm-O-Disc	214-370-2744
UT	Salt Lake City, Trembly Assocs.	801-295-4703
VA	Lynchburg, Glen White Assoc.	804-385-6110
WI	Milwaukee, D. Dolin Sls.	414-482-1111
Can	Mississauga, Ont., Gidden-Morton Assoc.	416-671-8111

Local Distributors

CA	Saratoga, Testco	408-253-1900
MA	Burlington, Atlantic Comps.	617-270-0051

THERMODYNAMIC ENGINEERING INC., 4880 Adohr Lane, Camarillo, CA 93012, Tel: 805-484-0472, FAX: 805-482-0693; Empl.: 30; *Sls. Mgr.:* Daniel Gantka

THERMODYNE INTERNATIONAL LTD., 20850 S. Alameda St., Long Beach, CA 90810, Tel: 310-603-1976, FAX: 310-603-1929; FSC No.: 29724; Empl.: 100-120; *Sls. Mgr.:* Gary S. Ackerman

THERMO ELECTRIC, 109 Fifth St., Saddle Brook, NJ 07662, Tel: 201-843-5800, TELEX: 178127 THERMO2SARC , FAX: 201-843-7144; Empl.: 250

THERMOELECTRICS, See TECA

THERMOMETRICS, INC., 808 U.S. Hwy. #1, Edison, NJ 08817-4695, Tel: 908-287-2870, FAX: 908-287-8847; FSC No.: FSCM 58090; Empl.: 150; *Sls. Mgr.:* Dan Lippman

THERMONICS, INC., 3350 Scott Blvd., Bldg. 32, Santa Clara, CA 95054, Tel: 408-496-6838, FAX: 408-496-6918

THERMOSEN, INC., Allied Controls, Inc., 150 E. Aurora St., Waterbury, CT 06708, Tel: 203-757-4200, FAX: 203-757-4202; FSC No.: 00428; Empl.: 10

THERMOSET PLASTICS INC., 5101 East 65th St., Indianapolis, IN 46220, Tel: 317-259-4161, TELEX: 910-250-5447, ESYLNK: 62045624, FAX: 317-252-8402; Empl.: 65; *Sls. Mgr.:* Bob Meyer

THERMOTRON INDS., 291 Kollen Park Dr., Holland, MI 49423, Tel: 616-392-1491, FAX: 616-392-5643; Empl.: 500; *Sls. Mgr.:* Lynn Ternan

THHC LIGHTING, 17870 Castleton St., Ste. 246, City of Ind., CA 91748, Tel: 818-965-6088, FAX: 818-810-4746; Empl.: 5; *Sls. Mgr.:* Clint N.W. Ling; *Dist. Mgr.:* Clint N.W. Ling

THIRD DOMAIN, INC., P.O. Box 17568, Tucson, AZ 85731-7568, Tel: 602-290-1820, TELEX: 602-885-1189; Empl.: 9; *Sls. Mgr.:* Sharon Raban

THOMAS & BETTS CORPORATION, ELECTRONICS DIVISION, 200 Executive Center Dr., P.O.Box 24901, Greenville, SC 29616-2401, Tel: 803-676-2900, FAX: 803-676-2994; FSC No.: 59730; Empl.: 4,700; *Sls. Mgr.:* Rich Kampf; *Dist. Mgr.:* Dennis Martin, Dir. of Mktg.

THOMAS ELECTRONICS, INC., 100 Riverview Dr., Wayne, NJ 07470, Tel: 201-696-5200, FAX: 201-696-8298; FSC No.: ;01852; Empl.; 380; *Sls. Mgr.:* Bruce Piaget, VP Sls.

THOMSON COMPONENTS & TUBES CORP., Thomson CSF, 40 G Commerce, Totowa, NJ 07511, Tel: 201-812-9000, FAX: 201-812-9050; Empl.: 20; *Sls. Mgr.:* Victor Pastore

THOMSON PASSIVE COMPONENTS CORP., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367, Tel: 818-887-1010, TELEX: 408067, FAX: 818-702-0831; Empl.: 25; *Sls. Mgr.:* Steve Chegwin

THORDARSON MEISSNER, Components Corp. of Amer., 628 Belmont St., Mt. Carmel, IL 62863, Tel: 618-262-5121, FAX: 618-263-3150; FSC No.: 96256; Empl.: 75; *Sls. Mgr.:* Lori L. Jeffries; *Dist. Mgr.:* Pat Hoh

THORN AUTOMATED SYSTEMS, INC, THORN EMI, 835 Sharon Dr., Westlake, Ohio 44145, Tel: 216-871-9900, FAX: 216-871-8320; Empl.: 440; *Sls. Mgr.:* Michael Collins, VP Mktg.

THORN EMI ELECTRON TUBES INC., 23 Madison Rd., Fairfield, NJ 07006, Tel: 201-575-5586, TELEX: RCA 221236 TEGI, FAX: 201-575-8717; Empl.: 25; *Sls. Mgr.:* Michael R. Avery

THORSON ENGINEERING CO., 6225-76th St. S.E., Snohomish, WA 98290, Tel: 206-334-4214

THREE-FIVE SYS., INC., 10230 S. 50th Pl., Phoenix, AZ 85044, Tel: 602-496-0035, FAX: 602-496-0168; FSC No.: 70365; Empl.: 300; *Dist. Mgr.:* Julie Scarboro
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Local Distributors

CA	Los Angeles, Bell	310-826-2355
MD	Gaithersburg, Pioneer-Technlgs.	301-921-3825
OH	Cleveland, Pioneer-Standard	216-587-3600
Can	Mississauga, Ont., Zentronics	416-507-2600

3L GLOBAL ELECTRONICS, 3L Coils, 2915 Anvil St. N., St. Petersburg, FL 33710, Tel: 813-343-2679, FAX: 813-343-4410; Empl.: 80; *Sls. Mgr.:* Bruce Small; *Dist. Mgr.:* Bruce Small

3M CO., see listing under letter "M"

360 SYSTEMS, 18740 Oxnard St., Tarzana, CA 91356, Tel: 818-342-3127, FAX: 818-342-4372; Empl.: 25; *Sls. Mgr.:* Don Bird; *Dist. Mgr.:* Don Bird .... **D•1072**

THRUST INDUSTRIES, INC., R.R. 2 Box 105B, Haubstadt, IN 47639, Tel: 800-467-6730, 812-768-6730, FAX: 812-768-6213; Empl.: 20; *Sls. Mgr.:* James E. Riggs
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Local Sales Offices & Reps

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IN	Kokoma/Ft. Wayne, Skyline Sls. Assoc.	317-452-6500
NY	Auburn, Bravado Prods.	315-255-1222
OK	Tulsa, T-Tec Sls.	903-734-4526
TX	Arlington, T-Tec Sls.	817-274-0505
TX	El Paso, T-Tec Sls.	915-581-7920
TX	Gilmer, T-Tec Sls.	903-734-4526
EXP	Guadalajara, Mexico, T-Tec Sls.	523-635-3248

THUNDER SCIENTIFIC CORP., 623 Wyoming S.E., Albuquerque, NM 87123, Tel: 505-265-8701, 800-872-7728, FAX: 505-266-6203; Empl.: 26; *Sls. Mgr.:* J. L. Bennewitz

TIDEWATER TECHNOLOGICAL, P.O. Box 1008, Newport News, VA 23601, Tel: 804-874-2800, FAX: 804-596-5142; Empl.: 10

TIF INSTRUMENTS, INC., 9101 N.W. 7th Ave., Miami, FL 33150, Tel: 305-757-8811, FAX: 305-757-1028; Empl.: 500; *Sls. Mgr.:* Cameron W. Petrie; *Dist. Mgr.:* Gary Hladilek

TII INDUSTRIES INC., 1385 Akron St., Copiague, NY 11726, Tel: 516-789-5000, TELEX: 144631, FAX: 516-789-5063; *Sls. Mgr.:* Jim Roach, VP Sls.

TIL-TEK LIMITED, 500 Van Buren St., P.O. Box 550, Kemptville, Ontario, Canada K0G 1J0, Tel: 613-258-5928, FAX: 613-258-7418; *Sls. Mgr.:* Hector Boudreau

TIMBER-TOP, Hopkins Rd., Box 517E, Watertown, CT 06795, Tel: 203-274-6706, FAX: 203-274-8041; FSC No.: 06773; Empl.: 5; *Sls. Mgr.:* W. E. Fischer

TIME AND FREQUENCY LTD., 2315 NW 107 Ave., Miami, FL 33172, Tel: 305-593-8000, FAX: 305-593-8002; Empl.: 110; *Sls. Mgr.:* Sandy Cohen

TIMECO, INC., 1035 - 26th St., P.O. Box 8038, Huntington, WV 25705, Tel: 304-523-5149; Empl.: 7; *Sls. Mgr.:* James E. Myers

TIME MARK CORP., 11440 E. Pine St., Tulsa, OK 74116, Tel: 918-438-1220, FAX: 918-437-7584; Empl.: 60; *Sls. Mgr.:* Steve Purple; *Dist. Mgr.:* Steve Purple

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AL	Madison, Benchmark Tech. Sls., Inc.	205-464-0033
CO	Denver, Motion Technlg.	303-757-3003
FL	Safety Harbor, Jack Colgan & Assocs., Inc.	813-725-5182
GA	Norcross, Benchmark Tech. Sls., Inc.	404-446-1711
IN	Ft. Wayne, Material Consultants	219-744-1315
MA	Natick, Wayland Engrg. Sls., Inc.	508-655-6080
NJ	Lakewood, Atek Inc.	908-905-4443
NC	Raleigh, Benchmark Tech. Sls., Inc.	919-850-0633
WA	Federal Way, Wilson Elctrn. Sls. Team	206-946-8016
CA	San Clemente, A.T.A. Assocs.	714-661-9700

TNR TECHNICAL INC., 279 Douglas Ave. No.1112, Altamonte Springs, FL 32714, Tel: 407-682-4311, FAX: 407-682-4469; Empl.: 9; *Sls. Mgr.:* Jerrold Lazarus

TOBE DEUTSCHMANN LABS., INC., 550 Turnpike St., Canton, MA 02021, Tel: 617-828-3366, FAX: 617-828-3048; FSC No.: 21966; Empl.: 25; *Sls. Mgr.:* T. Deutschmann, Jr.

TOCOS AMERICA, INC., Tokyo Cosmos Electric Co., Ltd., 1177 E. Tower Road, Schaumburg, IL 60173, Tel: 708-884-6664, FAX: 708-884-6665; Empl.: 2,000; *Sls. Mgr.:* Robert W. Kruse .... **A•2122-2123**

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AL	Huntsville, WLA & Assocs.	205-721-1788, FX-205-721-1789
AZ	Scottsdale, Pinnancle Comp. Sls.	602-994-0441, FAX:602-994-3638
AZ	Tucson, Pinnacle Comp. Sls.	602-886-1726, FAX:602-749-5539
CA	Colton, Inland Empire Elec. Sls.	714-872-0988, FAX:714-872-0988
CA	Pleasanton, Leddy Assocs.	510-417-1033, FAX:510-417-1458
CO	Denver, English-Damco Sls. Co.	303-782-0683, FAX:303-782-0670
FL	Altamonte Springs, TSS, Inc.	407-332-0067
FL	Boca Raton, TSS, Inc.	407-391-3718
FL	Clearwater, TSS, Inc.	813-530-5739
GA	Lawrenceville, WLA & Assocs.	404-339-9443, FAX:404-513-9148
IL	Deerfield, Mid-Tek Mktg. Co.	708-808-8822, FAX:708-808-8869
IN	Columbus, A E Sls.	812-378-4361, FAX:812-372-8216
IN	Fishers, AE Sls.	317-578-2121,FAX:317-842-7703
IN	Leesburg, AE Sls.	219-834-1232, FAX:219-834-1234
MD	Randallstown, Chesapeake Indl. Mktg.	410-653-0476,FAX:410-653-4675
MA	Woburn, Radian Assocs., Inc.	617-933-7386, FAX:617-933-3516
MI	Kentwood, Miltimore Sls., Inc.	616-554-9292, FAX:616-554-9210
MI	Novi, Miltimore Sls., Inc.	313-349-0260, FAX:313-349-0756
MN	Roseville, Vector Comp. Sls.	612-631-1334, FAX:612-631-1329
NM	Albuquerque, Zia Tech. Sls.	505-296-4255, FAX:505-296-4255
NY	Pittsford, Franklin Sls. Corp.	716-248-8251, FAX:716-248-3866
PA	Philadelphia, Check Assocs., Inc.	215-487-3007, FAX:215-483-1096
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255, FAX:214-235-0271
WA	Seattle, Northmar, Inc.	206-524-5170, FAX:206-524-0402
Can	Oakville, Ont., Haltronics Ltd.	416-844-2121, FAX:416-844-0129

Local Distributors

CA	Chatsworth, EW Elctrns.	818-718-2500, FAX:818-718-9007
CA	Chatsworth, Passive Comps. Inc.	818-700-8838, FAX:818-700-9389
CA	Fremont, KEA Elctrns.	415-651-2600, FAX:415-651-2691
CA	Industry, ITAL Elctrns. Sls., Inc.	818-968-8515, FAX:818-336-1725
CA	Irvine, Kelex Elctrns.	800-4-CAPACI, FAX:714-474-1231
CA	Lake Elsinore, Dave Vest	FAX:714-245-3835
CA	San Jose, Passive Comps.	408-441-1441
CA	San Jose, Surface Mount Ctr.	408-453-2023, FAX:408-453-5699
CA	Santa Maria, Garrett Inst. & Comps.	805-922-0594, FAX:805-922-3643
CA	Tustin, H.T.S.	714-259-7733,FAX:714-544-4871
CA	Yorba Linda, Corona Elctrns.	714-283-8185, FAX:714-283-8191
CO	Aurora, QPS Elctrns. Inc. (CO)	303-343-9260, FAX:303-343-3051
FL	Boca Raton, N.R.C. Elctrns.	407-241-8600, FAX:407-241-3328
FL	Clearwater, Atlantic Elctrns.	813-531-5900, FAX:813-535-6354
FL	Ft Lauderdale, Stock Elctrns.	305-978-9875
FL	Lakeland, Atlantic Elctrns.	813-687-0200, FAX:813-687-0300
FL	Orlando, Atlantic Elctrns.	800-354-2505, FAX:407-352-9528
FL	W. Palm Bch., Atlantic Elctrns.	407-686-8553, FAX:407-686-6964
IL	Addison, Belford Elctrns., Inc.	708-691-1100, FAX:708-691-1118
IL	Bensenville, Voyager Elctrns.	708-860-1300, FAX:708-860-1573
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620, FAX:708-884-7573
IN	Indianapolis, Meunier Elctrns. Supp.	317-635-3511, FAX:317-631-4707
IN	Indianapolis, MAR Elctrns.	317-633-6699, FAX:317-633-6687
IN	Indianapolis, R.M. Elctrns. Co. Inc.	317-291-7110, FAX:317-291-1675
MD	Beltsville, Petricko Sls., Inc.	301-937-4960, FAX:301-937-5299
MD	Gaithersburg, Axis Elctrns.	301-840-9640, FAX:301-840-9299
MA	Andover, Aved Elctrns., Inc.	800-441-AVED, FAX:508-794-0159
MA	Billerica, Baldwin Comps. Ctr. Inc.	508-667-6710, FAX:508-671-0034
MN	Fridley, Voyager Elctrns.	612-571-7766, FAX:612-571-9519
MN	Plymouth, Leeds	612-557-1277,FAX:612-557-1499
NH	Salem, Diamond Elctrns.	603-894-4420, FAX:603-894-5897
NJ	Whippany, A.D.I.	201-428-0510,FAX:201-887-0923
NM	Albuquerque, Betatron	505-821-1122, FAX:505-828-0450
NY	Ronkonkoma, Baldwin Comps. Ctr. Inc.	800-645-5608,FAX:516-588-5441
NY	Syracuse, A.D.R. Technlgs.	315-437-7087, FAX:315-437-7794
PA	Wayne, Peak Elctrns.	215-293-9000, FAX:215-687-4579
TX	Austin, Tinkertronics, Inc.	512-926-4420, FAX:512-926-9590
TX	Dallas, Off the Shelf Comps.	214-247-0052, FAX:214-247-2332
TX	Richardson, All American	214-231-5300
TX	Richardson, Comp. Technlg. Corp.	214-437-2211, FAX:214-437-2265
TX	Richardson, Off the Shelf Comps.	214-238-0808, FAX:214-669-0560
WA	Seattle, KAM	206-382-1300
WI	Brookfield, Leeds	414-789-6995, FAX:414-789-6994
Can	Burlington, Alternate Source Comp.	800-661-9536
Can	Calgary,Alb., Memco	403-258-3399, FAX:403-259-3459
Can	Surrey, B.C., Memco	604-590-1553, FAX:604-590-5008

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CA	San Clemente, Todd Prods. Corp.	714-496-1155
CA	San Diego, Todd Prods. Corp.	619-672-9062
CO	Englewood, Thorson Rocky Mtn. Inc.	303-773-6300
FL	Altamonte Springs, Glen White Assocs.	407-322-4875
FL	Baco Raton, Glen White Assocs.	407-393-0776
FL	Palm Harbor, Glen White Assocs.	813-787-8503
GA	Duluth, Glen White Assocs.	404-418-1500
IL	Hoffman Estates, Todd Prods. Corp.	708-882-3325
MD	Glen Arms, Glen White Assocs.	410-592-9105
MA	Hingham, Northeast Reps.	617-749-8700
MI	Jenison, ELectro MKtg.	616-667-2983
MI	Livonia, Electro Mktg.	313-421-7590
MN	Minneapolis, R. K. Sales Assocs.	612-571-1001
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Fairfield, T.A.M.	201-575-4130
NY	Syracuse, Labtronics	315-455-7314
NC	Raleigh, Glen White Assocs.	919-848-1931
OH	Dayton, Electro Mktg.	513-890-8322
OH	No. Royalton, Electro Mktg.	215-582-0075
OR	Bothell, Temco Northwest	206-481-6150
PA	Allison Park, Electro Mktg.	412-492-0688
PA	Glenside, Koebert Assocs.	215-887-2310
TN	Gray, Glen White Assocs.	615-477-8850
TX	Houston, AID Elctrns. Inc.	713-575-7959
TX	Irving, AID Elctrs. Inc.	214-790-4761
UT	Salt Lake City, Thorson Rocky Mtn. Inc.	801-942-1683
VA	Lynchburg, Glen White Assocs.	804-385-6110
WA	Bothell, Temco Northwest	206-481-6150

TODD SYSTEMS, INC., 50 Ash St., Yonkers, NY 10701, Tel: 914-963-3400, FAX: 914-963-3506; Empl.: 45; *Sls. Mgr.:* S. Edwards .... **A•2582-2585**

Local Distributors

AL	Mobile, Kretzer's Inc.	205-438-5611
CA	Berkley, Roma Elctrns.	410-644-0661
CA	San Francisco, Aris Corp.	415-550-8605
CT	Stamford, Elm Elctrns.	203-348-6278
FL	Miami, Electronic Equip.	305-526-6000
FL	Miami Bch., B. Frank Inc.	305-861-8227
GA	Macon, Giga Corp.	912-745-2897
IL	Aurora, Bwy. Appliance	708-897-8688
LA	New Orleans, Gulf Marine Supp.	504-525-6252
MD	Brookeville, Albee Sls.	301-924-5538
MA	Boston, Astro Int.	617-323-6993
NJ	Newark, Cotrapex, Inc.	201-589-1416
NJ	Newark, Pinto Trading	201-344-7748
NY	New York, ABC Trading Co.	212-228-5080
NY	New York, Taft Elctrns.	212-575-5194
OH	Dayton, K. Elctrns.	513-426-1877
TX	Houston, Cross & Co.	713-673-3100
TX	Houston, Western Sls.	713-869-6671
VA	Fairfax, Atlantic Export	703-573-8383
WA	Seattle, ForeigN Elctrns.	206-682-2761
WA	Seattle, Pearl Elctrns.	206-622-6200
EXP	NY, New York, Able Intl., Ltd.	212-696-5300

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TOKO AMERICA, INC., 1250 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-297-0070, FAX: 708-699-7864; Empl.: 75; *Sls. Mgr.:* Frank Migliarese; *Dist. Mgr.:* Tom Quinlan

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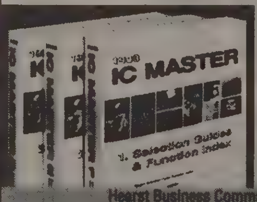

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CA	Irvine, Centaur Corp.	714-261-2123
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CA	Sacramento, Taarcom Inc.	916-782-1781
CA	San Diego, Centaur Corp.	619-278-4950
CO	Denver, Electrophase	303-237-3739
IL	Chicago, Heartland Technical	708-358-6622
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MA	Boston, Mac Allister & Assoc.	617-631-7556
MI	Detroit, Greiner Assocs.	313-499-0188
MN	Minneapolis, Technical Comps.	612-561-5556
NJ	Lodi, TRC Elctrns.	201-779-8282
OH	Dayton, J.C. Hofstetter	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-4477
OR	Portland, Power Factor	503-233-6969
PA	Allentown, TRC Elctrncs.	215-264-4995
TX	Austin, Kruvand Assoc.	214-437-3355
TX	Austin, Kruvano Assoc.	512-219-9441
TX	Dallas, Kruvand Assoc.	512-219-9441
TX	Dallas, Kruvano Assoc.	214-437-3355
WI	Milwaukee, Heartland Tech.	414-789-6860

Local Distributors

AL	Huntsville, Comp. Distrs.	205-851-7800, 800-888-0331
CA	Santa Ana, Foresight Elctrns.	714-833-2134, 800-253-0490
CA	Santa Clara, Foresight	408-980-9700,800-253-0490
CO	Englewood, Comp. Distrs.	303-770-6214, 800-551-7357
CO	Littleton, Displays Plus	713-240-4000,800-231-3612
FL	Clearwater, Comp. Distrs.	813-796-0466
FL	Palm Bay, Comp. Distrs.	407-724-9910, 800-558-2351
GA	Norcross, Comp. Distrs.	404-441-3320, 800-874-7209
IL	Roselle, Foresight Elctrns.	708-980-9890
NJ	Lodi, TRC Elctrns.	201-779-8282
PA	Allentown, TRC Elctrns.	215-264-4995
TX	Dallas, Comp. Distrs.	214-644-0373,800-848-4234
TX	Houston, Southwest Elctrns.	713-240-4000, 800-231-3612

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO, INC., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111, Tel: 201-374-8641, 800-867-3526, FAX: 201-374-7611; Empl.: 20; *Sls. Mgr.:* Harold Tischler .... **A•2581**

BRILL ELECTRONICS

(510) 834-5888

610 E. 10th. St., Oakland, CA 94606

TOPAZ®

(310) 452-8002

1220 Olympic Bl., Santa Monica CA 90404

TOREMA U.S.A., INC., 10401 West Office Drive, Houston, TX 77042, Tel: 713-977-2500, FAX: 713-977-5031; FSC No.: QB2R8; Empl.: 40; *Sls. Mgr.:* David P. Snelling

Toroid

SUPERIOR TRANSFORMERS

FAX: 410-860-0302

TOROID CORP. OF MARYLAND, 608 Naylor Mill Rd., Salisbury, MD 21801, Tel: 410-860-0300; Empl.: 48; *Sls. Mgr.:* Lennart Elmlund .... **A•2586-2592**

Local Sales Offices & Reps

AZ	Phoenix, Tech Rep	602-991-6646
CA	Anaheim, Texel	714-998-2941
CA	San Diego, Texel	619-560-1050
CA	San Jose, Marketing Co.	408-272-6836
CA	Seal Beach, Texel	213-596-9411
CA	Simi Valley, Texel	805-582-1223
FL	Boca Raton, Electro-Craft	407-394-9686
FL	Largo, Electro-Craft	813-544-1766
GA	Atlanta, Overton Assocs.	404-497-0166
IL	Wheeling, Ed Joyner & Co.	708-520-1200
MD	Salisbury, Toroid Corp. of Maryland	410-860-0300
MA	Southboro, Sullivan Tech. Sls.	508-881-2215
MN	Osseo, Gaffney Sls.	612-425-5484
MO	Salisbury, Toroid Corp. of Mo.	410-860-0300
NJ	Budd Lake, T & K Sls.	201-347-1856
NY	Clark Mills, KLM Garner	315-853-6126
NY	Pittsford, KLM Garner	716-381-8350
NY	Smithtown, T & K Sales.	516-724-3456
NC	Raleigh, Overton Assocs.	919-469-5190
OH	Vandalia, Whit-Com Sls.	513-898-5433
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Huntingdon Valley, Ed Leiby & Assoc.	215-659-8938
SC	Walhalla, Overton Assocs.	803-638-7101
TN	New Tazewell, Overton Assocs.	615-626-6009
VT	Ludlow, Verro & Assoc.	802-228-5240
VA	Alexandria, Ed Leiby & Assocs.	703-360-9039
WA	Seattle, Harry Levinson Co.	206-382-1300

TOROID TECHNOLOGIES, INC., 8-70 Hanlan Rd., Woodbridge, Ont., Can L4L 3P6, Tel: 905-850-5122, FAX: 905-850-5129; Empl.: 11; *Sls. Mgr.:* Saverio Panetta; *Dist. Mgr.:* Saverio Panetta

TOROTEL

PRODUCTS INCORPORATED

FAX: 816-763-2278

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030-3199, Tel: 816-761-6314; Empl.: 250; *Sls. Mgr.:* H. Norem .... **A•1301-1307, 2594-2596**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	San Jose, Tech Rep Inc.	408-261-8287
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
FL	Altamonte Springs, Semtronics Inc.	407-831-8233
KS	Overland Pk., QDC Inds.	913-642-2214
MD	Baltimore, Dickison Sls. Co.	301-823-0923
MA	Lowell, Underwood Sls.	508-256-8191
MI	Livonia, Electro-Mktg. Inc.	313-421-7590
NY	Northport, R. P. Luce & Co., Inc.	516-754-5064
NY	Pittsford, James E. Zimmerman Sls., Inc.	716-381-3186
OH	Dayton, Electro-Mktg. Inc.	513-890-8322
PA	Langhorne, R.P. Luce & Co.	215-757-3518
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Miriam Zanger .... **D•1326**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100, FAX: 216-232-4104; Empl.: 50; *Sls. Mgr.:* Lee Seabeck

TORTRAN INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-367-5188, FAX: 203-384-8120; Empl.: 6 .... **A•2593**

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 908-364-1800, FAX: 908-363-6234; Empl.: 200

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC., 9775 Toledo Way, Irvine, CA 92718, Tel: 714-455-2000, FAX: 714-859-3963

TOSHIBA INSTRUMENTATION DIV., Toshiba Intl. Corp., 5354 S. 129th E. Ave., Tulsa, OK 74134, Tel: 918-252-3548, FAX: 918-250-9023; Empl.: 20; *Sls. Mgr.:* Lewis E. Smith

TOSHIN KOGYO CO., R.G. Allen Co., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300

TOTAL CONCEPT SALES, 501 W. Glenoaks Blvd., Ste 343, Glendale, CA 91202-2896, Tel: 818-547-9476, FAX: 818-547-9473; Empl.: 3; *Sls. Mgr.:* Robert J. Cunningham; *Dist. Mgr.:* Robert J. Cunningham

TOTAL POWER INTERNATIONAL, INC., 418 Bridge St., Lowell, MA 01850, Tel: 508-453-7272, FAX: 508-453-7395; Empl.: 15; *Sls. Mgr.:* Patrick Letendre .... **D•2002**

All states not listed call T.P.I. direct 508-453-7272

Local Sales Offices & Reps

AZ	Tempe, Trembly	602-431-9417
CA	San Diego, Amasco	619-292-7666
CA	San Jose, Amasco	408-262-1500
CA	Torrance, Amasco	310-781-9494
CT	Weston, Paquette Elctrns.	203-544-8424
CO	Golden, Trembly Assoc.	303-279-3019
IL	Palatine, Vine Sls., Inc.	708-934-5476
IN	Carmel, Giesting & Assoc.	317-844-5222
KY	Versailles, Giesting & Assoc.	606-873-2330
MD	Ellicott City, Technology Sls.	301-461-7802
MA	Marlboro, JDS Reps.	508-460-0187
MI	Livonia, Giesting & Assoc.	313-478-8106
MN	Oakdale, Complete Sls.	612-731-2923
NV	Las Vegas, Trembly Assoc.	702-739-9770
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Buffalo, Lynn Assocs.	716-631-0054
OH	Cincinnati, Giesting & Assoc.	513-385-1105
OR	Portland, Index, Inc.	503-297-3364
PA	Gibsonia, Lynn Assocs.	412-443-3670
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Pittsburg, Giesting & Assoc.	412-828-6160
TX	Dallas, Rem Components	214-234-1069
UT	N. Salt Lake City, Trembly Assoc.	801-295-4703
WA	Bellevue, Inex, Inc.	206-271-2979
WI	Genoa City, Vine Sls. Inc.	414-279-3871

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
CA	San Jose, Power and Data	408-629-3550
MA	Marlboro, Now Electronics	508-460-0187
MN	Roseville, Parts 1	612-633-8079
TX	Houston, Wofford	713-847-3583

TOTAL TEMPERATURE INSTRUMENTATION, INC., PO Box 1073, 30 Krupp Dr., Williston, VT 05495, Tel: 802-863-0085, FAX: 802-863-1193; Empl.: 10; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

TOUCH TECHNOLOGY, 5524 Bee Caves Rd. Building L, Austin, TX 78746, Tel: 512-328-9284, FAX: 512-328-9285; Empl.: 65; *Sls. Mgr.:* Sue Ellen Smith

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737, FAX: 612-571-5605; Empl.: 75; *Sls. Mgr.:* Gary Schmitz

TOYOCOM

TOYOCOM U.S.A., INC.

FAX: 708-593-5678

TOYOCOM USA INC., 617 E. Golf Rd., Ste. 112, Arlington Heights, IL 60005, Tel: 708-593-8780/1-800-TOYOCOM; Empl.: 16; *Sls. Mgr.:* Dennis Reifel .... **A•1484-1495**

Local Sales Offices & Reps

AL	Huntsville, Electramark	205-830-4400
AZ	Tempe, Cantec Sls.	602-968-9021
CA	El Toro (Southern), English/Damco	714-753-1950
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Colorado Spgs., Pinnacle Rocky Mtn.	719-570-0180
FL	Maitland, EIR	407-660-9600
GA	Norcross, Electramark	404-446-7915
IL	Arlington Hgts., Toyocom U.S.A., (Corp. Hdqtrs.)	708-593-8785
IN	Carmel, Giesting & Assocs.	317-844-5222
IA	Cedar Rapids, ATS	319-393-8280
MD	Rockville, Cetech	301-590-0111
MD	Timonium, Cetech	410-666-0315

MA	Randolph, Hatch Assocs.	617-963-3306
MI	Coloma, Giesting & Assocs.	616-468-4200
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	Minneapolis, Scott Elctrns.	612-929-2985
NJ	Mountainside, Henry G. Richter	908-233-4615
NY	Fairport, Henry G. Richter	716-223-6010
NC	Raleigh, C-Tech Sls.	919-954-7000
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Phoenixville (E.PA), Henry G. Richter	215-495-6176
PA	Pittsburgh (W.PA), Giesting & Assocs.	412-828-3553
TX	Ft. Worth (xtal), Rice Entpr.	214-436-6062
UT	Salt Lake City, Pinnacle Rocky Mtn.	801-264-8366
WA	Renton, Quest Mktg.	206-228-2660
Intl	San German, Digit-Tech Sls.	809-892-4317
Can	Kanata, Ont. (East), C.M.T.	613-591-9555
Can	Mississauga, Ont. (East), C.M.T.	416-612-0900

TRACER ELECTRONICS, INC., 200 Broadacres Drive, Bloomfield, NJ 07003, Tel: 201-338-1234, FAX: 201-338-1125; Empl.: 10

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Westerville, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 50; *Sls. Mgr.:* Fred Meyer .... **C•1106-1113**

TRA-CON, INC., 55 North St., Medford, MA 02155, Tel: 617-391-5550; Empl.: 55; *Sls. Mgr.:* Dan Romanow

FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E-2, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Thomas L. Roberts; *Dist. Mgr.:* Sharon Altimari .... **A•1852-1857; D•1077, 1207**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Dana Point, S&S Technlgy., Inc.	714-661-4619
CA	Folsom, Disman-Bakner	916-983-1029
CA	Granada Hills, S & S Technlg., Inc.	818-366-2866
CA	Mountain View, Disman Bakner	415-969-3010
CA	San Diego, S & S Technlg. Inc.	619-484-2996
CO	Parker, Howard Assocs.	303-841-5755
FL	Harbour Bch, M. Lader Co.	800-442-3177
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
FL	Tampa, M. Lader Co.	813-264-1444
GA	Stockbridge, M. Lader Co.	800-442-3177
GA	Warner Robbins, JC Coefield	912-922-5555
IL	Northbrook, CJ Sls.	708-559-0660
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Columbia, M. Lader Co.	410-381-1550
MO	Florissant, Central Tech. Sls.	314-831-4069
NH	Amherst, TMR Assocs.	603-672-9336
NJ	Clarksboro, M Lader Co.	609-423-4213
NJ	Denville, Ascor Elctrns., Inc.	201-627-1863
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343
NY	Liverpool, R&D Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Seaford, Ascor Elctrns., Inc.	516-826-7204
NC	Greensboro, M. Lader Co.	919-674-8970
PA	Conshohocken, M. Lader Co.	215-825-3177
PA	East Greenville, M Lader Co.	215-679-8485
TX	Austin, Thorson Co.	512-467-2737
TX	Dallas, Thorson Co.	214-233-5744
TX	Houston, Thorson Co.	713-558-8205
VA	Strasburg, M. Lader Co.	703-465-9180
Can	Burnaby, B.C., Giga-Tron	604-299-4244
Can	Ottawa, Giga Tron Assocs. Ltd.	613-225-4090

Local Distributors

AZ	Scottsdale, Spirit Elctrns.	602-998-2444
CA	Mtn. View, Comstock Distrs., Inc.	415-969-3010
NY	Ronkonkoma, Compucon Distr., Inc.	516-981-8810
PA	Conshohocken, MLC Distrs., Ltd.	215-825-3177

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, FAX: 44-382-562643; Empl.: 30

FAX: 813-886-2794

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-2, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts .... **D•1077, 1207**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs., Inc.	205-776-9481
AZ	Phoenix, J. Smith Assocs.	602-267-0981
CA	Laguna Hills, Elotek Sys.	714-830-4856
CA	Mountain View, Disman Bakner	415-969-3010
CO	Parker, Howard Assocs.	303-841-5755
FL	Ft. Walton Bch., Mktg. & Consulting	904-863-3017
FL	Melbourne, Saber Assocs.	407-724-0920
GA	Lawrenceville, Saber Assocs., Inc.	404-962-8740
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
MA	Andover, Saret Assocs.	508-475-9332
MO	Maryland Hgts., KJS Mktg., Inc.	314-770-1412
NM	Albuquerque, J. Smith Assocs.	505-345-6501
NC	Clayton, Saber Assocs., Inc.	919-553-5009
PA	Philadelphia, Rabal Assocs.	215-922-6914
TX	Austin, Thorson	512-467-2737
TX	Dallas, Thorson	214-233-5744
TX	Houston, Thorson	713-558-8205
Can	Burnaby, B.C., Giga-Tron	604-299-4244
Can	Ottawa, Giga-Tron Assocs., Ltd.	613-225-4090

TRANSAMERICA DELAVAL, INC., See CEC Instruments, IMO Inds. Inc.

TRANSAMERICA DELAVAL, See Gems Sensors, IMO Inds. Inc.

Trans American Transformer Inc.

FAX: 516-928-0852

TRANS AMERICAN TRANSFORMER, 26 Hulse Rd., E. Setauket, NY 11733, Tel: 516-928-0762; FSC No.: 61619; Empl.: 30 .... **A•2597**

TRANSCHEM, Jetronics Industries, Inc., P.O. Box 667, 1521 Pomona Rd., Corona, CA 91718, Tel: 909-371-5751, FAX: 909-371-9602; FSC No.: 03526; Empl.: 60; *Sls. Mgr.:* Ernie Aiu, Genl. Mgr.

TRANSCO PRODUCTS, INC., Subsidiary of Datron Systems Inc., Vard Newport, Camarillo, CA 93012, Tel: 805-987-8007, TELEX: 857579, FAX: 805-484-0830; FSC No.: 82152; Empl.: 300; *Sls. Mgr.:* Larry Neeley, Sls. Mgr.

TRANSDUCERS & SYSTEMS, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 60; *Sls. Mgr.:* J.L. Jamieson, Mktg. VP

All states not listed consult factory, N. Branford, CT

TRANSDUKTOR, INC., See Ulveco, Inc.

TRANSENE, Rte. 1, Rowley, MA 01969, Tel: 508-948-2501, FAX: 508-948-2206; Empl.: 21; *Sls. Mgr.:* H. Femino

TRANSFORMER DESIGN , MTE Corporation, W147 N9525 Held Drive, Menomonee Falls, WI 53051, Tel: 414-253-8200, FAX: 414-253-8222; Empl.: 120; *Sls. Mgr.:* John A. Houdek

TRANSFORMER ENGINEERING CORPORATION, 2550 Brookpark Rd., Cleveland, OH 44134, Tel: 216-741-5282, FAX: 216-741-4860; Empl.: 85; *Sls. Mgr.:* William M. Dick

TRANSFORMER TECHNOLOGIES, INC., 402 Locust St., Mt. Vernon, NY 10552, Tel: 914-668-1600, FAX: 914-668-4794; Empl.: 15; *Sls. Mgr.:* Thomas Quaglieri .... **A•2598**

Local Sales Offices & Reps

IL	Highland Pk., Mid-Tek Mktg.	708-831-1130
VA	Ashland, Glasscock Assocs.	804-798-2125

TRANSICOIL INC, Eagle-Picher Inc., 2560 General Armistead Blvd., Trooper, PA 19403, Tel: 215-539-4400, FAX: 215-539-3400; FSC No.: 82686; Empl.: 215; *Sls. Mgr.:* John Stalber; *Dist. Mgr.:* Fran Mashintonio

TRANSISTOR DEVICES, INC., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-361-6622, FAX: 201-361-7665; FSC No.: 09004; Empl.: 650; *Sls. Mgr.:* Martin M. O'Donnell .... **D•2003**

Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs., Inc.	205-539-1485
AZ	Phoenix, Trembley Assocs.	602-431-9417
AZ	Tucson, Trembley Assoc.	602-790-9945
CA	Bakersfield, FLW, Inc.	805-398-0720
CA	Campbell, SMA	408-370-6900
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW Inc.	714-751-7512
CO	Colorado Springs, Trembley Assocs.	719-475-0072
CO	Denver, Trembley Assocs.	303-279-3019
CT	Scientific Dvcs., Inc.	203-248-9361
FL	Melbourne, Reynolds Assocs., Inc.	407-259-7000
GA	Duluth, Reynolds Assocs., Inc.	404-476-4992
IL	Wheeling, Ed Joyner & Co.	312-520-1200
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Lexington, E. F. Delfino, Inc.	617-862-1118
MI	Ann Arbor, Ashby Assocs., Inc.	313-995-4082
MN	Anoka, Tech. Solutions, Inc.	612-785-9303
MO	Earth City, Midwest Tech. Sls. Inc.	314-298-8787
NV	Las Vegas, Trembley Assocs., Inc.	702-739-9770
NJ	Comp-Tech Sls.	201-935-2152
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NM	Alburquerque, Trembley Assocs. Inc.	505-266-8616
NM	Las Cruces, Trembley Assocs. Inc.	505-526-1615
NY	Commack, Comp-Tech Sls.	516-499-9189
NY	New Hyde Park, Comp-Tech Sls.	516-488-4520
NC	Raleigh, Reynolds & Assocs., Inc.	919-876-0282
OH	Arcanum, Ashby Assocs., Inc.	513-692-8713
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
PA	Southampton, Campbell Assoc.	215-322-6630
TX	Austin, Jim Hughes Co.	512-467-8896
TX	Lewisville, Jim Hughes Co.	214-221-1536
UT	N. Salt Lake City, Trembley	801-295-4703
VA	Alexandria, Dyna-Rep Co.	703-354-1222
Can	Weston Ont., Duncan Instrs. Canada Ltd.	416-742-4448

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, FAX: 516-293-3793; FSC No.: 17755; Empl.: 44; *Sls. Mgr.:* Fred Haber ... **D•1208-1210**

Local Sales Offices & Reps

NY	Saugerties, Beckrep	914-246-3031
OR	Beaverton, Seltech Elctrns. Mfg. Rep. Inc.	503-629-9254
TX	Richardson, Scientific Sls. Co.	214-231-6541
WA	Bellevue, Seltech Elctrns. Mfg. Rep. Inc.	206-746-7970
Can	St. Laurent, Que., Testforce Sys. Inc.	514-856-0970

TRANS METRICS, INC., 5325 Naiman Pkwy Ste.E , Solon, OH 44139, Tel: 216-248-2229, FAX: 216-248-7780; FSC No.: 6685; Empl.: 20; *Sls. Mgr.:* James N. Dietrich

TRANSONIC SYSTEMS INC., 34 Dutch Mill Rd., Ithaca, NY 14850, Tel: 607-257-5300, TELEX: 413523, ESYLNK: 62050974; Empl.: 40

TRANSPARENT DEVICES, INC., 853 Lawrence Drive, Newbury Park, CA 91320, Tel: 805-499-5000, FAX: 805-499-5888; Empl.: 26; *Sls. Mgr.:* C. Estiandan ... **B•1126**

Local Sales Offices & Reps

CA	Irvine, Cal Rep, Inc.	714-509-7707
CO	Aurora, Electrodyne	303-695-8903
GA	Acworth, EAB, Inc.	404-975-3660
IL	Glendale Heights, Synergistic Sls.	708-858-8686
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
MD	Towson, ATS, Inc.	410-296-9360
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	E. Brunswick, Shepard Assocs.	908-254-5757
NY	E. Syracuse, Nycom, Inc.	315-437-8343
OH	Solon, Five Star Elctrns.	216-349-1611
OK	Tulsa, Delta Comps., Inc.	918-592-7711
PA	Frazer, Indl. Comps.	215-889-0650
PA	Pittsburgh, Marktech	412-367-2327
TX	Seagoville, Delta Comps., Inc.	214-287-6333
UT	Salt Lake City, Electrodyne	801-264-8050
WA	Seattle, J.J. Assocs.	206-246-6619

WI	Brookfield, Synergistic Sls.	414-821-1516
MA	Westford, Elctrn. Microtech Assoc.	508-692-0070

TRANSTECHNOLOGY ELECTRONICS, Transtechnology Corporation, 8800 Allen Rd., Peoria, IL 61615-1584, Tel: 309-693-3300, TWX: 510-390-3691, FAX: 309-693-3308; FSC No.: 30463; Empl.: 105; *Sls. Mgr.:* Ignas Budrys; *Dist. Mgr.:* Ignas Budrys

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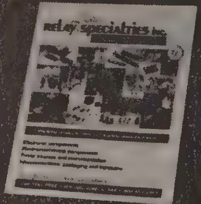

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TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, 800-535-5552, TWX: 910-262-3094, FAX: 414-355-7341; *Sls. Mgr.:* Jim Campion, VP Sls.; *Dist. Mgr.:* Terry Tuttle

UCE, INC., 35 Rockland Rd., Norwalk, CT 06854, Tel: 203-838-7509, FAX: 203-838-2566; Empl.: 20; *Sls. Mgr.:* C. Rob Wilcox; *Dist. Mgr.:* Greg Borstelmann

UDS/MOTOROLA, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1993, Tel: 205-430-8000, TELEX: 752602 UDS HTV, FAX: 205-830-5657; Empl.: 1000; *Sls. Mgr.:* Tony Zalenski

U. E. SYSTEMS, INC., 12 West Main St., Elmsford, NY 10523, Tel: 914-592-1220, 800-223-1325, TELEX: 229676, FAX: 914-347-2181; Empl.: 20

ULTRAN LABORATORIES, 1020 East Boal Ave., Boalsburg, PA 16827, Tel: 814-466-6200, FAX: 814-466-6847; FSC No.: 6635,AJ14,H266,5999; Empl.: 13; *Sls. Mgr.:* Julie L. Rhodes

ULTRAVOLT, INC., CS9002, Ronkonkoma, NY 11779, Tel: 800-876-POWER, FAX: 516-363-2423; Empl.: 15; *Sls. Mgr.:* Jim Morrison …… **D•2013-2015**

ULVAC NORTH AMERICA CORPORATION, P.O. Box 799, 105 York Street, Kennebunk, ME 04043, Tel: 207-985-2973, TELEX: 46-9045, FAX: 207-985-4459; Empl.: 50; *Sls. Mgr.:* Susan Zilaro; *Dist. Mgr.:* Harold Baum

Ulveco

FAX: 713-977-5031

ULVECO, INC., 10401 West Office Dr., Houston, TX 77042, Tel: 1-800-527-7042; Empl.: 50; *Sls. Mgr.:* Dave Snelling …… **A•2600-2601**

Local Sales Offices & Reps

AZ	Chandler, Techni-Source Corp.	602-497-0711
AR	Van Buren, Hightower Indl. Sls.	501-471-8116
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Murrieta, Van Gott & Assocs.	909-698-7774
CA	San Jose, Carmen Elctrns.	408-275-3775
CO	Franktown, MRC	303-660-8750
CT	Avon, Tom Maguire Assocs.	203-673-3019
FL	Maitland, E I R, Inc.	407-660-9600
GA	Duluth, PCI	404-623-8604
IL	Arlington Heights, Hill Sales Corp.	708-255-4400
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Ann Arbor, Lintott Assocs., Inc.	313-665-8457
MN	Minneapolis, Electro-Serv Co.	612-338-3475
NH	Windham, Tom Maguire Assocs.	603-437-1245
NM	Albuquerque, Techni-Source Corp.	505-268-4232
OH	Lexington, North Central Mktg.	419-884-9804
PA	Exton, Linear Sls.	215-524-8080

UNADILLA ANTENNA MFG. CO., Ballardvale Station, P.O. Box 4215, Andover, MA 01810, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* P. Jannini

UNDERWATER KINETICS, 1020 Linda Vista Dr., San Marcos, CA 92069, Tel: 619-744-7560, FAX: 619-744-7320; Empl.: 85; *Sls. Mgr.:* Greg Sippel

UNDERWOOD INDUSTRIES OF N.Y., INC., d/b/a Viking Products, 456 Broad St., P.O. Box 269, Waverly, NY 14892, Tel: 607-565-4551, FAX: 607-565-9650; Empl.: 7; *Sls. Mgr.:* Robert Pichette

UNGAR, Rubbermaid Office Products Group, 5620 Knott Ave., Buena Park, CA 90621, Tel: 714-994-2510, TELEX: 4720750 Eldon, FAX: 714-523-7790; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* Richard Shivers; *Dist. Mgr.:* Dianna Paul

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, FAX: 203-265-2690; Empl.: 45

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700, 800-526-1389, FAX: 201-674-3803; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* Steven Mercadante

UNIMAX, A Divison of C & K, Ives Rd., P.O. Box 152, Wallingford, CT 06492, Tel: 203-269-8701, FAX: 203-265-5398; FSC No.: 80207; Empl.: 250; *Sls. Mgr.:* B. D'Amico

UNIMEASURE, INC., 7055 N.W. Grandview Dr., Corvallis, OR 97330, Tel: 503-757-3158, FAX: 503-757-0858

UNION CARBIDE CHEMICALS & PLASTICS COMPANY INC., Industrial Chemicals Div., Crystal, 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123, Tel: 619-279-4500, FAX: 619-565-8926; Empl.: 125; *Sls. Mgr.:* L R Rothrock

UNIPLEX CORP., 2905 Country Dr., St. Paul, MN 55117, Tel: 612-490-1936, FAX: 612-490-0495; Empl.: 8; *Sls. Mgr.:* M. Bryan

UNIPOWER
CORPORATION

FAX: 305-971-1837

UNIPOWER CORPORATION, 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-2442; FSC No.: 62125; Empl.: 260; *Sls. Mgr.:* Warren Peters, Mgr. Tech. Sls. …… **D•2016-2035**

Local Sales Offices & Reps

AL	Huntsville, Marco Mktg.	205-883-9630
AZ	Phoenix, Comp. Sls.	602-263-6022
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	San Jose, The JSYS Grp.	408-928-1411
CO	Denver, AKI Enterprises	303-756-0700
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
IL	Itasca, Beta Technlgy.	708-250-9586
MD	Gaithersburg, Deltatronics	301-253-0615
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg.	616-791-7370
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Great Neck, F & F Metro	516-482-4080
NY	Rochester, Elcom Sls. Inc.	716-385-1400
NY	Skaneateles, Elcom Sls. Inc.	315-685-8967
OH	Columbus, McFadden Sls.	614-761-3177
OR	Tigard, Northwest Comp. Sls.	503-620-3285
PA	Blue Bell, Deltatronics	215-641-9930
TX	Richardson, Jim D. Gray Assocs.	214-699-9976
VA	Alexandria, Deltatronics	703-971-1733
WA	Kirkland, Northwest Comp. Sls.	206-828-2104
WI	Milwaukee, Beta Technlg.	414-543-6609
Can	Mississauga, Andy Bauman Assocs.	416-828-2600
Can	W. Vancouver, Leister Blake Entprs.	604-926-6127

Local Distributors

CA	N. Hollywood, B.J. Wolfe	213-877-5518
CA	San Jose, B.J. Wolfe	408-371-3443
CA	San Jose, ForeSight Elctrns.	408-980-9700
CA	Santa Ana, ForeSight Elctrns.	714-833-2134
FL	Land-O-Lakes, AJ'S Power Source	813-996-2583
IL	Roselle, ForeSight Elctrns.	708-980-9890
NH	Salem, Diamond Elctrns.	603-894-4420
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	Houston, Wofford Elctrns.	713-351-2255

UNI-POWER HYBRIDS INTERNATIONAL, See Hybrids Intl. Ltd.

UNIT DESIGN, 1811 N. Case St., Orange, CA 92665, Tel: 714-282-8100, FAX: 714-282-8188; Empl.: 20; *Sls. Mgr.:* Nanette Janes

UNITED CHEMI-CON

FAX: 708-640-6341

UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 708-696-2000; Empl.: 65 …… **A•1171-1173**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell	205-883-5110
CA	Los Altos, Recht Assoc.	415-964-6321
CA	Santa Ana, Jones & McGeoy Sls., Inc.	714-547-6466
CO	Englewood, Purdy & Assocs.	303-790-2211
GA	Norcross, R. O. Whitesell	404-449-9190
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
IN	Indianapolis, R. O. Whitesell	317-876-9000
IA	Cedar Rapids, J.R. Sls., Inc.	319-393-2232
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Versailles, R. O. Whitesell	606-873-1182
MI	Grand Rapids, R. O. Whitesell	616-942-5420
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R. O. Whitesell	616-983-7337
MN	Plymouth, Twist Co.	612-550-0922
NY	Hauppauge, Aurora Mktg.	516-434-1313
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Cleveland, R. O. Whitesell	216-447-9020
OH	Dayton, R. O. Whitesell	513-298-9546
OR	Beaverton, Elctrn. Source, Inc.	503-627-0838
PA	Ambler, W.R. Hartmaier	215-643-6691
PA	Pittsburgh, R. O. Whitesell	412-963-6161
PA	Spring House, Hartmaier, Assoc.	215-643-6691
TN	Knoxville, R. O. Whitesell	615-694-9476
TX	Austin, RAM Elctrn Sls.	512-250-5082
TX	Houston, RAM Elctrn. Sls.	713-580-7394
TX	Plano, RAM Elctrn. Sls.	214-578-5400
Can	Scarborough, Ont., JRL/Franklin	416-756-9862

Local Distributors

AL	Huntsville, Hammond Elctrns	205-830-4764
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura Hills, Bell Inds.	818-706-2608
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Camarillo, Milgray Elctrns.	800-635-7812, 805-484-4055
CA	Chatsworth, Passive Comps.	818-700-8838
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Irvine, Milgray Elctrns.	714-753-1282
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	Tustin, Capstone Elctrns.	713-730-0349
CA	Tustin, Projections Unltd.	714-544-2700
CA	Tustin, Time Elctrns.	714-669-0100
CO	Denver, Capstone Elctrns.	303-375-1300
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Milford, Milgray	800-922-6911
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Melbourne, New Yorker Elctrns.	407-727-0955
FL	Winter Pk., Milgray Elctrns.	800-241-5523
GA	Atlanta, Time Elctrns.	404-984-0923
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Milgray Elctrns.	800-241-5523
IL	Chicago, Newark Elctrns.	312-907-5211

IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Palatine, Milgray Elctrns.	800-322-6271
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wood Dale, Nep Elctrns.	708-595-8500
KS	Overland Pk., Milgray Elctrns.	800-255-6576, 913-236-8800
MD	Columbia, Milgray Elctrns.	800-638-6656
MD	Columbia, Time Elctrns.	301-964-3090
MA	Hopkinton, Interface Elctrns.	508-435-6858
MA	Peabody, Time Elctrns.	508-532-9756
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, Milgray Elctrns.	800-334-6941
MA	Wilmington, North Star Elctrns.	508-657-5155
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Marlton, Capstone Elctrns.	609-727-7800
NJ	Marlton, Milgray Elctrns.	800-257-7111
NJ	Parsippany, Milgray Elctrns.	800-622-0291
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	Teterboro, EAC	201-288-4477
NY	Farmingdale, Milgray Elctrns.	800-645-4729
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Milgray Elctrns.	800-562-3118
OH	Cleveland, Milgray Elctrns.	800-321-0006
OH	Dublin, Time Elctrns.	614-761-1100
OR	Beaverton, Future Elctrns.	503-645-9454
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	Malvern, Interface Elctrns.	215-889-2060
SC	Greensville, Hammond Elctrns.	803-233-4121
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Dallas, Milgray Elctrns.	800-637-7227
TX	Fort Worth, TTI, Inc.	817-740-9000
TX	Houston, Time Elctrns.	713-530-0800
UT	Salt Lake City, Milgray Elctrns.	800-537-9739
UT	W. Valley, Time Elctrns.	801-973-8181
WA	Bothell, Projections Unltd.	206-485-2147
WA	Redmond, Time Elctrns.	206-882-1600
WI	Milwaukee, Marsh Electronics	414-786-5300
WI	New Berlin, Nep Elctrns.	414-785-9100
Can	Mississauga, Ont., Capstone	416-495-7705
Can	Mississauga, Ont., Time Elctrns.	416-672-5300
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Richmond, B.C., Electrosonics, Inc.	604-273-2911
Can	Vancouver, B.C., Future	604-438-5545
Can	Willowdale, Ont., Electronics	416-494-1666
Can	Willowdale, Ont., Milgray Elctrns.	800-268-3315, 416-756-4481
Can	Winnipeg, Sas., Zentronics	204-694-1957

(UEC) UNITED ELECTRIC CONTROLS, P. O. Box 9143, Watertown, MA 02272-9143, Tel: 617-926-1000, TELEX: 92 2445, FAX: 617-926-2568; Empl.: 420; *Sls. Mgr.:* Dave Williams; *Dist. Mgr.:* George Miller

UNITED FOAM PLASTICS, 172-Q E. Main St., Georgetown, MA 01833, Tel: 508-352-2200, FAX: 508-352-7169; FSC No.: 55900; Empl.: 200; *Sls. Mgr.:* R.L. Bailly

UNITED MOTION TECHNOLOGY, 2954 Scott Blvd., Santa Clara, CA 95054, Tel: 408-970-9742, 1-800-424-STEP, FAX: 408-986-8009; Empl.: 4

Local Sales Offices & Reps

CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CT	Essex, Winslow Elec. Co.	203-767-8229
FL	Pampano Bch., Motion Prods.	305-783-9003
NY	Cazenovia, Delen Assocs.	315-655-8602
PA	Pittsburgh, Precision Dvcs.	412-941-7662
Can	Ottawa, Graham Dewar & Assoc.	613-744-8463

UNITED PRICING REPORTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

UNITED SOLDER WRAP INC., See Vector Elctrns. Co., Inc.

UNITED STATES CRYSTAL CORP., 3605 McCart St., Fort Worth, TX 76110, Tel: 817-921-3014, 800-433-7140, TWX: 910-893-4084, FAX: 817-923-0424; FSC No.: 52847; Empl.: 75; *Sls. Mgr.:* Jan Henderson

UNITED STATES ELECTRONICS, 60 Brown Ave., Springfield, NJ 07081, Tel: 201-912-0111, FAX: 201-912-0015; Empl.: 20

UNITED SUPERTEK, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0730, FAX: 408-922-0534; Empl.: 55; *Sls. Mgr.:* Roger Meade

UNITED SWITCH COMPANY, 3214 W. McGraw, Seattle, WA 98199, Tel: 206-282-8823, FAX: 206-282-9173; Empl.: 3; *Sls. Mgr.:* John Spaulding

UNITED TECHNICAL PRODUCTS, 6 Headley Pl., Fallsington, PA 19054, Tel: 800-553-5300, FAX: 215-736-8515; Empl.: 50; *Sls. Mgr.:* Bob Harbison, Jr.

UNITED TECHNOLOGIES MICROELECTRONICS CENTER, United Technologies Corp., 1575 Garden of The Gods Rd., Colorado Springs, CO 80907, Tel: 719-594-8000, 1-800-MIL-UTMC, FAX: 719-594-8032; Empl.: 308; *Sls. Mgr.:* Dwight Deem

UNITED WIRE & CABLE CORP., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-757-3872, FAX: 508-753-2173; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDUSTRIES, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161, FAX: 714-871-4164; FSC No.: 0AMM9; Empl.: 40; *Sls. Mgr.:* D. Molby

UNITRACK®

UNITRACK INDUSTRIES, INC.

FAX: 302-424-5055

UNITRACK INDUSTRIES, INC., 967 E. Masten Cir., Milford, DE 19963, Tel: 302-424-5050; Empl.: 40; *Sls. Mgr.:* Anna Orcutt .... **C•1114-1115**

Local Sales Offices & Reps

AZ	Paradise Valley, Techrep-Arizona	602-991-6646
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Clara, Cindel/Penmark	408-988-8331
CO	Highlands Ranch, Valcomp Elctrns., Inc.	303-791-0330
FL	Clearwater, Brennan Assocs.	813-446-5006
IA	Des Moines, The Beams Co.	515-255-1148
IL	Glen Ellyn, Lincoln, Hodges & Assocs.	708-469-6750
IN	Ft. Wayne, Outman Sls.	219-489-7699
MD	Ellicott City, Callas Elctrns., Inc.	410-465-0044
MA	Northboro, Easterly Sls. Assocs.	508-393-7399
MI	Chelsea, Sean T. Sls.	313-475-2021
MN	St. Paul, Countryman Assocs.	612-645-9151
NJ	Hampton, Churchill Assocs.	908-735-6626
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
NY	Rochester, Nortek	716-387-0640
NC	Greensboro, Loki Data Prods., Inc.	919-234-5066
OH	Akron, Augnat Assocs.	216-239-2499
PA	Souderton, Intek, Inc.	215-723-0433
TX	Richardson, Barry Sls.	214-234-0255

Local Distributors

CA	Milpitas, M.S. Inserts & Fasteners	408-946-6565
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Clara, Context Engrg.	408-748-8676
CO	Denver, Integrated Elctrns., Inc.	303-393-6121
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Coral Springs, HAI Elctrns., Inc.	305-752-7520
GA	Norcross, Applied Power, Inc.	404-263-0421
MA	Billerica, M.S. Inserts & Fasteners	508-670-5600
MA	Northboro, Papi Supp. Co.	508-393-3127
MA	Winchester, Webb Distbn.	617-729-5800
MI	Grand Rapids, S-F Elctrns. Supp. Co.	616-459-0216
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Warren, Rem Elctrns. Supp. Co., Inc.	216-373-1300
TX	Houston, Tristar Elctrns.	713-667-7200
TX	Wylie, Air Quip/Robleyco	214-442-3573

UNITREK CORPORATION, 3000 Lewis & Clark Hwy., Ste.2, Vancouver, WA 98661, Tel: 206-699-7277, FAX: 206-694-9230; Empl.: 80; *Sls. Mgr.:* John Sailer

UNITRODE CORP., 580 Pleasant St., Watertown, MA 02172, Tel: 617-926-0404, FAX: 617-924-1235; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRODE INTEGRATED CIRCUITS CORP., 7 Continental Blvd., Merrimack, NH 03054-0399, Tel: 603-424-2410, TWX: 95-3040

UNIVERSAL AD-YU/D-F INC., 2517 E. Norwich St., St. Francis, WI 53235, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10; *Sls. Mgr.:* Ronald Tessmer

UNIVERSAL INSTRS. CORP., MECHANIZED ELCTRN. ASSEMBLY (MEA) DIV., See Mechanized Elctrn. Assembly Div., Universa

UNIVERSAL SEMICONDUCTOR INC., 1925 Zanker Rd., San Jose, CA 95112, Tel: 408-436-1906, FAX: 408-436-1125; FSC No.: 62305; Empl.: 30; *Sls. Mgr.:* Uday B. Koppikar

Universal Voltronics

FAX: 914-241-3129

UNIVERSAL VOLTRONICS DIV., Thermo Voltek Corp., 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; FSC No.: 14225; Empl.: 85 .... **D•2037-2039**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Los Alamitos, Tritek Sci. Dvcs.	714-362-3592
CO	Wheat Ridge, Trembly Assocs.	303-921-8900
IN	Ossian, Science Sls. Inc.	219-622-7383
NV	Las Vegas, Trembly Assoc., Inc.	702-739-9770
NJ	Roseland, Tech. Mktg. Assoc.	201-228-7800
NM	Albuquerque, Trembly Assoc., Inc.	505-266-8616
PA	Audubon, Holmes Assocs., Inc.	215-666-0637
TX	El Paso, Trembly Assoc.	915-533-9380
UT	No. Salt Lake City, Trembly Assocs., Inc.	801-295-4703
WA	Bellevue, The Western Rep.	206-637-0947
Can	Nepean, Ont., Datacomp Elctrns.	613-723-8825
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

Local Distributors

AZ	Phoenix, Trembly Assoc. Inc.	602-967-2058
CO	Wheat Ridge, Trembly Assoc. Inc.	303-421-8900
NV	Las Vegas, Trembly Assoc. Inc.	702-739-9770
NM	Albuquerque, Trembly Assoc. Inc.	505-266-8616
UT	North Salt Lake, Trembly Assoc. Inc.	801-295-4703
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

UNIVERSITY SOUND, INC., Mark IV Industries, 13278 Ralston, Sylmar, CA 91342, Tel: 818-362-9516, FAX: 818-367-5292; Empl.: 72; *Sls. Mgr.:* Greg McLagan

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 50; *Sls. Mgr.:* G. Urban

U.RD

United Research and Development

FAX: 714-831-6371

U.R.D. AMERICA, P.O. Box 6006, Laguna Nigel, CA 92607, Tel: 714-831-0111; *Sls. Mgr.:* Lawrence Sultan .... **D•1169**

Local Sales Offices & Reps

CA	Canoga Pk., C & W Comp. Sls.	818-700-2684
IL	Lena, BB & J Sls., Inc.	815-369-2066
MA	Brookline, Reliable Sls.	617-738-8305
NY	Franklin Sq., Cooper Simon Emtec	516-489-0404

USAPEX CORP., 2378 Walsh Ave., Ste B, Santa Clara, CA 95051, Tel: 408-982-9063, FAX: 408-982-0223; FSC No.: 77-0326422; Empl.: 15

USAR SYSTEMS, INC., 568 Broadway Ste. 405, New York, NY 10012, Tel: 212-226-2042, FAX: 212-226-3215; Empl.: Less than 10; *Sls. Mgr.:* Tony D'Amato

US DIGITAL

FAX: 206-260-7452

U. S. DIGITAL CORP., 17401 N.E. Stoney Meadows Dr., Vancouver, WA 98682, Tel: 206-260-7451; *Sls. Mgr.:* David Madore .... **B•2019-2023; D•1327**

Local Sales Offices & Reps

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

Local Distributors

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

USD PRODUCTS, Div. of Bussmann, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-4600, FAX: 708-867-2211; Empl.: 200; *Sls. Mgr.:* Mr. Chris Osmun

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-6381, FAX: 818-786-9162; FSC No.: 88245; Empl.: 100; *Sls. Mgr.:* Ed Wallen

U.S. ELCO, INC., See Cosel USA Inc.(Formerly US Elco)

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200, FAX: 201-848-9006; Empl.: 25; *Sls. Mgr.:* James F. Golden

U.S. POWER/RELCO MIDWEST, U.S. Power Converting Co., 8830 West 61st North, Wichita, KS 67205, Tel: 316-722-6440; Empl.: 12; *Dist. Mgr.:* Jonathan P. Snow .... **C•1081; D•1913**

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 310-316-9984, FAX: 310-316-9050; Empl.: 8; *Sls. Mgr.:* Van Snow; *Dist. Mgr.:* Tom Clark .... **C•1081; D•1913**

Local Sales Offices & Reps

KS	Wichita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616
Can	Torrance, U.S. Power Conv. Co.	310-316-9984

Local Distributors

CA	Torrance, U.S. Power Converting/L. Snow & Assocs.	310-316-9984
KS	Witchita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

U.S. RESISTOR, INC., P.O. Box 1059, St. Marys, PA 15857-1059, Tel: 814-781-7679, FAX: 814-834-9201

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25

U.S. TERMINALS INC., 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, FAX: 513-561-8755; FSC No.: 12615; Empl.: 45; *Sls. Mgr.:* George L.Stepp

FAX: 818-287-7350

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297; Empl.: 20; *Sls. Mgr.:* Bill Jacobs; *Dist. Mgr.:* Bill Jacobs .... **C•1652-1653**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-536-9775
AZ	Scottsdale, Western High Tech. Mktg.	602-860-2702
CA	Oceanside, Noo Rep Tech Sls.	619-941-0558
CA	San Gabriel, U.S. Toyo Fan Corp.	818-287-5297
CA	Sunnyvale, U.S. Toyo Fan Corp.	408-737-0123
CO	Boulder, Comp. Prod. Sls.	303-530-2800
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Woodridge, Golten Assoc.	708-985-5100
IA	Blue Grass, Rothkopf & Assocs.	319-381-4396
KS	Olathe, Rothkopf & Assocs.	913-829-8897
MD	Towson, Dalbrook Corp.	410-296-3165
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Brighton, W. R. Hummon	313-486-5333
MN	New Brighton, Boerger & Assoc.	612-636-4339
MO	St. Louis, Rothkopf & Assocs.	314-961-4485
NJ	Fort Lee, Nepture Elec.	201-461-2789
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NY	Plainview, Neptune Elec.	516-349-1600
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Richfield, Geotronix	216-659-6100
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Allison Pk., Geotronix Inc.	412-487-1770
PA	Lansdale, Dalbrook Corp.	215-362-8033
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Richardson, Zonk & Assoc.	214-238-7651
VA	Fredericksburg, Dalbrook Corp.	703-786-1873
WA	Snohomish, Unicomp, Inc.	206-568-0511
PR	Santruce, SISCO	809-726-3137
Can	Montreal, Dynatech Elctrns.	514-276-4477

Local Distributors

AZ	Scottsdale, Added Value Elctrns.	602-951-9788
CA	Fremont, Connex Elctrns.	510-656-7722
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Tustin, Added Value Elctrns. Distr.	714-259-8258
CO	Wheatridge, Added Value Elctrns.	303-422-2529
CT	Hamden, Astrex, Inc.	203-288-0044
UT	Salt Lake City, Added Value Elect.	801-975-9500
IL	Elk Grove, Martec Assocs.	708-956-8090
MD	Beltsville, Petricko Sls.	301-937-4960
MA	Haverhill, Cord Elctrns.	617-374-0100
MA	W. Springfield, Astrex, Inc.	413-788-7341
MN	Fridley, Voyager Elec.	612-571-9519
MN	Minneapolis, Aerospace Computer Supp.	612-884-4725
NY	Elmsford, Multimeterics	914-347-3666
NY	Endwell, Astrex, Inc.	607-754-3823
OR	Beaverton, Comp. Resources, Inc.	503-641-8488
PA	Willow Grove, Astrex, Inc.	215-784-9934
TX	Richardson, Zec Sls.	214-669-0895
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280
Can	Surrey, B.C., MEMCO	604-590-1553

U.S. TRANSFORMER AND INDUCTOR, 1400 E. College Dr., Cheyenne, WY 82007, Tel: 800-584-9339, FAX: 307-637-4883; Empl.: 11; *Sls. Mgr.:* Carl Le Jamdre

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 908-922-1009, FAX: 908-922-1848; FSC No.: 23261; Empl.: 35

UTICOR TECHNOLOGY, 4140 Utica Ridge Rd., Bettendorf, IA 52722, Tel: 319-359-7501, FAX: 319-359-9094; Empl.: 110; *Sls. Mgr.:* Tom Howard

UTI INSTRUMENTS CO., 2030-C Fortune Dr., San Jose, CA 95131, Tel: 408-428-9400, FAX: 408-428-0823; Empl.: 80; *Sls. Mgr.:* Tom Strahl

UVP, INC., 5100 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-285-3123, 800-452-6788, FAX: 818-285-2940; Empl.: 100; *Sls. Mgr.:* Phil Spillane

VAIL SILICON TOOLS, 692 A S. Military Trail, Deerfield Beach, FL 33442, Tel: 305-570-5580, FAX: 305-428-1811; Empl.: 4; *Sls. Mgr.:* Jim Prince; *Dist. Mgr.:* Doug Beard

VALHALLA
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FAX: 619-457-0127

VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-457-5576; Empl.: 75; *Sls. Mgr.:* Kerry Clark .... **D•1328-1331**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
CA	Costa Mesa, Cutlass Elctrns.	714-549-9358
CA	San Diego, Amasco	619-292-7666
CA	San Jose, ARC Tech. Resources	408-263-6486
CA	Sunnyvale, ARC Technical Resources	408-773-8871
CA	Torrance, Cutlass Elctrns.	213-324-7360
FL	Orlando, Currie, Peak & Frazier	407-855-0843
FL	Pace, Currie, Peak & Frazier	904-994-0599
FL	Tampa, Currie, Peak & Frazier	813-854-5116
FL	W. Melbourne, Currie, Peak & Frazier	407-724-6795
GA	Dulth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Comtel Midwest Co.	708-392-4040
IN	Indianapolis, Comtel Midwest Co.	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MD	Landover, Sel-Tronics	301-341-2700
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Farmington Hills, Carter, McCormic & Peirce (CMP)	313-477-7700
MN	Wayzata, Comtel Midwest Co.	612-476-1551
MO	Kansas City, Comtel Midwest	913-268-0762
NY	Rochester, Eastern Systems	716-292-1460
NC	Charlotte, Currie, Peak & Frazier	704-846-1702
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Englewood, Carter, McCormic & Peirce (CMP)	513-836-0951
OH	Parma, Carter, McCormic & Peirce (CMP)	216-398-0400
OR	Portland, Westcon, Inc.	503-283-0132
PA	Philadelphia, Robert Meyers Assocs.	215-224-1663
PA	Pittsburg, Carter, McCormic & Peirce (CMP)	412-826-3800
TX	Dallas, Entest	214-980-9876
TX	Houston, Entest	713-686-7306
VA	Hampton, Sel-Tronics	804-827-6308
WI	New Berlin, Comtel Midwest Co.	414-544-6042

VALIDYNE ENGINEERING CORPORATION, 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, TELEX: 65-1303, FAX: 818-886-6512; Empl.: 200

VALLEY ELECTROMAGNETICS, ECM Motor Co., 1099 Proctor Dr., Elkhorn, WI 53121, Tel: 414-723-6400, FAX: 414-723-7373; Empl.: 100; *Sls. Mgr.:* R. Forschler

VALOR ELECTRONICS, 9715 Business Park Avenue, San Diego, CA 92131-1642, Tel: 619-537-2500, TELEX: 653406 VALORSD, FAX: 619-458-0875; FSC No.: 15003; Empl.: 5000; *Sls. Mgr.:* Brad Rogers .... **A•1686-1687, 2602-2603; D•2215**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech.	205-464-0033, FAX:205-464-9909
AZ	Scottsdale, American Mktg., Inc.	602-948-2778, FAX:602-860-4455
CA	Garden Grove, Elsco Elctrns.	714-891-4621, FAX:714-891-1251
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800, FAX:408-496-6952
CO	Englewood, Comp. Sls., Inc.	303-779-8060, FAX:303-779-8357
FL	Boca Raton, So. Atlantic Comp. Sls.	417-391-1034
FL	Orlando, So. Atlantic Comp., Sls.	407-857-3650, FAX:407-857-3298
FL	Seminole, So. Atlantic Comp., Sls.	813-595-6397, FAX:813-595-6397
GA	Norcross, Benchmark Technlg.	404-446-1711, FAX:404-448-2854
ID	Meridian, Utah CSI	208-888-3554
IL	Arlington Hgts., KMA Sls., Co.	708-398-5300, FAX:708-398-5708
IN	Carmel, Valentine Assoc., Inc.	317-846-0008
MA	Topsfield, Whitehead Assocs. Inc.	508-887-8050, FAX:508-887-5434
MI	Canton, Techrep Inc.	313-981-1950, FAX:313-981-2006
MN	Minneapolis, DeBeck-Hays Assocs. Inc.	612-835-3610,FAX:612-835-0515
NJ	Marlton, BGR Assocs.	609-983-1020, FAX:609-983-1879
NJ	Matawan, Ashtec, Inc.	908-583-6903, FAX:908-583-0379
NY	Apalachin, T-Squared Elctrns. Co.	607-625-3983
NY	Cicero, T-Squared Elctrns. Co.	315-699-1559
NY	Port Washington, Ashtec Inc.	516-767-0336, FAX:516-767-0981
NY	Victor, T-Squared Elctrns. Co.	716-924-9101
NC	Raleigh, Benchmark Technlg.	919-850-0633, FAX:919-850-0725
OH	Dayton, KW Elctrn. Sls.	513-890-2150, FAX:513-890-5408
OH	Shaker Heights, KW Elctrn. Sls.	216-491-9177, FAX:216-491-9102
PA	Pittsburgh, KW Elctrn. Sls.	412-492-0777, FAX:412-492-0780
TX	Austin, Kruvand	512-219-9441,FAX:512-219-1932
TX	Dallas, Kruvand	214-437-3355,FAX:214-680-8854
UT	Midvale, Utah CSI	801-561-5099
WA	Seattle, Northmar Inc.	206-524-5170, FAX:206-524-0402
WI	Milwaukee, KMA Sls. Co.	414-259-1771, FAX:414-259-0246
PR	Rio Piedras, D.K. Marketing	809-765-5380, FAX:809-758-5380
Can	Rexdale,Ont., Electro-Source, Inc.	416-675-4490

Local Distributors

AL	Huntsville, Hall-Mark Elctrns. Corp.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns. Corp.	602-437-1200

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1026 6th. AVENUE
OAKLAND, CA 94606

CA	Chatsworth, Hall-Mark Elctrns. Corp.	818-773-4560
CA	Irvine, Hall-Mark Elctrns. Corp.	714-727-6000
CA	Milpitas, Sierra West	408-945-1050
CA	Riverside, Electronic Supply	714-683-7300
CA	Rocklin, Hall-Mark Elctrns. Corp.	916-624-9781
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Diego, Hall-Mark Elctrns. Corp.	619-268-1201
CA	San Jose, Elctrn. Supp.	408-453-3770
CA	San Jose, Hall-Mark Elctrns. Corp.	408-432-4000
CO	Englewood, Hall-Mark Elctrns. Corp.	303-790-1662
CT	Cheshire, Hall-Mark Elctrns. Corp.	203-271-2844
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Casselberry, Hall-Mark Elctrns. Corp.	407-830-5855
FL	Largo, Hall-Mark Elctrns. Corp.	813-541-7440
FL	Pompano Bch., Hall-Mark Elctrns. Corp.	305-971-9280
GA	Duluth, Hall-Mark Elctrns. Corp.	404-623-4400
IL	Wood Dale, Hall-Mark Elctrns. Corp.	708-860-3800
IN	Indianapolis, Hall-Mark Elctrns. Corp.	317-872-8875
KS	Lenexa, Hall-Mark Elctrns. Corp.	913-888-4747
MD	Columbia, Hall-Mark Elctrns. Corp.	301-988-9800
MA	Billerica, Hall-Mark Elctrns. Corp.	508-667-0902
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Plymouth, Hall-Mark Elctrns. Corp.	313-416-5800
MN	Bloomington, Hall-Mark Elctrns. Corp.	612-881-2600
MO	Earth City, Hall-Mark Elctrns. Corp.	314-291-5350
NH	Manchester, Cronin Elctrns.	603-624-0105
NJ	Moorsetown, Hall-Mark Elctrns. Corp.	609-235-1900
NJ	Parsippany, Hall-Mark Elctrns. Corp.	201-515-3000
NJ	Rockaway, Tonar Inds. Inc.	201-586-9000
NY	Fairport, Hall-Mark Elctrns. Corp.	716-425-3300
NY	Ronkonkoma, Hall-Mark Elctrns. Corp.	516-737-0600
NC	Raleigh, Hall-Mark Elctrns. Corp.	919-872-0712
OH	Solon, Hall-Mark Elctrns. Corp.	216-349-4632
OH	Worthington, Hall-Mark Elctrns. Corp.	614-888-3313
OK	Tulsa, Hall-Mark Elctrns. Corp.	918-254-6110
TX	Austin, Hall-Mark Elctrns. Corp.	512-258-8848
TX	Dallas, Hall-Mark Elctrns. Corp.	214-343-5822
TX	Houston, Hall-Mark Elctrns. Corp.	713-781-6100
UT	Salt Lake City, Hall-Mark Elctrns., Inc.	801-269-0416
WA	Seattle, Hall-Mark Elctrns. Corp.	206-547-0415
WI	New Berlin, Hall-Mark Elctrns. Corp.	414-797-7844
Can	Pointe Claire, Tonar Inds., Inc.	514-694-3057

VALPEY-FISHER:MATEC CORP, 75 South St, Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; FSC No.: 5955; Empl.: 120; *Sls. Mgr.:* Mark Freyermuth, Mktg. Mgr.; *Dist. Mgr.:* John Pimentel

VALPEY-OPT COMPANY, Valpey-Fisher Corp./Opt Inds., 75 South St, Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; Empl.: 7; *Sls. Mgr.:* Wim Van Den Akker

VAMISTOR CORP., 144 River Bend Drive, Sevierville, TN 37862, Tel: 615-453-0001, FAX: 615-453-0003; FSC No.: 56856, OEBU2; Empl.: 53; *Sls. Mgr.:* Pat Healy; *Dist. Mgr.:* Pat Healy

VANGUARD ELECTRONICS CO., 1480 W. 178th St., Gardena, CA 90248, Tel: 310-323-4100, FAX: 310-329-8427; FSC No.: 03550; Empl.: 250; *Sls. Mgr.:* Kenneth R. Finley (Intl.); *Dist. Mgr.:* John Hoenig (Domestic)

VANN INSTRUMENTS, 1046 Vassar N.E., Albuquerque, NM 87106, Tel: 505-265-2498, FAX: 505-268-9722; *Sls. Mgr.:* Michael E. Vann

VAN WATERS & ROGERS INC., Univar Corp., PO Box 64004, St. Paul, MN 55164-0004, Tel: 612-774-9400, FAX: 612-774-0850; Empl.: 3000; *Sls. Mgr.:* George Coyle

VARIAN ASSOCIATES, Electron Device Business, 3100 Hansen Way, Palo Alto, CA 94304, Tel: 415-493-4000, 800-544-4636, TELEX: 34 8476, FAX: 415-424-6276; FSC No.: 02845; Empl.: 10,700; *Sls. Mgr.:* John Beighley

VARIAN MICROWAVE EQUIPMENT PRODUCTS, Varian Assocs., Inc., 3200 Patrick Henry, Santa Clara, CA 95054, Tel: 408-496-6273, TELEX: 510-601-5674 MEDSC, TWX: 348476, FAX: 408-496-6235; FSC No.: 59782; Empl.: 300; *Sls. Mgr.:* Don Crumm

VARITRONIX, See VL Electronics

VARTA BATTERIES, INC., 300 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-2500, 800-431-2154, FAX: 914-592-2667; Empl.: 33

VASAK INDS., INC., 211 Eucalyptus Drive, El Segundo, CA 90245, Tel: 1-800-67-VASAK; Empl.: 10; *Sls. Mgr.:* John Vasak

VA-TRAN SYSTEMS INC., 677 Anita St. Ste. A , Chula Vista, CA 91911, Tel: 619-423-4555, FAX: 619-423-4604; Empl.: 10; *Sls. Mgr.:* J.E. Sloan

VEAM, Litton Systems, 100 New Wood Rd., Watertown, CT 06795, Tel: 203-274-9681, TELEX: 710-477-0039, FAX: 203-274-4963; FSC No.: 55561; Empl.: 80; *Sls. Mgr.:* Maryellen Myers

VECTOR
ELECTRONIC COMPANY

FAX: 818-365-5718

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Sylmar, CA 91342, Tel: 818-365-9661, 800-423-5659; FSC No.: 82893; Empl.: 95; *Dist. Mgr.:* J. Forman …… **C•1025, 1674-1675, 1678-1681**

For Vector Elctrns.' sales offices and reps. in all other states- 800-423-5659.

Local Sales Offices & Reps

CA	Carlsbad, QPI Sls.	714-431-8859
CA	Santa Ana, Mike Roth	714-647-0606
FL	Melbourne, Saber Assocs.	407-724-0920
IL	Inverness, Carvel Eng.	708-934-9600
MA	Needham Hgts., Todino	617-444-7925
NJ	Newark, Rical Assocs.	201-643-0880
NM	Albuquerque, Odyssey1	505-345-9695
OH	Solon, Five Star	216-349-1161
OR	Beaverton, Luscombe, Eng.	503-636-6664
PA	King of Prussia, KSI, Inc.	215-783-6400
TX	Dallas, Technlg. Reps.	214-713-9027
VA	Alexandria, Dyna-Rep	703-354-1222

National Distributors

Local Distributors

IL	Chicago, Newark Elctrns.	312-784-5100
MD	Gaithersburg, Pioneer Technlgs.	301-921-0660
MN	Thief River Falls, Digi-Key	800-344-4539
OH	Cleveland, Pioneer Stand. Elec.	216-587-3600
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Ft. Worth, Allied	800-433-5700
TX	Ft. Worth, Allied Elctrns.	800-433-5700

THE VECTOR GROUP, INC., 189 Horsham Rd., Horsham, PA 19044, Tel: 1-800-523-3696, FAX: 215-672-3411; Empl.: 10; *Sls. Mgr.:* Frank Menichello

VECTRONICS MICROWAVE CORP., 113 Lincoln Blvd., Middlesex, NJ 08846, Tel: 908-356-2377, FAX: 908-356-6782; FSC No.: 32846; Empl.: 30; *Sls. Mgr.:* John G. Vogler

VECTRON LABORATORIES, INC., 166 Glover Ave., P.O. Box 5160, Norwalk, CT 06856-5160, Tel: 203-853-4433, TWX: 710-468-3796, FAX: 203-849-1423; FSC No.: 27802; Empl.: 340; *Sls. Mgr.:* Larry Jawitz …… **A•1502-1509**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	Mountain View, Schoenduve Corp.	415-962-8330
CA	San Diego, Midwin & Olifson, Inc.	800-275-8765
CA	Tarzana, Midwin & Olifson, Inc.	800-275-8765
CO	Parker, Techn. Mktg. Assocs.	303-841-3435
CT	Watertown, May Tech.	203-274-3777
FL	Melbourne, Saber Assocs.	800-432-6288
GA	Lawrenceville, Saber Assocs.	800-327-0853
IL	Libertyville, GMR Sls., Inc.	708-367-8440
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	Kokomo, Valentine & Assocs.	317-453-3799
IN	South Bend, Valentine & Assocs.	219-288-7070
MO	St. Louis, Rush & West Assocs.	314-965-3322
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Burtonsville, Eastern Instrumentation	301-384-8500
MA	Reading, May Tech.	617-942-7135
MI	Grand Rapids, R. P. Urban Assocs.	616-245-0511
MN	Burnsville, Allied Comp. Reps.	612-435-7876
NY	Great Neck, F & F Metro	516-482-4080
NM	Albuquerque, J. Smith & Assocs.	505-345-6501
NY	Rochester, T—Squared Elctrns.	716-924-9101
NC	Clayton, Saber Assocs.	800-327-0853
OH	Englewood, A. Nace Co.	513-836-0931
OH	Hudson, A. Nace Co.	216-656-3273
PA	Havertown, SWR Tech., Inc.	215-353-6639
TX	Dallas, Texas Avionics	214-437-5677
UT	Salt Lake City, Techn. Mktg. Assocs.	801-483-1009
WA	Seattle, Datacom	206-285-2525
Can	Quebec, Microvolt Elctrns.	514-421-4164

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300, FAX: 516-349-8321; *Sls. Mgr.:* Gary DiBiase

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FAX: 308-324-4985

VEETRONIX, INC., Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Eddie Howerter …… **B•1816-1817**

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, FAX: 703-938-6311; FSC No.: 23115; Empl.: 160; *Sls. Mgr.:* Joe E. Bennett

VEKTREX ELECTRONIC SYSTEMS, INC., 8675 Miralani Dr., Ste. 150, San Diego, CA 92126, Tel: 619-578-6787; FSC No.: 0BV42; Empl.: 5

VELMEX, INC., P. O. Box 38, East Bloomfield, NY 14443, Tel: 716-657-6151, 800-642-6446, FAX: 716-657-6153; Empl.: 30; *Sls. Mgr.:* R. Yurick

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, FAX: 408-727-0389; Empl.: 25; *Sls. Mgr.:* Sam Link …… **D•1388**

VEMALINE PRODUCTS DIV., See Handles Unlimited

VENABLE INDUSTRIES, INC., 2120-M Braker Ln., Austin, TX 78758, Tel: 512-837-2888,800-262-2522, TELEX: 752421, FAX: 512-837-3209; Empl.: 20; *Sls. Mgr.:* Shelley Kelly

VENT RAK, See General Devices

VERDURE INDUSTRIES INC., PO Box 24886, Omaha, NE 68124, Tel: 402-691-8300, FAX: 402-691-8400; Empl.: 7; *Sls. Mgr.:* Larry Johnson

VERMONT PRECISION RESISTOR, Codeco Corp. of Vermont, P.O. Box 1207, Stowe, VT 05672-1207, Tel: 802-253-8567, 802-253-7649, FAX: 802-253-8019; Empl.: 8 …… **A•2036-2037**

Local Sales Offices & Reps

MA	Framingham, Gallagher Assosc.	508-626-2346
VT	Burlington, Twin State Sls.	802-658-7868

VERMONT RESEARCH CORP., Precision Pk., N. Springfield, VT 05150, Tel: 802-886-2256, FAX: 802-886-2682; Empl.: 50; *Sls. Mgr.:* John Dimitruk

VERNITECH:VERNITRON CORP., 300 Marcus Blvd., Deer Pk., NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; FSC No.: 30223; Empl.: 170

VERNITRON CONTROLS, Vernitron Corp., See Magtech Controls, Vernitron Corporation

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VERNITRON

VRN INTERNATIONAL DIVISION

FAX: 813-347-3881

VERNITRON CORP., Precision Comps. Group, 2800 Anvil St. N, St. Petersburg, FL 33710, Tel: 813-347-2181; FSC No.: 84048; Empl.: 350; *Sls. Mgr.:* Dennis Snavely/Roger Millheim; *Dist. Mgr.:* K. Hansen .... **A•1308, 2124-2126, 2599**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
AK	Factory Direct	813-347-2181
AZ	Phoenix, Shefler-Kahn	602-257-9015
AR	Little Rock, Doby Assoc.	501-221-0326
CA	Los Angeles, Factory Direct	813-347-2181
CA	Santa Clara, West Rep	408-988-3188
CO	Denver, J.F. Hurlbut Co.	303-279-7796
NH	Amherst, D.A. Crowley & Assoc.	603-673-7050
FL	Largo, Electrocraft	813-544-1766
IL	Downers Grove, Golten Assocs.	708-985-5100
IN	Indianpolis, Elctrns. Reps.	317-894-1414
KS	Lenexa, MTS	913-888-5100
MD	Manchester, Imagitron Sls.	410-374-5600
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MI	St. Joseph, R.C. Merchant & Co.	616-983-7378
MN	Minneapolis, PSI	612-944-8545
MS	Jackson, Doby Assocs.	601-981-1138
NM	Albuquerque, Shefler-Kahn	505-345-3591
NY	Great Neck, Mos Assocs.	516-487-3966
NY	Syracuse, Pi'tronics	315-435-7346
OH	Cleveland, Baehr Greenleaf	216-892-1770
OH	Dayton, Baehr Greenleaf	513-439-0724
PA	Warrendale, Baehr Greenleaf	412-934-3088
TX	Dallas, Erickson Sls.	214-739-5833
Can	Scarbourough, Ont., JRL Assocs.	416-756-9862
Can	W. Vancouver, Leister Blake	604-926-6127

Local Distributors

AZ	Phoenix, Future	602-968-7410
AZ	Scottsdale, Kent	602-998-0399
AZ	Tempe, TTI	602-431-1191
CA	Agoura Hills, Zeus	818-889-3838
CA	Los Angeles, Bell	310-826-3975
CA	Los Angeles, TTI	818-891-8885
CA	San Diego, Kent	619-453-7133
CA	San Diego, TTI	619-748-2025
CA	San Jose, Future	408-434-1122
CA	San Jose, TTI	408-946-5577
CA	San Jose, Zeus	408-629-4789
CA	Santa Ana, TTI	714-641-9393
CA	Santa Clara, Kent	408-727-9830
CA	Torrance, Kent	310-320-2700
CO	Denver, TTI	303-429-6806
CT	Bethel, Future	203-743-9594
CT	Wallingford, TTI	203-284-7474
FL	Baco Raton, Jaco	407-241-7943
FL	Clearwater, Future	813-530-1222
FL	Orlando, TTI Inc.	407-849-1000
GA	Norcross, Jaco	404-449-9508
GA	Norcross, RS	404-242-0520
GA	Norcross, TTI	404-662-0911
IL	Elk Grove, Kent	708-364-1300
MA	Wilmington, TTI Inc.	508-658-4700
MD	Columbia, TTI	410-995-1331
MD	Columbia, Zeus	410-997-1118
MA	Bolton, Future	508-779-3000
MA	Lexington, Zeus	617-246-8200
MA	Tewksbury, JACO	508-640-0010
MN	Eden Prarie, TTI	612-933-8555
MN	St. Pauls, Kent	612-642-2828
MO	St. Louis, Olive	314-997-7709
MD	Columbia, Jaco	301-995-6620
NJ	Marlton, Future	609-596-4080
NJ	Mt. Carmel, TTI	609-234-6400
NY	Hauppauge, Fairmont Elec. Sls.	516-231-3313
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Liverpool, Future	315-451-2371
NY	Mamaroneck, New Yorker	914-698-7800
NY	Port Chester, Zeus	914-937-7400
NY	Port Jefferson Station, Unique	516-474-4320
NY	Ronkonkoma, TTI Inc.	516-737-2000
OH	Columbus, Elctrns. Mktg.	614-299-4161
OH	Dayton, Bell Micro-Mil	513-434-8231
OH	Dayton, Zeus	513-293-6162
OH	Independence, TTI	216-328-9755
PA	Philadelphia, P.E.I. Genisus	215-673-0400
TX	Addison, JACO	214-733-4300
TX	Ft. Worth, Allied	817-595-3500
TX	Ft. Worth, TTI Inc.	817-595-3100
TX	Richardson, Zeus	214-783-7010
UT	Salt Lake City, Future	801-972-8489
WA	Bothell, Future	206-489-3400
WA	Redmond, TTI	206-882-0291
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERN KIEBLER ELECTRONICS, INC., 201 N. Gables, Wheaton, IL 60187, Tel: 708-668-5407, FAX: 708-462-7590; Empl.: 150; *Sls. Mgr.:* Vern Kiebler

VERSALOGIC CORP., 3888 Stewart Rd., Eugene, OR 97402, Tel: 800-824-3163, FAX: 503-485-5712

VERTEK INTL. INC., 9465 Customhouse Plaza, Ste. D, San Diego, CA 92173, Tel: 619-661-6868, FAX: 706-686-3444(Mexico); Empl.: 150

VERTEX INDUSTRIES, INC., P. O. Box 996, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, FAX: 201-472-0814; Empl.: 85; *Sls. Mgr.:* Carlo Pastore

VERTOX CO., 10022 Imperial Ave. E , Garden Grove, CA 92643, Tel: 714-530-4541, FAX: 714-530-0143; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 12; *Sls. Mgr.:* Cyndi Reish

VETRA SYSTEMS CORP., 27 Newtown Rd., Plainview, NY 11803, Tel: 516-454-6469, FAX: 516-454-1648; Empl.: 10; *Sls. Mgr.:* Jim Del Rossi .... **B•1852**

VG CONTROLS, INC., 34 Jenkins Road, Hewitt, NJ 07421, Tel: 201-853-4600, TELEX: 201-853-7913; Empl.: 3 .... **B•1855**

VGI, INC., Vikay Industrial Pte. Ltd., 1800 Vernon St., Roseville, CA 95661, Tel: 916-783-7878, FAX: 916-783-7845; Empl.: 14; *Sls. Mgr.:* Gary Johnson

VIABLE SYSTEMS INC., Box 369, Sherborn, MA 01770, Tel: 508-653-7665, TELEX: 922 495 VIABLEUS, FAX: 508-653-6645; Empl.: 30

VIATRAN CORPORATION, 300 Industrial Drive, Grand Island, New York 14072, Tel: 716-773-1700, TELEX: 710-260-1353, ESYLNK: 716-773-2488; Empl.: 110

VIA WEST INTERFACE, INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716, 1-800-266-5716, FAX: 1-602-623-5718; Empl.: 4; *Sls. Mgr.:* Robert S. Bos

VIBRAC, 16 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC, FAX: 603-886-3857; Empl.: 50; *Sls. Mgr.:* R. Searle

Vibra• Metrics INC.

FAX: 203-288-4937

VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-U-SENS-IT; Empl.: 25; *Sls. Mgr.:* William McClain .... **B•2024**

Local Sales Offices & Reps

AZ	Tempe, Rusler Tech.	602-897-2877
CA	Huntington Bch., Transducer Sys. Co.	714-969-7690
CO	Longmont, Weaver & Assocs.	303-772-1999
GA	Tunnel Hill, Pump & Vibration Consits.	404-935-5851
MI	Troy, Satullo Assoc., Inc.	313-585-4811
LA	Greenwell Springs, Vibratronics	504-261-7580
MI	Troy, Satullo Assocs., Inc.	313-585-4811
NM	Albuquerque, Mesa Tech. Corp.	505-883-8833
NY	E. Berne, Northeast Rsch. Assoc.	518-872-2062
OH	Cleveland, Abitec	216-531-9122
OR	Portland, R & T Factors, Inc.	503-287-6114
PA	New Hope, NOVA Pennsylvania Inc.	215-297-0950
RI	Narragansett, Pat Assocs.	800-628-8860
SC	Spartanburg, Pat Assocs.	803-591-4284
TN	Chattanooga, Pump & Vibation Consits.	404-935-5851
TX	Friendswood, Parameter Meas.	713-482-8470
TX	Webster, Parameter Meas.	214-907-6300
UT	W. American Fork, Highland Tech. Mktg.	801-756-2634
VA	Powhatan, IHN Mntc & Eng. Svcs.	804-598-7625
WA	Issaquah, Avantech	206-392-4033
WI	Mequon, James L. Griffin Co. Inc.	414-241-4451
EXP	Hamden, CT, Vibra-Metrics, Inc.	203-288-6158
Can	Burnaby, BC, Machinery Condition Monitoring	506-738-8675

Can	Montreal, Que., Silentec, Ltd.	514-731-3397
Can	St. John, NB, Dynamic Signal Analysis Corp.	604-433-8515

Local Distributors

CT	Ledyard, Emprise Corp.	203-464-8555
MA	Action, Lindskog Balancing Co.	508-263-2040

VIBRO-METER CORP., P.O. Box 5058, Billerica, MA 01822-5058, Tel: 508-663-7322, TELEX: 948145, TWX: 710-320-1872, FAX: 508-667-1944; FSC No.: 62587; Empl.: 50; *Sls. Mgr.:* John Strich

VICOM SYSTEMS, INC., 46107 Landing Pkwy., Fremont, CA 94538, Tel: 415-498-3200, FAX: 415-498-3325; Empl.: 45; *Sls. Mgr.:* Michael Piltoff, Sls. VP

VICOR CORP., 23 Frontage Rd., Andover, MA 01810, Tel: 508-470-2900, TELEX: 910-380-5144, ESYLNK: 508-475-6715; Empl.: 400; *Sls. Mgr.:* D. Nesbitt; *Dist. Mgr.:* L. Cavanaugh

V.I. CORPORATION, 47 Pleasant St., Northampton, MA 01060, Tel: 413-586-4144, FAX: 413-586-3805; Empl.: 75; *Sls. Mgr.:* Paul Maguire, VP Nat. Sls.

VICTOREEN, INC., 6000 Cochran Rd., Solon, OH 44139-3395, Tel: 216-248-9300, 216-248-9043, FAX: 216-248-9301; Empl.: 350; *Sls. Mgr.:* Glenn Whiteley .... **A•2038-2040**

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, TELEX: 952122, TWX: 710-382-1534, FAX: 401-828-0441; Empl.: 500; *Sls. Mgr.:* E. M. Colasanto

VICTOR ENGINEERING, 1000 Calle Cordillera, San Clemente, CA 92673, Tel: 714-366-2931, FAX: 714-366-2385

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933, FAX: 213-559-4167; Empl.: 30

VICTORY ENGINEERING CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, FAX: 201-379-5982; Empl.: 98

VIDCO, INC., 6175 S.W. 112th Ave., Beaverton, OR 97005, Tel: 503-641-1804, FAX: 503-641-1806; Empl.: 10; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, 10 Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613, FAX: 914-764-4613; Empl.: 5

VIDEO DISPLAY CORP., 1868 Tucker Industrial Dr., Tucker, GA 30084, Tel: 404-938-2080,800241-5005, FAX: 404-493-3903; Empl.: 300; *Sls. Mgr.:* Robert (Bob) Liss; *Dist. Mgr.:* Randy Russell

VIDEO MONITORS, INC., Dotronix, Inc., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785, TELEX: 510-100-1880, FAX: 715-834-5672; Empl.: 120; *Sls. Mgr.:* J. Jenson

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33716, Tel: 813-577-1216, FAX: 813-577-2082; *Sls. Mgr.:* Bill Strickland

VIKING ELECTRONICS, INC., 1531 Ind. St. PO Box 448, Hudson, WI 54016, Tel: 715-386-8861, FAX: 715-386-7423; Empl.: 40; *Sls. Mgr.:* Roy Crist

VIKING ELECTRONICS, INC., 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, FAX: 818-882-5713; FSC No.: 05574; Empl.: 150; *Sls. Mgr.:* William Vockerath; *Dist. Mgr.:* William Vockerath

VIKING INDUSTRIAL PRODUCTS, 729 Farm Rd., Marlboro, MA 01752, Tel: 508-481-4600, FAX: 508-481-4602; Empl.: 25; *Sls. Mgr.:* Aubrey Elms

VIRGINA PANEL CORPORATION, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, FAX: 703-942-2856; FSC No.: 18117; Empl.: 130; *Sls. Mgr.:* Norman D. Wood

FAX: 703-375-0135

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-375-0100; FSC No.: 59608; Empl.: 110; *Sls. Mgr.:* Barry D. Lee .... **C•1508-1509, 1814-1817**

Local Sales Offices & Reps

AL	Huntsville, Solutions, Inc.	205-539-3152
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Arcadia, H M C Inc.	818-447-0958
CA	San Diego, HMC, Inc.	619-484-8921
CA	Santa Clara, Penmark Sls. Co.	408-980-1303
CO	Denver, Lindberg Co.	303-758-9033
FL	Apopka, Dan-Tech Sls.	407-884-0252
FL	Clearwater, Dan-Tech Sls.	813-441-2609
FL	Davie, Dan-Tech Sls.	305-581-2884
GA	Marietta, Solutions, Inc.	404-951-5683
IL	Wheaton, CS Tech. Sls., Inc.	708-653-8126
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Norwood, MacInnis Co.	617-762-8090
MI	Livonia, Engrg. & Mktg. Svcs. Co.	313-522-9465
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MS	Meridian, Solutions, Inc.	601-482-4647
MO	Lake St. Louis, Markline Technlgs.	314-625-6222
NJ	Englewood, Sprung & Rea Inc.	201-569-5666
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Buffalo, Empire Tech.	716-381-8500
NY	Skaneateles, Empire Tech.	315-685-5703
NC	Raleigh, Solutions, Inc.	919-790-7606
OH	Rocky River, Oak Hill Mktg.	216-333-0000
OH	Westerville, Oak Hill Mktg.	614-890-5150
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Harrisburg, All-Tech. Mktg.	717-540-1204
PA	West Chester, All-Tech Mktg., Inc.	215-344-0134
KS	Overlook Pk., Markline Technlgs.	913-681-8880
TX	Austin, M-Rep	512-250-0828
TX	Dallas, M-Rep	214-484-5711
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Mountlake Terrace, SPS Elctrns.	206-323-4140
Can	Downsview, Ont., Tienkay, Inc.	416-736-1221
Can	Montreal, Que., XLR8 Inc.	514-481-6566

Local Distributors

CA	Canoga Park, Acort Inds.	818-700-2991
NH	Manchester, Yankee Elctrn. Supp. Co.	800-365-9720
Can	Downsview, Ont., P.S. Comps.	416-665-9546

VISHAY-MANN SYSTEM, See Vishay Resistive Systems

VISHAY RESISTORS, 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-5812; Empl.: 500; *Sls. Mgr.:* William Brennan ... **A•2041-2048, 2127**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, VEC	619-535-9080
CA	Tustin, VEC	714-544-7024
CO	Loveland, VEC	303-667-7500
GA	Atlanta, JWL Assocs.	404-518-8500
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IL	Skokie, IRI-Illinois	708-967-8430
IN	Indianapolis, Scott Elctrns.	317-841-0010
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Bloomington, IRI of Minnesota	612-854-8027
NJ	Flanders, K & R Engrg. Sls. Co.	201-584-5235
NY	Fairport, L-Mar Assocs.	716-425-9100
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OR	Beaverton, Uni Comp, Inc.	503-643-1645
PA	Horsham, TMI	215-441-4300
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Austin, BPA, Inc.	512-346-9186
TX	Richardson, BPA, Inc.	214-234-8438
WA	Snohomish, Uni Comp, Inc.	206-568-0511
WI	Brookfield, IRI-Wisconsin	414-789-9393
Can	Burnaby, B.C., Kaytronics, Inc.	604-294-2000
Can	Calgary, Alberta, Kaytronics	403-275-7000
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Mississauga, Ont., Kaytronics, Inc.	416-507-6400
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

Local Distributors

AZ	Scottsdale, Kent Elec./Shelley-Ragon	602-998-0399
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Chatsworth, Kent Elec./Shelley-Ragon	818-998-3333
CA	Chatsworth, Passive Comps. Inc.	818-700-8838
CA	Milpitas, Kent Elec./Shelley-Ragon	408-262-5300
CA	Mission Hill, TTI, Inc.	818-891-8885
CA	San Diego, Kent Elec./Shelley-Ragon	619-453-7133
CA	San Diego, TTI, Inc.	619-748-2025
CA	San Jose, Passive Comps.	408-441-1441
CA	Santa Ana, TTI, Inc.	714-641-9393
CA	Sunnyvale, TTI, Inc.	408-946-5577
CA	Torrance, Kent/Shelley-Ragon	310-321-2700
CO	Englewood, Kent Elec./Shelley-Ragon	303-762-0670
CO	Westminister, TTI, Inc.	303-429-6806
CT	Berlin, Kent Elec./Shelley-Ragon	203-829-2100
FL	Largo, Kent Elec./Shelley-Ragon	813-545-0057
FL	Orlando, TTI, Inc.	407-859-1000
FL	St. Petersburg, MMG Elec./L&S	813-521-2966
CT	Wallingford, TTI, Inc.	203-284-7474
GA	Norcross, TTI, Inc.	404-662-0911
IL	Elk Grove, Kent Elec./Shelley-Ragon	708-364-1300
IL	Schaumburg, TTI, Inc.	708-884-6500
IA	Cedar Rapids, Kent Elec./Shelley-Ragon	319-373-0525
KS	Overland, Kent Elec./Shelley-Ragon	816-254-3410
MD	Baltimore, RESCO/Baltimore	410-931-8200
MD	Beltsville, RESCO/Washington	301-937-9100
MA	Chelmsford, Kent Elec./Shelley-Ragon	508-250-9666
MA	Tewksbury, TTI, Inc.	508-851-2000
MN	Minnetonka, TTI, Inc.	612-933-8555
MN	St. Paul, Kent Elec./Shelley-Ragon	612-642-2828
MS	Columbia, TTI, Inc.	410-995-1331
MO	Hazlewood, Kent Elec./Shelley-Ragon	314-895-1515
MO	Independence, Kent Elec./Shelley-Ragon	816-254-3410
NJ	Denville, Kent Elec./Shelley-Ragon	201-625-5500
NJ	Mt. Laurel, TTI Inc.	609-234-6400
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Ronkonkoma, Mast Distrs., Inc.	516-471-4422
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Charlotte, TTI, Inc.	704-522-0277
SC	Charleston, L & S	803-720-4242
OH	Dayton, Micro Mil Div.	513-434-8231
OH	Dayton, TTI, Inc.	513-898-8330
OH	Independence, TTI, Inc.	216-328-9755
OR	Beaverton, Kent Elec./Shelley-Ragon	503-626-8300
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Austin, Kent Elec./Shelley-Ragon	512-834-1900
TX	Fort Worth, TTI, Inc.	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-740-9000
TX	Houston, Kent Elec./Shelley-Ragon	713-780-7770
TX	Houston, Texas Comp. Corp.	713-468-3882
TX	Houston, TTI, Inc.	713-879-5800
TX	Richardson, Kent Elec./Shelley-Ragon	214-669-2600
WA	Redmond, Kent Elec./Shelley-Ragon	206-883-7200
WA	Redmond, TTI, Inc.	206-882-0291
Can	Burnaby, B.C., Kaytronics	604-294-2000
Can	Kanata, Ont., Kaytronics	613-564-0080
Can	Mississauga, Ont., Kaytronics	416-507-6400
Can	Que., Kaytronics, Inc.	514-745-5800

VISIONARY ELECTRONICS, 141 Parker Avenue, San Francisco, CA 94118, Tel: 415-751-8811

VISION ENGINEERING, INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, FAX: 203-355-0712; Empl.: 15; *Sls. Mgr.:* Richard Jones

VISION ENGINEERING LABORATORIES, Amglo Kemlite Laboratories Inc., 8787 Enterprise Blvd., Largo, FL 34643, Tel: 813-539-0448, FAX: 813-539-8535

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Local Sales Offices & Reps

CT	Litchfield, Intrade	203-567-5901

Local Distributors

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FL	Ft. Lauderdale, Component Distrs.	813-796-0466
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GA	Norcross, Component Dist. Inc.	404-441-3320
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VITEC ELECTRONICS CORP., 8530 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1535, FAX: 209-651-1538; *Sls. Mgr.:* Ed Green

VITEC, INC., 236000 Mercantile Rd., Cleveland, OH 44122, Tel: 1-800-321-6384, FAX: 216-464-5324; Empl.: 300; *Dist. Mgr.:* Ernie Hopp

VITEQ CORP., 1000 Aerospace Rd., Lanham, MD 20706, Tel: 301-731-0400, F^X: 301-731-5995; Empl.: 120; *Sls. Mgr.:* Edward Bone

VITREK CORPORATION, 7576 Trade Street, San Diego, CA 92121, Tel: 619-586-1695, FAX: 619-586-0802; Empl.: 42; *Sls. Mgr.:* Kevin Clark ... **D•1333**

VIZ METEOROLOGICAL INSTRUMENTS, 335 E. Price St., Philadelphia, PA 19144-5782, Tel: 215-844-2626, TWX: 710-670-2626; FSC No.: 41226; Empl.: 325; *Sls. Mgr.:* Tom Curran; *Dist. Mgr.:* Tom Curran

VL ELECTRONICS, INC., 3250 Wilshire Blvd., Ste. 1301, Los Angeles, CA 90010-1603, Tel: 213-738-8700, FAX: 213-738-5340; FSC No.: 95-3896380; Empl.: 10; *Sls. Mgr.:* C. Kreslake; *Dist. Mgr.:* C. Kreslake ... **B•1127**

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CA	San Diego, Varitronix	213-738-8700
CO	Denver, MRC	303-660-8750
DC	D.C./Baltimore, Eastern Elctrns.	919-876-7591
GA	Norcross, Giesting & Assocs.	404-242-9320
IL	Des Plaines, ESCO Assocs.	708-298-5310
IN	Indianapolis, J. C. Hofstetter Co.	317-897-7914
IA	Marion, A.E.M. Assocs.	319-377-1129
KS	Olathe, A.E.M. Assocs.	913-888-0022
MA	Canton, New England Elctrn. Sls.	617-828-4835
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TX	Dallas, Altech	214-418-0850
MN	St. Paul, Proud Inds.	612-646-9428
WI	Colgate, Rep One	414-628-4016
WI	Madison, Rep 1 & Assocs.	608-835-7365
Can	Toronto, Ont., Norgay Entprs., Ltd.	416-234-8966
Can	Vancouver, Norgay Ltd.	604-275-1121

Local Distributors

CA	Los Angeles, VL Elctrns Inc.	213-738-8700
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NC	Raleigh, Eastern Elctrns.	919-876-7591

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VME MICROSYSTEMS INTL. CORP., 12090 South Memorial Pkwy., Huntsville, AL 35803-3308, Tel: 205-880-0444, FAX: 205-882-0859; FSC No.: OBPH5; Empl.: 137; *Sls. Mgr.:* Al Casteleyn

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VOICE CONNEXION, 17835 Skypark Circle, Ste. C, Irvine, CA 92714, Tel: 714-261-2366, FAX: 714-261-8563; *Sls. Mgr.:* Shirley Dworak

VOICE IDENTIFICATION, Box 714, Somerville, NJ 08876, Tel: 908-526-3408, FAX: 908-526-5714; Empl.: 7

VOICE PROCESSING CORP., 1 Main St., Cambridge, MA 02142, Tel: 617-494-0100, FAX: 617-494-4970; Empl.: 19

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NY	Eastchester, WD. Sls.	914-779-8840
NY	Rochester, Micro-Tech. Mktg.	716-426-0806
NC	Raleigh, Tingen Tech. Sls.	919-870-6670
OH	Westlake, KRW Sls.	216-871-7521
OR	Portland, Power Factor Assocs.	503-657-6969
PA	Harleysville, Thomas Jackson Assocs.	215-256-8877
TX	Dallas, AID Elctrns.	214-790-4781
Can	Mississauga, Ont., BBD Elctrns.	416-821-7800

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CA	Milpitas, Compumech Elctrns.	408-945-9100
FL	Ft. Lauderdale, Panamtech	305-792-7220
GA	Norcross, Satori Elctrns.	404-242-0606
IL	Chicago, Dalec Distrs.	312-283-0300
IL	Roselle, Foresight Elctrns.	708-980-2155
MA	Burlington, Atlantic Comps.	617-270-0051
MI	Livonia, LWC Distrs.	313-464-7700
WA	Seattle, Westlake Elctrns. Supp.	206-622-6600
Can	Mississauga, Ont., bbd Elctrns.	416-821-7800

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VOLTAGE MULTIPLIERS, INC., 8711 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1402, TELEX: 530484, FAX: 209-651-0740; FSC No.: 60211; Empl.: 85; *Sls. Mgr.:* Karen Spano

VOLTARC TECHNOLOGIES, INC., 186 Linwood Ave., P.O. Box 688, Fairfield, CT 06430, Tel: 203-255-2633, TELEX: 96-4337, FAX: 203-259-1194; Empl.: 500; *Sls. Mgr.:* Gino J. Ciancanelli

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FAX: 508-879-8669

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CA	Santa Clara, Electro Venture-North	408-727-1553
FL	Melbourne, Saber Assocs., Inc.	800-327-0853
GA	Lawrenceville, Saber Assocs., Inc.	800-327-0853
IL	Arlington Hgts., Berndt Assoc., Inc.	708-632-0900
IN	Carmel, Berndt Assoc., Inc.	317-844-0114
MI	Plymouth, E Q S Sys.	313-455-7920
NH	Nashua, Intersell	603-880-6500
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NY	Fayetteville, M.P. Andrews Mfg's. Rep.	315-637-5291
NY	Wantagh, Bytec	516-781-7400
NC	Clayton, Saber Assocs.,Inc.	800-327-0853
OH	Chesterland, E Q S Sys.	216-729-2222
OH	Dayton, E Q S Sys.	513-236-7676
MN	Minneapolis, Berndt Assoc., Inc.	612-546-2021
OR	Portland, Power Factor & Assoc.	503-233-6969
PA	Huntington Valley, Sci Rep, Inc.	215-322-6500
PA	Wexford, E Q S Sys.	412-935-0678
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-546-9570
VA	Fairfax, SCI Rep, Inc.	703-385-0600
WA	Seattle, Datacom	206-285-2525
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CA	Santa Clara, W-J Elctrns. Sls.	408-982-9222

VOLTRONICS CORPORATION, 100-10 Ford Rd., Denville, NJ 07834, Tel: 201-586-8585, FAX: 201-586-3404; FSC No.: 18736;Multiple; Empl.: 70; *Sls. Mgr.:* Nicholas J. Perrella

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IL	Chicago, CSJ Inc.	708-559-0660
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Columbia, M. Lader Co.	800-442-3177
NY	Hartsdale, Spectrum Sls. Inc.	914-472-8600
PA	Camphill, Quick Response Tech. Sls.	215-362-9225
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TX	Ft. Worth, Diversified Comps.	817-244-7704

VU-DATA CORPORATION, 9180 Brown Deer Rd., San Diego, CA 92121, Tel: 619-452-7670, FAX: 619-452-2543; FSC No.: 34160; Empl.: 20; *Sls. Mgr.:* M. Knapp

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WABASH MAGNETICS, CONTROL PRODS. GRP., First & Webster Streets, Wabash, IN 46992, Tel: 219-563-2191, FAX: 219-563-1652; Empl.: 250; *Sls. Mgr.:* Stanley P. Bickhart

WAGO CORP., 9085 N. Deerbrook Trail, Brown Deer, WI 53223, Tel: 414-354-5511, FAX: 414-354-1268; FSC No.: 65996; *Sls. Mgr.:* Thomas J. Artmann

WALDMANN LIGHTING CO., 9 W. Century Dr., Wheeling, IL 60090, Tel: 708-520-1060, 800-634-0007, FAX: 708-520-1730; *Sls. Mgr.:* Gary Cardoza

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Local Sales Offices & Reps

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CA	Santa Barbara, Abbeon Cal, Inc.	805-966-0810
CT	Westport, A.J. Abrams Co.	203-226-3010
IL	Chicago, McMaster Carr Supp. Co.	312-834-9600
MA	Gardner, MR Resources	508-632-7000
MD	Baltimore, Davis Instrs.	301-243-4301
NY	Rochester, Transcat	716-458-4801
TX	Garland, Tucker Elctrns.	214-348-8800

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IL	Chicago, McMaster Carr Supp. Co.	312-834-9600
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TX	Garland, Tucker Elctrns.	214-348-8800
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WALL INDUSTRIES, 5 Watson Brook Rd., Exeter, NH 03833, Tel: 603-778-2300, FAX: 603-778-9797; Empl.: 50

WALL LENK CORPORATION, Box 3349, Kinston, NC 28502-3349, Tel: 919-527-4186, FAX: 919-527-4189; FSC No.: 79165; Empl.: 60; *Sls. Mgr.:* William Goettche

WALTHER ELECTRIC CORPORATION, WALTHER WERKE, Ferdinand Walther, 10 Alvin Ct, E. Brunswick, NJ 08816, Tel: 908-238-1166, FAX: 908-238-0764; Empl.: 220; *Sls. Mgr.:* Craig J. Nimick

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Local Sales Offices & Reps

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IN	Kokomo, (SAI)Schillinger Assoc. Inc.	317-455-2708
MI	Southfield, Turner Assocs.	313-353-7660
NY	Bayshore, Richard McGrath Inc.	516-968-8448
WA	Seattle, Repwest	206-283-8351

WANDEL & GOLTERMANN INC., 2200 Gateway Centre Bvld., Morrisville, NC 27560-9228, Tel: 919-460-3300, FAX: 919-481-4372; Empl.: 40; *Sls. Mgr.:* Calvin Church

WARREN G-V, General Signal Corp., 1 Apollo Drive, Whippany, NJ 07981, Tel: 201-386-1200, FAX: 201-386-9331; FSC No.: 93929; Empl.: 140; *Sls. Mgr.:* William J. Vandertulip; *Dist. Mgr.:* William J. Vandertulip ... **B•1908**

Local Sales Offices & Reps

AZ	Phoenix, Dorton Entprs. Inc.	602-944-2957
CA	Brea, Masco Inc.	714-529-0866
CA	Saratoga, Testco	408-253-1900
CO	Golden, James Hurlburt Co.	303-279-7796
IL	S. Elgin, R.K. Elctrns.	708-695-8552
KS	Lenexa, Midtech Inc.	913-541-0505
MA	Norwood, Comp. Mktg. Svcs.	617-762-4339
MN	Eden Praire, PWC Inc.	612-934-1409
NY	Hauppauge, Sticom	516-366-4221
NY	Rochester, Lamb Comps. Inc.	716-328-6350
PA	Hatboro, AQS Inc.	215-674-3562
TX	Carrollton, Seaton Corp.	214-980-9860

WARREN-KNIGHT INSTRUMENT CO., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WATERS INSTRUMENTS INC., 2411 7th St. N.W., Rochester, MN 55903, Tel: 507-252-3700, FAX: 507-288-7218; Empl.: 135; *Sls. Mgr.:* Peter D. Kozachok

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AZ	Paradise Valley, Techrep-Don Epand	602-443-8288
CA	Alameda, Liaison, Inc.	501-769-1991
CA	Lomita, Techrep	310-539-9070
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
FL	Melbourne, R-Rep Co.	407-242-9800
IL	Palatine, Vine Sls., Inc.	708-934-5476
KS	Overland Park, Acorn Elctrns.	913-649-6402
MA	Lowell, Underwood Sls. Corp.	508-256-8191
MO	St. Louis, Acorn Electronics	314-421-1751
OH	Dayton, INH Comp. Sls.	513-434-8808
PA	Blairsville, Meas. Instrs. East	412-459-8092
PA	Newtown, Indl. Sls. Assoc.	215-860-2076
TX	Dallas, Allied Comps.	214-238-0408
TX	Dallas, Circom, Inc.	214-690-0400

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, TELEX: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 2600

WAVETEK CORP., 9145 Balboa Ave., San Diego, CA 92123, Tel: 619-279-2200, FAX: 619-450-0325; Empl.: 260; *Sls. Mgr.:* Joe Gomula; *Dist. Mgr.:* Michael Latham

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WAVETEK COMMUNICATIONS DIV., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203-6109, Tel: 317-788-9351, ESYLNK: 317-782-4607; FSC No.: 34280; Empl.: 303; *Sls. Mgr.:* Gary Culbertson; *Dist. Mgr.:* Ben Constantini

For Sls. Ofcs. & Reps. 9145 Balboa Ave, San Diego, CA 92123

WAVETEK INSTRUMENTS DIVISION, Wavetek Corp., 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-279-2200, FAX: 619-565-9558; *Sls. Mgr.:* Joe Gomula

WAYNE KERR INC., Farnell Electronics plc, 11 Sixth Rd., Woburn, MA 01801, Tel: 617-938-8390, 1-800-933-9319, FAX: 617-933-9523; Empl.: 7; *Sls. Mgr.:* Ken Harrison

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WEARNES HOLLINGSWORTH, Electrical Products Division, 1601 N. Powerline Rd., Pompano Bch., FL 33069, Tel: 305-979-2050, FAX: 305-960-1431; Empl.: 117; *Sls. Mgr.:* Jack Kelly

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Local Sales Offices & Reps

AZ	Hartland Sls.	602-492-0012
CA	Lighthorse Technlgs.	619-270-7399
CA	Signal Entprs.	818-957-0640
CA	Trademark Assocs.	408-997-1216
CO	Donohue Sls. Co.	303-455-1719
CT	C.W. Assocs.	203-656-2339
FL	EAB, Inc.	407-339-4986
GA	EAB, Inc.	404-975-3660
IL	Production Comps.	312-774-3434
MI	Urban Assocs.	616-245-0511
MN	Engr. Prods.	612-835-9022
MO	M.I.N.K. Assocs.	314-291-5454
NH	Bell Controls	603-882-6984
NY	L-Tron	716-383-0050
NY	Sticom Sls. & Mktg.	516-366-4221
OH	R.K. Comp. Sls.	216-642-9312
OR	Controltek	503-641-0876
PA	Freedman-Malta Assocs.	215-337-9211
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Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean Inc.	205-830-1540
AZ	Mesa, Hartland Sls. Inc.	602-834-7042
CA	Newport Bch., SPA Inc.	714-863-1193
CA	San Diego, SPA Inc.	619-530-0209
CA	San Jose, Silicon Valley Sls.	408-432-1967
CO	Boulder, Stratford Grp.	303-530-3194
FL	Apopka, Cartwright & Bean Inc.	407-889-9100
FL	Deerfield, Cartwright & Bean Inc.	305-429-3400
GA	Norcross, Cartwright & Bean Inc.	404-368-0160
IL	Palatine, Key Entprs. Inc.	708-991-2144
IN	Indianapolis, MEI (Mktg. Engrs.)	317-872-5665
IA	Davenport, Rush & West Assocs. Inc.	319-388-9494
KS	Olathe, Rush & West Assocs.,Inc.	913-764-2700
KY	Lexington, Mktg. Engrs. Inc.	606-275-4103
LA	Covington, Cartwright & Bean Inc.	504-892-1700
MD	Randalls Town, Chesapeake Indl. Mktg.	410-653-0476
MA	Scituate, Olsen Tech Sls. Inc.	617-545-5101
MI	Farmington, Marlow Assocs. Inc.	313-478-2240
MI	Novi, Marlow Assocs., Inc.	313-348-5791
MN	Eden Prairie, PWC Inc.	612-934-1409
MS	Jackson, Cartwright & Bean Inc.	601-981-1170
MO	St. Louis, Rush & West Assocs.,Inc.	314-965-3322
NH	Nashua, Olsen Tech. Sls. Inc.	603-888-3619
NJ	Woodbridge, Riser Sls.Inc.	908-634-0954
NY	Buffalo, NRM Mktg. Inc.	716-634-4300
NY	Skaneateles, NRM Mktg. Inc.	315-685-8991
NY	Spencerport, NRM Mktg. Inc.	716-352-9166
NC	Charlotte, Cartwright & Bean Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean Inc.	919-876-4130
OH	Dayton, Marlow Assocs., Inc.	513-274-9666
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Allison Pk., Marlow Assocs., Inc.	412-487-0664
PA	Spring Grove, Select Sls. Assocs.	717-229-2977
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TN	Knoxville, Cartwright & Bean Inc.	605-693-7450
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TX	Dallas, Electra Reps. Inc.	214-248-3852
TX	Houston, Aid Elctrns., Inc.	713-575-7959
WA	Snohomish, SPS Elctrns.	206-323-4140
WI	Milwaukee, Key Entprs. Inc.	414-762-2323

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AZ	Phoenix, Beswitched	602-275-4805
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AZ	Tempe, Control Design Supp. Inc.	602-829-7981
AR	N. Little Rock, Control Design Supp. Inc.	501-851-3137
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CA	Brea, Interconnect Specialties Inc.	714-961-7955
CA	Fountain Valley, Comp. Ctr.	714-979-0433
CA	Fremont, Connex Elctrns. Corp.	510-656-7722
CA	San Carlos, Control Design Supp. Inc.	415-592-4806
CA	San Diego, Control Design Supp.	619-457-9822
CA	San Diego, DECO ELctrns.Inc.	619-693-1595
CA	Santa Ana, BDS Elctrns. Inc.	714-662-1050
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CT	Yalesville, Glynn Elctrns.	203-265-2498
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FL	Largo, Electronic Precepts of FL Inc.	813-544-3636
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FL	Sanford, Control Design Supp. Inc.	407-328-8011
GA	Fayetteville, Frankland Inc.	404-461-4026
GA	Stone Mtn., Control Design Supp. Inc.	404-979-3500
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Can	Nepean, Ont., Weiss Co.	613-225-1810
Can	Transcona,Man., Deskin Sls.	204-224-1321
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Local Distributors

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Can	Dorval, Que., Elkon	514-636-0510
Can	Drummondville, Que., Marnel Intl., Inc.	819-478-3128
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Can	Mississauga, Ont., Rush Elctrns. Ltd.	416-677-7280
Can	Mississauga, Ont., Sayal Elctrns.	416-238-8640
Can	Montreal, Que., Cite Electronique	514-526-9184
Can	Montreal, Que., Crobel Electronique Ltee	514-493-8818
Can	Montreal, Que., D.T. Shaw Co. Ltd.	514-332-1163
Can	Montreal, Que., Versatech Elctrns. Inc.	514-335-3833
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Can	Oakville, Ont., Cantwell Cullen & Co.	416-842-8470
Can	Point Viau Laval, Que., Montcalm Electronique	514-663-3102
Can	Quebec, Que., Pro Technique Que. Inc.	418-529-5774
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Can	St. Laurent, Que., Access-O-Tronik	514-335-6000
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Can	St. Laurent, Que., Ferrotronics Components Inc.	514-333-7288
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Can	Ste. Foy, Que., Crobel Electronique Ltee	418-687-1171
Can	Stittsville, Ont., Carsten Elctrns. Ltd.	613-831-1620
Can	Transcona, Man., Deskin Sls.	204-224-1321
Can	Vancouver,B.C., Deskin Sls.	604-324-8343
Can	Winnipeg, Man., WES Elctrns. Ltd.	204-632-1260

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VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
Can	Ottawa, Ont., Gigatron	613-225-4090

WERLATONE, INC., P. O. Box 47, Rte. 22, Brewster, NY 10509, Tel: 914-279-6187, FAX: 914-279-7404; FSC No.: 28812; Empl.: 13; *Sls. Mgr.:* G. Werlau

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AZ	Kachina Controls	602-886-4984
CA	Northern CA, Seco Controls	510-798-8300
CA	Southern CA, RDX Corp.	714-599-0985
CO	Anderson Controls	303-692-0290
FL	Datarep Inc.	407-843-5224
IL	Ray Knitter Assoc.	708-690-6363
IN	IN North, Jack Margis Assoc.	219-374-5905
IN	IN South, Ray Knitter Assoc.	317-862-2788
IA	Simone Engrg.	319-364-2378
LA	Weschler	216-238-2550
MA	Eastern Systems	508-435-2151
MI	G&D Assoc.	313-684-5233
MN	Waltam Sales	612-781-2778
MO	Controls Midwest	816-842-4290
NE	Simone Engrg.	402-592-0098
NV	Vegas, Kachina Ctrls.	702-791-5666
NJ	RJM Sales	908-322-7880
NM	Kachina Controls	505-345-1045
NY	NY, Eastern Sys.	508-435-2151
NC	J.H. Instruments	704-889-5600
OH	OH (North), Advanced Technlg.	216-835-5050
OH	OH (South), CKM Indl.	513-871-1413
OK	Wallace & Schoeffler	918-742-5331
OR	McLaren Inc.	503-627-0757
PA	PA (East), RJM Sales	215-643-6610
TX	Wilsher Co.	713-683-6826
UT	Anderson Controls	801-566-5864
VA	Martin Control Equip.	804-321-7143
WA	McLaren Inc.	206-827-9400

WV	Cavcon Sys., Inc.	304-342-0385
WI	WI (East), Ray Knitter Assoc.	414-544-1976

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FL	Maitland, EIR, Inc.	305-660-9600
IN	Indianapolis, John H. Weaver Co.	317-257-7661
MA	Framingham, Bengal Assocs.	617-877-2639
MA	Randolph, Bengal Assocs.	617-961-4120
MI	Madison Hgts., DEM Sls., Inc.	313-583-1500
MN	Minneapolis, Furber Sls. Co.	612-881-3620
NY	Shirley, Tri-Tek Mktg.	516-395-3391
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Willoughby Hills, Versatron	216-944-0082
PA	Montgomeryville, Quick Response Tech Sls.	215-362-9225
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NY	Jericho, B & D Assocs.	516-937-3593
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TX	El Paso, Alexander Entprs.	915-591-3142
TX	Rowlett, Campion Sls. Co., Inc.	214-475-8313

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IL	Arlington Hgts., Comtel Midwest	312-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
MA	Andover, Western Graphtec	508-470-1806
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Milford, T.M.S.	313-360-1514
MN	Wayzata, Comtel Midwest	612-476-1551
MO	St. Peters, Western Graphtec	314-279-3915
NM	Albuquerque, Vic Myers Assocs.	505-294-1791
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NY	Kings Pk., K.L.S.	516-724-3155
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WESTREX PRODUCTS, 25 Denby Rd., Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 200; *Sls. Mgr.:* Joe Grimaldi

WESTRONICS INC. OF TEXAS, A Baker Hughes Co., 5001 Blue Mound Rd., Box 961003, Ft. Worth, TX 76161, Tel: 817-625-2311, FAX: 817-625-1068; Empl.: 130; *Sls. Mgr.:* Jim Bittikoffer

WESTVACO-STATIC CONTROL, 311 Industry Ave., P.O. Box 1675, Springfield, MA 01101-1675, Tel: 413-787-9783, FAX: 413-787-9626; *Sls. Mgr.:* Arthur Semle

WHEELOCK, INC., 273 Branchport Ave., Long Branch, NJ 07740, Tel: 908-222-6880, FAX: 908-222-8707; Empl.: 200; *Sls. Mgr.:* William L. Goldstein, Sls./Mktg. VP

WHITE-RODGERS LOGANSPORT DIV., See Stancor/ White Rodgers

S.S WHITE TECHNOLOGIES INC., 151 Old New Brunswick Rd, Piscataway, NJ 08854-3761, Tel: 908-752-8300, FAX: 908-752-3750; FSC No.: 0KZS2; Empl.: 100; *Sls. Mgr.:* Craig Griffin; *Dist. Mgr.:* Pam Barnhard

WHITE TECHNOLOGY, INC., Bowmar Instrument Corp., 4246 E. Wood St., Phoenix, AZ 85040, Tel: 602-437-1520, FAX: 602-437-9120; FSC No.: 54230; Empl.: 93; *Sls. Mgr.:* Steve McComb, Bob Faris

WHITMOR WIRE & CABLE CORP., 27737 Ave. Hopkins, Valencia, CA 91355, Tel: 805-257-2400, FAX: 805-257-2495; FSC No.: 15851; Empl.: 29; *Sls. Mgr.:* Mark Lee; *Dist. Mgr.:* Mark Lee

W A mark of safety

Wickmann USA, Inc.

FAX: 404-699-9176

WICKMANN USA, INC., 4100 Shirley Drive, Atlanta, GA 30336, Tel: 404-699-7820; Empl.: 600-650; *Sls. Mgr.:* Michael V. Nagle; *Dist. Mgr.:* Joyce Bullard .... **B•1394-1398**

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
GA	Atlanta, JWL Assoc.	404-518-8500
IL	Crystal Lake, Golbeck Milota Assoc.	815-459-0504
IN	Indianapolis, J.C. Hofstetter Co.	317-897-7914
MD	Baltimore, Muncy Sls. Assocs.	410-484-6376
MA	Needham Hgts., Rosen & Assocs.	617-449-4700
MI	Grand Rapids, R.P.Urban & Assocs.	616-245-0511
MN	Minneapolis, RK Sls.	612-571-1001
NJ	Monmouth Junction, S.E.A. Co., Inc.	908-821-4100
NC	Charlotte, JWL Assoc.	704-541-5750
OH	Medina, J.C. Hofstetter Co.	216-725-4477
OR	Beaverton, Temper Tech. Mktg.	503-292-8201
TX	Dallas, Rem Comps.	214-234-1069

Local Distributors

CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Van Nuys, Fuses Unlimited	818-786-8111
CA	Yorba Linda, Target Elctrns.	714-692-1630
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
IL	Crystal Lake, Right Distrs.	815-459-0645
MA	Sharon, Adcour Inc.	617-784-8123
MN	Roseville, Parts 1	612-633-8079
NJ	Orange, Actionfuse Co.	800-232-3873
OH	Cincinnati, Schuster Elctrns.	800-521-1358
OH	Twinsburg, Schuster Elctrns.	216-425-8134
OR	Beaverton, Comp. Resources Inc.	800-537-5494
TX	Dallas, Fuses Unltd.	214-907-8600
TX	Tomball, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Intermountain Fuse	801-265-8333
WA	Kent, Comp. Resources Inc.	800-547-6523
WI	Milwaukee, Progressive Image, Inc.	800-686-7764
Can	Downsview, Ont., PS Comps., Inc.	416-665-9546

WIDE BAND ENGINEERING CO., INC., Box 21652, Phoenix, AZ 85036, Tel: 602-254-1570, FAX: 602-254-1570; FSC No.: 58907; Empl.: 10

WIDE RANGE ELCTRNS. CORP., 174 Chesterfield Indl. Blvd., Chesterfield, Missouri 63005, Tel: 314-532-5887, FAX: 314-532-5492; Empl.: 11; *Sls. Mgr.:* Donald Toone

WIELAND INC., 49 International Rd., Burgaw, NC 28425, Tel: 919-259-5050, FAX: 919-259-3691; FSC No.: 06229; Empl.: 100; *Sls. Mgr.:* Carl Gruenberg, V.P. Sls. & Mktg.; *Dist. Mgr.:* Steve Vineis

WIKO, LTD., 10490 West 164th Place, Orlando Park, IL 60462, Tel: 1-800-323-1107, FAX: 1-800-241-9928; Empl.: 40; *Sls. Mgr.:* Jerry Francis

WILBRECHT ELECTRONICS, 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791, FAX: 612-222-7639; Empl.: 150; *Sls. Mgr.:* R. Vermilyea

WILCO

FAX: 317-293-9462

WILCO CORP., 6451 Saguaro Court, Indianapolis, IN 46268, Tel: 317-293-9300 ... **A•1309-1313, 2604-2605**

Local Sales Offices & Reps

IL	Arlington Heights, M.B. Sls.	708-392-9499

WILCO WIRE & CABLE CO., INC., 1921 Las Plumas Ave., San Jose, CA 95133, Tel: 408-926-8880, FAX: 408-251-0508; Empl.: 52; *Sls. Mgr.:* Joe Shepherd; *Dist. Mgr.:* Sylvia Neal

WILCOXON RESEARCH, INC., 21 Firstfield Rd., Gaithersburg, MD 20878, Tel: 301-330-8811, FAX: 301-330-8873 .... **B•2025**

WILKERSON INSTRUMENT COMPANY INC., 2915 Parkway St, Lakeland, FL 33811, Tel: 813-646-3909, FAX: 813-644-5318; Empl.: 56; *Sls. Mgr.:* Julie Unger

WILKINSON, P.O. Box 4558, Westlake Village, CA 91359, Tel: 818-889-0050, 800-822-4653, FAX: 818-889-3810; Empl.: 28; *Sls. Mgr.:* R. Cook; *Dist. Mgr.:* R. Cook

W.L. WILLIAMSON & ASSOC., LTD., 528 S. Extension Rd., Mesa, AZ 85210, Tel: 602-833-5202, FAX: 602-833-5529; Empl.: 3

WILLIAMSON CORPORATION, 70 Domino Dr., Concord, MA 01742, Tel: 508-369-9607, FAX: 508-369-5485; FSC No.: 92-3343 WILIAMSON WCRD; Empl.: 25; *Sls. Mgr.:* William R. Barron

WILMAR ELECTRONICS, INC., 2430 Amsler St., Torrance, CA 90505, Tel: 310-326-6668, FAX: 310-326-9147; FSC No.: 25248; Empl.: 25; *Sls. Mgr.:* Zev Heifetz

Local Sales Offices & Reps

CA Emeryville, Davis Gregory & Doll 415-428-9103
CA - Fountain Valley, J.S.B. Engrg. 714-546-5402
GA Atlanta, Sls. of Georgia, Inc. 404-875-7726
NJ Flanders, Guido Assocs. 201-347-4643

WILMORE ELECTRONICS CO., INC., Box 1329, Hillsborough, NC 27278, Tel: 919-732-9351, TELEX: 292617, FAX: 919-732-9359; Empl.: 48; *Sls. Mgr.:* J. L. Harris .... **D•2041, 2218-2220, 2306-2307**

WILSON COMPANY-SYSTEMS DIVISION, 16301 Addison Road, Dallas, TX 75248, Tel: 214-931-8666, 800-580-1212, FAX: 214-248-1177; Empl.: 65; *Sls. Mgr.:* Jerry Herrin; *Dist. Mgr.:* Jerry Herrin

WILSON, H. F., ENGINEERING CO., 475 Taft Ave., Glen Ellyn, IL 60137, Tel: 708-469-7473, FAX: 708-469-8663; Empl.: 21; *Sls. Mgr.:* Robert W. Carroll; *Dist. Mgr.:* Howard Wilson

WILTRON, 490 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-778-2000, TELEX: 285227 WILTRON MH, FAX: 408-778-0239; FSC No.: 20944; Empl.: 800

THE WINATIC CORP., Electro-Technik Industries, Inc., 409 Commerce Rd., Vestal, NY 13850, Tel: 607-729-6318, FAX: 607-729-6446; Empl.: 125; *Sls. Mgr.:* Ted Zaparzynski

WINEGARD CO., 3000 Kirkwood St., Burlington, IA 52601-2000, Tel: 319-754-0600, FAX: 319-754-0787; Empl.: 300; *Sls. Mgr.:* James Riffel, Sls. Dir.

WINSYSTEMS, INC., 715 Stadium Dr., Arlington, TX 76011, Tel: 817-274-7553, FAX: 817-548-1358; FSC No.: 1AU87

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-448-1903, 800-742-6809, FAX: 317-448-4823; Empl.: 10 .... **D•1146**

WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021-2824, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 22

WIRE GRAPHICS, INC., 95 Sherwood Ave., Farmingdale, NY 11735, Tel: 516-293-1525, FAX: 516-293-1607; Empl.: 23; *Sls. Mgr.:* Nat Stettin

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, FAX: 203-232-2062; Empl.: 900; *Sls. Mgr.:* Scott Bartosch

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; FSC No.: FSCN 50738; Empl.: 225; *Sls. Mgr.:* Russell Morgan, Sls. & Svc. Mgr.; *Dist. Mgr.:* Phil Negrin, Mktg. Mgr.

WOLFRAM RESEARCH, INC., 100 Trade Center Drive, Champaign, IL 61820-7237, Tel: 217-398-0700, FAX: 217-398-0747; Empl.: 1000; *Sls. Mgr.:* Zoe Miolier; *Dist. Mgr.:* Roy Chumko

WONDERWARE, 16 Technology, Ste 154, Irvine, CA 92718, Tel: 714-727-3200; Empl.: 45; *Sls. Mgr.:* Jerry Brooks; *Dist. Mgr.:* Rick Mellor

WONTRONICS, 3048 N. Coolidge Ave., Los Angeles, CA 90039, Tel: 213-660-6230, FAX: 213-913-2299; *Sls. Mgr.:* Frank Phillips

WORLD PRODUCTS INC., 19654 8th St. East, Sonoma, CA 95476, Tel: 707-996-5201, TELEX: Worldpro snom 171715, FAX: 707-996-3380; FSC No.: 410966309; Empl.: 445; *Sls. Mgr.:* Mark Beynon .. **A•1177, 2050-2051, 2224-2225; B•1128-1129, 1399**

Local Sales Offices & Reps

AZ Scottsdale, American Mktg. 602-948-2778, FAX:602-860-4455
AZ Tempe, Spectrum Assocs., Inc. 602-966-1788, FAX:602-966-1726
CA Anaheim (North), Jay Mktg. Assocs. 714-768-7519, FAX:714-581-1211
CA Anaheim (South), Jay Mktg. Assocs. ... 714-974-7182, FAX:714-283-2915
CA Fullerton, Jay Mktg. Assocs. 714-870-9573, FAX:714-870-1448
CA Mission Viejo, Jay Mktg. Assocs. 714-768-7519, FAX:714-581-1211
CA Mt. View, Straube Assocs. Inc. 415-969-6060, FAX:415-964-6526
CA Newport Bch. (NEC only), S.P.A. Elctrn. Sls. 714-863-1193,FAX:714-863-1250
CA Northridge, Jay Mktg. Assocs. 818-363-6308, FAX:818-363-6790
CA San Jose (NEC only), Signet Tech. Sls. 408-453-0611,FAX:408-453-0633
CO Englewood, Purdy Co. Assocs. 303-790-2211, FAX:303-790-2230
CT Bloomfield, Zaslow Sls. Co., Inc. 203-242-7781, FAX:203-243-9442
FL Boca Raton, Aurora-Schmitt Assocs. 407-392-9497,FAX:407-392-9497
FL Orlando, Aurora-Schmitt Assocs. 407-297-6039, FAX:407-297-6039
GA Alpharetta, Pinnacle Mktg. 404-410-9980, FAX:404-410-9980
IL Arlington Hgts., Davix Intl. Ltd. 708-259-5300, FAX:708-259-5428
IN Indianapolis, Elctrn. Sls. & Engrg. 317-849-4260, FAX:317-841-0231
IA Marion, Associated Elctrn. Mktg., Inc. 319-377-1129,FAX:319-377-1539
MD Towson, Arbotek Assocs., Inc. 410-825-0775, FAX:410-337-2781
MI Livonia, Lowell-Wendt Mktg. Co. 313-464-2722, FAX:313-464-3123
MN Minneapolis, Tecteam Sls. Inc. 612-854-6616, FAX:612-854-8031
MO St. Louis, AEM, Inc. 314-298-9900, FAX:314-298-8660
NJ Marlton, BGR Assocs. 609-983-1020, FAX:609-983-1879
NM Albuquerque, Syntech 505-266-7951, FAX:505-292-4411
NY Hauppauge, Aurora-Schmitt Assocs. 516-434-1313,FAX:516-434-1572
NY New Hartford, Franklin Sls. 315-793-3161, FAX:315-793-3139
NY Pittsford, Franklin Sls. 716-248-8251, FAX:716-248-3866
NC Raleigh, Pinnacle Mktg. 919-848-0404, FAX:919-848-0101
NC Wilmington, Pinnacle Mktg. 919-686-4696, FAX:919-686-4697
OH Dayton, Baehr Greenleaf & Assocs. (BGA) 513-439-0724,FAX:513-439-0387
OH Dayton, John Stephenson & Assoc. 513-435-0745, FAX:513-435-7902
OH Westlake, Baehr Greenleaf & Assoc. 216-892-1770,FAX:216-892-1771
OR Beaverton, Luscombe Engrg. 503-636-6664, FAX:503-697-7611
PA Pittsburgh, Baehr Greenleaf & Assoc. 412-934-3088,FAX:412-934-3990
TX Austin, Comp. Technlg. 512-288-7328, FAX:512-288-7372
TX Dallas, Comp. Technlg. 214-783-8831, FAX:214-783-4801
TX Houston, Comp. Technlg. 713-690-3011, FAX:713-462-9906
WA Bellevue, Luscombe Engrg. 206-643-1463, FAX:206-649-9120
WI Menomonee Falls, Davix Intl. Ltd. 414-255-1600, FAX:414-255-1863

Local Distributors

AL Huntsville, All American 205-837-1555, FAX:205-837-7732
AL Huntsville, Reptron Elctrns. Inc. 205-722-9500, FAX:205-722-9565
CA Corona, Compumech Elctrns. 714-278-4761, FAX:714-278-4761
CA Milpitas, Compumech Elctrns. 408-945-9100, FAX:408-945-9395
CA San Diego, All American 619-458-5850
CA San Diego, All American 619-458-5850, FAX:619-458-5866
CA San Diego, Neumann 619-695-3005, FAX:619-695-0935
CA San Jose, All American Semiconductor Inc. 408-943-1200,FAX:408-943-1393
CA Santa Clara, Trinity Elctrns. 408-980-9011, FAX:408-980-9014
CA Sunnyvale, Target Elctrns. 408-733-0384, FAX:408-733-0397
CA Thousand Oaks, Compumech Elctrns. 805-492-6299,FAX:805-492-8429
CA Torrance, All American Semiconductor Inc. 310-320-0240,FAX:310-320-7207
CA Yorba Linda, Target Elctrns. 714-692-1630, FAX:714-692-1547
CO Aurora, QPS 303-373-2766,FAX:303-373-4029
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112, FAX:305-735-1121
FL Melbourne, Pridmore 407-727-2491, FAX:407-723-1213
FL Miami, All American Semiconductor Inc. 305-621-8282,FAX:305-620-7831
FL Sunrise, All American Semiconductor Inc. 305-572-7999,FAX:305-749-9229
FL Tampa, Reptron Elctrns. 813-854-2351, FAX:813-855-0942
GA Athens, Resource Elctrns. 706-613-7755, FAX:706-613-7856
GA Norcross, Reptron Elctrns. 404-446-1300, FAX:404-446-2991
ID Boise, Radar Elctrn. 208-337-2227, FAX:208-337-2322
IL Chicago, All American 312-659-9075, FAX:312-477-9962
IL Lisle, Components Inc. 708-852-7707, FAX:708-852-0263
IL Schaumburg, QPS Elctrns., Inc. 708-884-6620, FAX:708-884-7573
IL Schaumburg, Reptron Elctrns. 708-882-1700, FAX:708-882-8904
IL Wheeling, All American 708-970-8976, FAX:708-537-5631
IA Des Moines, Midstate 515-244-7231, FAX:515-244-0828
MD Rockville, All American Semiconductor Inc. 800-426-0420,FAX:301-251-8574
MA Norwood, Emtel ... 617-769-9500,FAX:617-769-8329
MA Wakefield, All American Semiconductor Inc. 617-246-2300,FAX:617-246-2305
MI Livonia, Reptron Elctrns. 313-525-2700, FAX:313-525-3209
MN Eden Prairie, All American Semiconductor Inc. 612-944-2151,FAX:612-944-9803
MN Minnetonka, Reptron Elctrns. 612-938-0000, FAX:612-938-3995
MO Fenton, Beckwith Elctrns. 314-343-6463, FAX:314-343-7026
MO St. Charles, Finnigan Elctrns. 314-946-6201, FAX:314-724-8956
NE Omaha, Mid-State Distbn. Co. 402-592-5965, FAX:402-331-7382
NE Omaha, Midstate 402-592-5965
NJ West Berlin, GCI ... 609-768-6767,FAX:609-768-3649
NM Albuquerque, Betatron 505-821-1122, FAX:505-828-0450
NY Penn Yan, Advacom 315-536-2221
NY Ronkonkoma, All American Semiconductor 516-981-3935,FAX:516-981-3947
NC Charlotte, Resource Elctrns. 704-521-8682, FAX:704-558-4696
NC Hickory, Resource Elctrns. 704-328-1130, FAX:704-328-8318
NC Raleigh, Reptron Elctrns. 919-870-5189, FAX:919-870-5210
NC Raleigh, Resource Elctrns. 919-829-0704, FAX:919-527-9647
NC Winston-Salem, Resource Elctrns. 919-724-5961, FAX:919-723-7024
OH Dayton, Advacom, Inc. 513-274-5900, FAX:513-274-9124
OH Middleburg, Advacom, Inc. 216-826-3300, FAX:216-826-1669
OH Solon, Reptron Elctrns. 216-349-1415, FAX:216-349-1634
OR Portland, Radar Elctrns. 503-232-3404, FAX:503-235-0428
PA Harrisburg, Cumberland Elctrns. 717-232-5999, FAX:717-238-5379
PA McKean, Advacom Inc. 814-476-7774, FAX:814-476-7724
PA York, Advacom, Inc. 717-741-9277, FAX:717-741-9462
SC Columbia, Resource Elctrns. 803-779-5332, FAX:803-765-9276
SC Greensville, Resource Elctrns. 803-297-1430, FAX:803-297-1439

SC	No. Charleston, Resource Elctrns.	803-552-2671, FAX:803-552-2676
TN	Gray, Resource Elctrns.	615-477-2131, FAX:615-477-4407
TN	Oakridge, Resource Elctrns.	615-481-3393, FAX:615-481-3397
TX	Austin, Omni Pro Elctrns.	512-794-9200, FAX:512-338-9576
TX	Carrollton, Omni Pro Elctrns.	214-713-9000, FAX:214-732-8743
TX	Houston, Omni Pro Elctrns.	713-270-1700, FAX:713-270-8020
TX	Richardson, All American Semiconductor	214-231-5300,FAX:214-437-0353
UT	Salt Lake City, All American	801-682-8313, FAX:801-261-3885
VA	Charlottesville, Virginia Elctrn. Comp.	804-296-4184,FAX:804-971-8411
WA	Edmonds, Oman & Assocs.	206-774-1887, FAX:206-771-2296
WA	Richland, Radar Elctrns.	509-943-8336, FAX:509-943-6790
WA	Seattle, Radar Elctrns.	206-282-2511, FAX:206-282-1598
WA	Spokane, Radar Elctrns.	509-747-3053, FAX:509-456-8069
WI	Lisle, Comps. Inc.	414-529-4106, FAX:708-852-0263
WI	Milwaukee, QPS Elctrns.	414-789-7577, FAX:708-884-7573
Can	Calgary, Alb., Memco	403-258-3399, FAX:403-258-3459
Can	Ontario, Sanbek Sls.	519-746-5801, FAX:519-746-6561
Can	Ontario, Utech	416-609-2900,FAX:416-609-2588
Can	St. Laurent, Que., C.I.E. Elctrns.	514-342-2447, FAX:514-342-4073
Can	St. Laurent, Que., Versatech Elctrns.	514-335-3833, FAX:514-355-0307
Can	Surrey, B.C., Memco	604-590-1553, FAX:604-590-5008
KS	Lenexa, Associated Elctrn. Mktg., Inc.	913-888-0022,FAX:913-888-4848

WORLD PRODUCTS INC.

FAX: 707-996-3380

WORLD PRODUCTS INC., Systems Devices Grp., 19654 8th St. E., Sonoma 95476, Tel: 707-996-5201; Empl.: 50 ..... **A•1177, 2050-2051, 2224-2225; B•1128-1129, 1399**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assocs.	602-966-1788
CA	Los Angeles, SPA Elctrn. Sls.	714-863-1193
CA	San Jose, Signet Tech. Sls.	408-453-0611
CO	Denver, Donohue Sls., Co.	303-455-1719
FL	Melbourne, R-Rep Co., Inc.	407-242-9800
IL	Arlington, KMA Sls. Co.	312-398-5300
IN	Fort Wayne, Berberich Assoc.	219-486-0673
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NJ	Livingston, Avemark Tech. Mktg.	201-992-5331
OH	Dayton, Berberich Assocs. Inc.	513-433-0342
OR	Beaverton, Luscombe Engrg./N.W.	503-636-6664
PA	Hatboro, AQS Electro	215-674-4421
TX	Dallas, Southwestern Tech. Sls.	214-369-0977
VA	Herndon, Stinson Assocs.	703-620-1332
WA	Bellevue, Luscombe Engrg./N.E.	206-643-1463
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Montreal, ELI Manis Inc.	514-484-2923

Local Distributors

AL	Huntsville, Reptron Elctrns. Inc.	205-722-9500, FAX:205-722-9565
CA	Anaheim, Compumech Elctrns.	714-939-9100, FAX:714-939-9113
CA	Milpitas, Compumech Elctrns.	408-945-9100, FAX:408-945-9395
CA	San Diego, All American	619-458-5850
CA	San Diego, Neumann	619-695-3005, FAX:619-695-0935
CA	San Jose, All American Semiconductor	408-943-1200,FAX:408-943-1393
CA	Santa Clara, Trinity Elctrns.	408-980-9011, FAX:408-980-9014
CA	Sunnyvale, Target Elctrns.	408-733-0384, FAX:408-733-0391
CA	Torrance, All American Semiconductor	800-831-8300,FAX:310-320-7207
CA	Yorba Linda, Target Elctrns.	714-692-1630, FAX:714-692-1547
CT	Yalesville, Schaal	203-269-3779, FAX:203-284-2159
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112, FAX:305-735-1121
FL	Melbourne, Pridmore	407-727-2491, FAX:407-723-1213
FL	Miami, All American Semiconductor	305-621-8282, FAX:305-620-7831
FL	Sunrise, All American Semiconductor	305-572-7999,FAX:305-749-9229
FL	Tampa, Reptron Elctrns.	813-854-2351, FAX:813-855-0942
FL	Winter Park, Deanco	407-671-5100, FAX:407-679-0361
GA	Augusta, Dixie Elctrns.	404-722-2055, FAX:404-722-0388
GA	Marietta, Deanco	404-429-0126, FAX:404-429-0333
GA	Norcross, Reptron Elctrns.	404-446-1300, FAX:404-446-2991
ID	Boise, Radar Elctrns.	208-336-2227, FAX:208-336-2322
IL	Lisle, Components Inc.	708-852-7707, FAX:708-852-0263
IL	Schaumburg, Reptron Elctrns.	708-882-1700, FAX:708-882-8904
IA	Cedar Rapids, Mid-State Distbg. Co.	800-798-9411, FAX:319-365-9411
IA	Des Moines, Mid-State Distbrg. Co.	515-244-7231, FAX:515-244-0828
IA	Mason City, Mid-State Distbg. Co.	800-798-8012, FAX:515-423-8012
IA	Ottowa, Mid-State Distbg. Co.	800-937-5407, FAX:515-682-5407
MD	Gaithersburg, Deanco	301-948-5444, FAX:301-963-6469
MA	Burlington, Schaal	617-272-7940, FAX:617-272-3343
MA	Norwood, Emtel	617-769-9500,FAX:617-769-8329
MA	Wakefield, All American Semiconductor	617-246-2300,FAX:617-246-2305
MI	Livonia, Reptron Elctrns.	313-525-2700, FAX:313-525-3209
MN	Eden Prairie, All American Seminconductor	612-944-2151,FAX:612-944-9803
MN	Minnetonka, Reptron Elctrns.	612-938-0000, FAX:612-938-3995
MO	Fenton, Beckwith Elctrns.	314-343-6463, FAX:314-343-7026
NE	Omaha, Mid-State Distbg. Co.	402-592-5965, FAX:402-331-7382
NJ	Fairfield, Deanco	201-575-7960, FAX:201-575-3606
NM	Albuquerque, Betatron	505-821-1122, FAX:505-828-0450
NY	Hauppauge, Schaal	516-434-7700, FAX:516-434-7111
NY	Ithaca, Deanco	607-257-4444,FAX:607-257-3678
NY	Penn Yan, Advacom Technlg.	315-536-2221, FAX:315-536-0828
NY	Ronkonkoma, All American Semiconductor	800-874-2830,FAX:516-981-3947
NC	Charlotte, Dixie Elctrns.	704-377-4348, FAX:704-377-2561
NC	Raleigh, Deanco	919-851-2065,FAX:919-859-4806
NC	Raleigh, Reptron Elctrns.	919-870-5189, FAX:919-870-5210
NC	Winston-Salem, Dixie Elctrns.	919-724-5961, FAX:919-723-7024
OH	Cleveland, Advacom, Inc.	216-826-3300, FAX:216-688-5914
OH	Solon, Reptron Elctrns.	216-349-1415, FAX:216-349-1634
OH	Worthington, Reptron Elctrns.	614-436-6675, FAX:614-436-4285
OR	Portland, Radar Elctrns.	503-232-3404, FAX:503-235-0428
PA	Harrisburg, Cumberland Elctrns.	717-232-5999, FAX:717-238-5379
PA	McKean, Advacom, Inc.	814-476-7774, FAX:814-476-7724
PA	Philadelphia, Deanco	215-735-3678
SC	Columbia, Dixie Elctrns.	803-779-5332, FAX:803-765-9276
SC	Greensville, Dixie Elctrns.	800-868-2260, FAX:803-297-1439
SC	No. Charleston, Dixie Elctrns.	803-868-3336, FAX:803-552-2676
TN	Gray, Dixie Elctrns.	615-477-3838, FAX:615-477-4407
TN	Oakridge, Dixie Elctrns.	615-481-3393, FAX:615-938-4133
TX	Austin, Omni Pro Elctrns.	512-794-9200, FAX:512-338-9576
TX	Dallas, Omni Pro Elctrns.	214-233-0500, FAX:214-385-7508
TX	Houston, Omni Pro Elctrns.	713-270-1700, FAX:713-270-8020
TX	Richardson, All American Semiconductor	214-231-5300,FAX:214-437-0353
VA	Charlottesville, Virginia Elctrns. Comps.	804-296-4184,FAX:804-971-8411
VA	Virginia Beach, Deanco	804-499-3322, FAX:804-499-1038
WA	Richland, Radar Elctrns.	509-943-8336, FAX:509-943-6790
WA	Seattle, Radar Elctrns.	206-282-2511, FAX:206-282-1598
WA	Spokane, Radar Elctrns.	509-747-3053, FAX:509-456-8069
Can	Nepean, Ont., Zanin Elctrns.	613-596-2911, FAX:613-596-2915
Can	St. Foy, Que., Zanin Elctrns.	418-681-1262, FAX:418-681-1264
Can	St. Laurent, Que., Zanin Elctrns.	514-342-6211, FAX:514-342-4071
Can	Toronto, Ont., Zanin Elctrns.	416-674-7220, FAX:416-674-7836

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753, FAX: 703-943-3826; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, 1001 Old Stage Rd., Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Tommy Little

WPI GROUP, INC., 18 Mill St., Warner, NH 03278, Tel: 603-456-3111, FAX: 603-456-2498; Empl.: 115; *Sls. Mgr.:* Paul D. Iverson

WSI, 47280 Kato Rd., Fremont, CA 94538, Tel: 510-656-5400, 800-451-5970 (USA), FAX: 510-657-5916; Empl.: 150; *Sls. Mgr.:* Bob Hoard; *Dist. Mgr.:* Mike Speckman

WYLE LABS, See Electronic Enclosures

XANTREX TECHNOLOGY INC., 3873 Airport Way, Bellingham, WA 98227-9754, Tel: 206-671-2966, FAX: 206-671-3095; *Sls. Mgr.:* Michael Rodger; *Dist. Mgr.:* Michael Rodger

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCEL CONTROLS, INC., 1600 W. 6th St., Mishawaka, IN 46544, Tel: 219-259-7804, FAX: 219-259-5769; Empl.: 40; *Sls. Mgr.:* Bruce Shepard

XCP, INC., 40 Elm St., P.O. Box 819, Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441, FAX: 303-443-6444; *Sls. Mgr.:* Andy Zeidler

XELTEK, 757 N. Pastoria Ave., Sunnyvale, CA 94086, Tel: 408-524-1935, FAX: 408-245-7084; Empl.: 19; *Sls. Mgr.:* Andrew Rao; *Dist. Mgr.:* Brian Lee

XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, FAX: 617-933-8804; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Dist. Mgr.:* L. Geery, T. Dos Santos, M. Mitchner

Xentek

FAX: 619-471-4021

XENTEK, INC., Taiyo Yuden USA, Inc., 1770 La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-4001; FSC No.: 53279; Empl.: 220; *Sls. Mgr.:* Chuck Henry ..... **D•2042-2047, 2308-2309**

Local Sales Offices & Reps

AL	Madison, Lamons Sls. Co.	205-461-7886
CA	Huntington Bch., Regan/Munro Sls., Inc.	714-841-1411
CA	San Jose, Ruppert Sls. & Eng.	408-998-8717
CO	Denver, AC Mktg.	303-433-1648
FL	Ft. Lauderdale, Post Mktg.	305-989-2931
FL	Indian Harbor Bch., Post Mktg.	407-777-0994
GA	Norcross, Lamons Sls. Co.	404-242-2610
IL	Itasca, LTD Technlgs., Inc.	708-773-2900
IA	Cedar Rapids, Midtec Assocs.	319-395-0028
KS	Lenexa, Midtec Assoc.	913-541-0505
MA	Chelmsford, Waterstate Sls.	508-256-2287

MI	Farmington Hills, Carter, McCormic & Pierce	313-477-7700
NJ.	Medford, Mech-Elec. Sls.	609-654-8209
MN	Richfield, Clay Rep Co.	612-861-2191
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Nashua, Bell Controls	603-882-6984
NC	Raleigh, Lamons Sls. Co.	919-846-1652
NJ	Fairfield, Astrorep	201-808-0025
NY	Babylon, Astrorep	516-422-2500
NY	Dewitt, ICS	315-445-9600
OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Portland, E-Square	503-292-8204
PA	Pittsburgh, Carter, McCormic & Pierce	412-826-3800
TN	Greenville, Lamins Sls. Co.	615-639-8711
TX	Austin, Pro Comp	512-331-0800
TX	Houston, Pro Comp	713-977-8550
TX	Hurst, Pro Comp	817-589-0336
TX	Richardson, Pro Comp	214-669-1500
VA	Richmond, Mech-Elec Sls.	804-231-4006
WA	Bellevue, E-Square	206-637-0302
WI	Milwaukee, LTD Technlgs.	414-774-1000

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682, FAX: 503-292-8697; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, United States Customer Operations, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,900

XETEL CORPORATION, 2525 Brockton Dr., Austin, TX 78758, Tel: 512-834-2266, FAX: 512-834-9250; Empl.: 395; *Sls. Mgr.:* Mark Trutna

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, FAX: 818-709-5235; Empl.: 21; *Sls. Mgr.:* Robert Browning

XICON CAPACITORS, P.O. Box 170537, Arlington, TX 76003, Tel: 800-628-0544, FAX: 817-473-1808; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* Buck Johnson

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 1010; *Sls. Mgr.:* Bruce Mattern,VP Sls.; *Dist. Mgr.:* Bruce Mattern

XILINX CORP., 2100 Logic Drive, San Jose, CA 95124, Tel: 408-559-7778, FAX: 408-559-7114

XITRON
TECHNOLOGIES

FAX: 619-458-9213

XITRON TECHNOLOGIES, 10225 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-458-9852; Empl.: 10; *Sls. Mgr.:* Stephen Merrill .... **D•1335**

XKD CORPORATION, Dynatech, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, FAX: 408-354-2606; *Sls. Mgr.:* Skip McLaughlin

XL MICROWAVE, 5811 Racine St., Oakland, CA 94609, Tel: 510-428-9488, FAX: 510-428-9469; Empl.: 7; *Sls. Mgr.:* William J. Artz

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XSIS ELECTRONICS, INC., 12620 W. 63rd St., Shawnee, KS 66216, Tel: 913-631-0448, FAX: 913-631-1170; FSC No.: 57051; Empl.: 12; *Sls. Mgr.:* Jerry Dehnert .... **A•1511**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Western High Tech. Mktg.	602-266-2070
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CA	Mission Viejo, Chaparrah Elctrn. Sls.	714-582-2950
FL	Ocalia, Florida Electro Comps.	904-351-4125
IL	Schaumberg, Sieger Assocs.	708-381-7403
KS	MidTech Assoc., Inc.	913-541-0505
KS	Lenexa, Midtec Assoc. Inc.	913-541-0505
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI, Inc.	410-461-2525
MA	Amesbury, Carl Sheys Assoc. Ltd.	508-388-3616
MN	Eden Prairie, Aldridge Assocs., Inc.	612-944-8433
NJ	Hasbrouck Heights, Comp. Tech. Sls.	201-288-7400
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Montgomeryville, Rufo Sys. Comps.	215-368-8495
TX	Sherman, Repmaster	214-247-6263
EXP	NY, Great Neck, Techcomp Intl.	516-466-2167
OH	Ft. Mitchell, G.W. Thelien Co.	606-341-8181

XYLOG CORP., 83 Hobart St., Hackensack, NJ 07601, Tel: 201-489-4040, FAX: 201-489-6745; Empl.: 30; *Sls. Mgr.:* Milton Frank

XYLOGICS, INC., 53 Third Ave., Burlington, MA 01803, Tel: 800-225-3317, FAX: 617-273-5392; Empl.: 165; *Sls. Mgr.:* Bernard D. Olmsted; *Dist. Mgr.:* Joe Twardy

XYZ ELECTRONICS, 4700 N. 600 W, McCordsville, IN 46055, Tel: 317-335-2128, FAX: 317-335-2128; Empl.: 5

YAMAICHI ELECTRONICS, INC., Yamaichi Electronics Co., Ltd., 1420 Koll Circle, Ste.B, San Jose, CA 95112, Tel: 408-452-0797, FAX: 408-452-0799; Empl.: 24; *Sls. Mgr.:* Bob Million; *Dist. Mgr.:* Jim Bennett

YARDNEY TECHNICAL PRODUCTS, INC., 82 Mechanic St., Pawcatuck, CT 06379, Tel: 203-599-1100, TELEX: 6813114, TWX: 710-470-0260; FSC No.: 87362; Empl.: 250; *Sls. Mgr.:* Louis R. Magnarella, VP

YELLOW SPRINGS INSTRUMENTS CO., Box 279, Yellow Springs, OH 45387, Tel: 800-765-4974, TELEX: 205437, FAX: 513-767-9353; Empl.: 359; *Sls. Mgr.:* Michael Flora .... **B•1909-1910**

Local Sales Offices & Reps

AZ	Chandler, Elec-Com Assocs.	602-893-2930
CA	San Dimas, RDX Corp.	714-599-0985
GA	Atlanta, Craft Assocs.	404-256-0420
IL	Lombard, Patrick & Douglas	708-268-1900
KS	Shawnee, Comtel Midwest	913-268-0762
MA	Natick, Andruss-Peskin	800-878-3919
MI	Canton, Tech-Rep, Inc.	313-981-1950
MN	Minneapolis, Automation Sensors, Inc.	612-537-6416
MO	Chesterfield, Advanced Indl. Sys.	314-532-2477
NJ	Scotch Plains, RJM Sls.	908-322-7880
NY	Syracuse, Labtronics	315-455-7314
OH	Chesterfield, EQS Assoc.	216-729-2222
PA	Chadds Ford, RJM Sls.	215-358-4014
VA	Richmond, Advanced Control	804-282-9499
Can	Scarborough, Ont., Finnan Engr. Prod.	416-438-6070

Local Distributors

CA	Foster City, Therm-X	415-571-1166
MA	Natick, Andruss-Peskin	508-653-3919
NJ	Scotch Plains, RJM Sls.	201-322-7880
OH	Dayton, RDP Corp.	513-253-6175
Can	Scarborough, Ont., Finnan Engrd.	416-438-6070

YOUNG TECHNOLOGY, 48012 Fremont Blvd., Fremont, CA 94538, Tel: 510-490-6373, FAX: 510-490-3214; Empl.: 30; *Sls. Mgr.:* Ian McLean; *Dist. Mgr.:* Ian McLean

YSI INCORPORATED, See Yellow Springs Instrument Co.

YUASA
EXIDE, INC.

FAX: 215-378-0345

YUASA-EXIDE, INC., 645 Penn St., Reading, PA 19601, Tel: 215-378-0333; Empl.: 2000; *Sls. Mgr.:* Ronn Alonso, Francis Taylor, Bill McKenty; *Dist. Mgr.:* Greg Rapp .... **D•1485**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Tempe, Westrep	602-820-9932
CA	Huntington Beach, West Elctrns.	310-493-5569
CA	San Diego, West Elctrns.	619-233-0236
CA	Santa Clara, Novatronix	408-727-9530
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, Over & Over	407-332-1222
FL	Coral Springs, Over & Over	305-753-7050
FL	Tampa, Over & Over	813-626-9100
GA	Norcross, Over & Over	404-449-6205
IL	Arlington Heights, Brainard-Nielsen	708-437-2700
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Vlg., R.W. Kunz & Assocs.	913-648-3535
KS	Wichita, R. W. Kunz & Assocs.	316-686-3436
MD	Hunt Valley, Samual K. MacDonald	410-584-8631
MA	Burlington, Kitchen & Kutchen	617-229-2660
MN	Anoka, Tech. Solutions	612-750-6122
MO	St. Louis, R.W. Kunz & Assocs.	314-966-4799
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	908-464-0203
NC	Charlotte, Over & Over	704-542-9111
NC	Raleigh, Over & Over	919-876-7338
OH	Columbus, McFadden Sls.	614-761-3177
OR	Beaverton, Westmark Elctrns.	503-641-8780
PA	Monroeville, Samuel K. MacDonald	412-373-1723
TX	Richardson, Krone & Assocs.	214-437-1892
UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Manitowoc, Brainard-Nielsen	414-797-7940
Can	Mississauga, Ont., Tech-Trek Ltd.	416-238-0366
Can	Nepean, Ont., Tech-Trek Ltd.	613-225-5161
Can	Richmond, B.C., Tech-Trek Ltd.	604-276-8735
Can	St. Laurent, Que, Tech-Trek Ltd.	514-337-7540

Local Distributors

AZ	Glendale, Lynntronics	602-931-5981
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Costa Mesa, House of Batteries	714-642-8222
CA	Santa Clara, Cypress Elctrns.	408-980-2500
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Norcross, Applied Power	404-263-0421
HI	Honolulu, Elctrl. Equip.	808-533-3881
IL	Downers Grove, Jarbo Battery	312-964-9358
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Brighton, Applied Power	313-229-6550
MN	Minneapolis, Bergquist Co.	612-835-2322
NH	Salem, Cronin Elctrns.	603-898-4440
NJ	Clifton, Engrd. Assemblies	201-340-0600
NY	Farmingdale, Battery Expeditors	516-752-0111
NY	Flushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Engrd. Assemblies	919-790-9700
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Solon, Repco Elctrns.	216-248-8900
OR	Portland, Standard Batteries of Portland	503-234-7251
TX	Allen, Prime Distrbg.	214-231-0170
WA	Redmond, Priebe Elctrns.	206-881-2363
EXP	National & Canada, Newark Elctrns.	800-367-3573
Can	Brampton, Ont., Zentronics	416-451-8445

ZAKI CORPORATION, 420 Maple St., Marlboro, MA 01752, Tel: 508-480-0201, FAX: 508-481-0595; *Sls. Mgr.:* Steven Sotsky

ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176, FAX: 415-968-4851; FSC No.: 58758; 5950; Empl.: 20 Average

ZAXTEK, 42 Corporate Pk. Ste. 100, Irvine, CA 92714, Tel: 714-474-1170, 800-421-0982, FAX: 714-474-0159; Empl.: 15; *Sls. Mgr.:* Robert J. Parente, Dir. of Sls. & Mktg.

Z COMMUNICATIONS, INC., 9939 Via Pasar, San Diego, CA 92126, Tel: 619-621-2700, FAX: 619-621-2722; FSC No.: 1564A; Empl.: 20; *Sls. Mgr.:* Devang Patel

ZEBRA TECHNOLOGIES CORPORATION, 333 Corporate Woods Pkwy., Vernon Hills, IL 60061-3109, Tel: 708-634-6700, TELEX: 206230, FAX: 708-913-8766; *Sls. Mgr.:* Kevin O'Donnell

CARL ZEISS, INC., One Zeiss Drive, Thornwood, NY 10594, Tel: 800-233-2343, FAX: 914-681-7446

ZENDEX CORP., 6780 Sierra Court, Ste. A, Dublin, CA 94568, Tel: 510-828-3000, TWX: 910-389-4009, FAX: 510-828-1574; Empl.: 20; *Sls. Mgr.:* Russ Gamble

ZENITH MAGNETICS, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025-2493, Tel: 708-391-8700; *Sls. Mgr.:* Bob Cunningham; *Dist. Mgr.:* Allan Parker

Local Sales Offices & Reps

AZ	Scottsdale, Vikeland Sls., Inc.	602-948-7921
CA	Dana Point, Electro Venture	909-496-5225

CA	Laguna Hills, Electro Venture-s	714-581-9244
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Tech Rep Sls.	303-758-7031
CO	Englewood, Tech. Rep. Sls.	303-799-8877
CT	Franklin, OEM Mktg. & Sls.	313-572-0516
FL	Clearwater, Tech. Rep. Assocs.	813-572-9900
IL	Arlington Hts., Hill Sls. Corp.	708-255-4400
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Farmington Hills, Carter Technlg. Inc.	313-477-7700
MN	Minneapolis, Comstrand, Inc.	612-574-9480
NH	Salem, OEM Mktg. & Sls.	603-893-1197
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
OH	Cleveland, S-Tek	216-468-0413
OR	Portland, Jos. V. Belusko Co.	503-222-4279
PA	Willow Grove, Tech Sls. Assoc.	215-784-0170
TX	Dallas, MGR Elctrns.	214-238-5246
VA	Alexandria, Mid-States Mktg., Inc.	703-370-2600

ZERCOM CORPORATION, P.O. Box 84, Zercom Drive, Merrifield, MN 56465-0084, Tel: 218-765-3151, FAX: 218-765-3900; Empl.: 160; *Sls. Mgr.:* Jeff Zernov

ZERO CABINETS (STANTRON), 12224 Montague St., Pacoima, CA 91331-2226, Tel: 818-890-3445, FAX: 818-890-4460; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier .... **C•1118-1123**

Local Sales Offices & Reps

AL	Huntsville, Esneault Assocs.- BJR	205-881-3569
AZ	Phoenix, Shefler/Kahn	602-581-0884
CA	Camarillo, Luscombe Engrg.	805-388-2058
CA	Long Bch., Luscombe Engrg.	310-594-5994
CA	Mission Viejo, Luscombe Engrg.	714-855-8954
CA	Montrose, Luscombe Engrg.	818-249-9000
CA	Pleasanton, Moulthrop Sls.	510-463-0450
CA	San Diego, Qualtronics	619-695-0118
CA	Thousand Oaks, Luscombe Engrg.	805-377-8415
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Indiana Rocks Bch., P & M Tech. Sls. Co.	813-593-3248
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
MD	Rockville, Marktron, Inc.	301-251-8990
MA	Palmer, Benoit & Co.	413-283-8348
MN	Bloomington, Elctrn. Sls. Agcy.	612-884-8291
MO	Raytown, Cadon Tech. Sls.	816-356-7685
MO	St. Louis, Cadon Tech. Sls.	314-645-8670
NH	Hudson, Benoit & Co.	603-598-3291
NM	Albuquerque, S & S Technlgs.	505-298-7177
NY	Commack, MTR Inc.	516-462-9580
NY	New Hyde Pk., MTR Inc.	516-326-8138
NY	Syracuse, Fountain, Young & Co., Inc.	315-437-7733
OH	Cincinnati, KCH Co.	513-931-1686
OR	Tigar, Halbar-R.T.S. Inc.	503-624-5741
PA	Boswell, B.E. Gibson, Co.	814-629-6772
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Effective Sls.	801-266-9617
VA	Martinsville, Engrg. Reps Assocs.	703-632-2365
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NJ	Fairfield, Micross Comps.	201-227-8007
NJ	West Berlin, Gen. Comps.	609-768-6767
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ZYLAB CORPORATION, 100 Lexington Dr., Buffalo Grove, IL 60089, Tel: 708-459-8000, FAX: 708-459-8054; Empl.: 21; *Sls. Mgr.:* Beth Harvey

ZYTRONICS, INC., 70 Tirrell Hill Road, Bedford, NH 03110, Tel: 603-623-8888, FAX: 603-623-4009; Empl.: 100; *Sls. Mgr.:* Debra Lemieux

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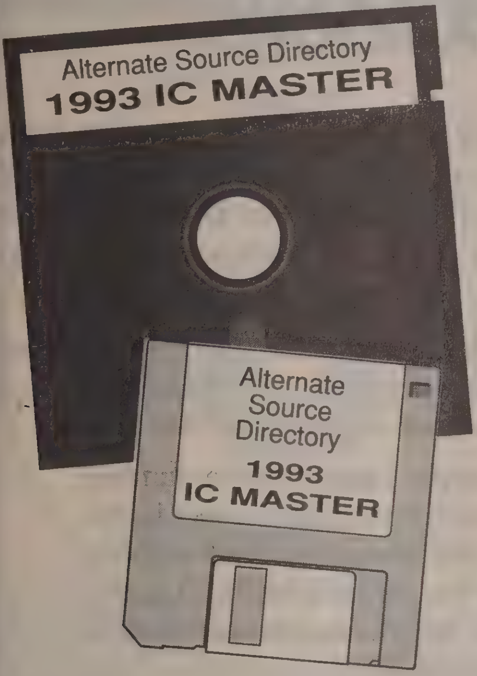

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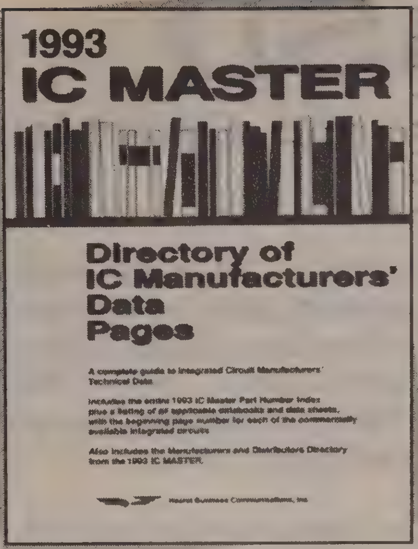

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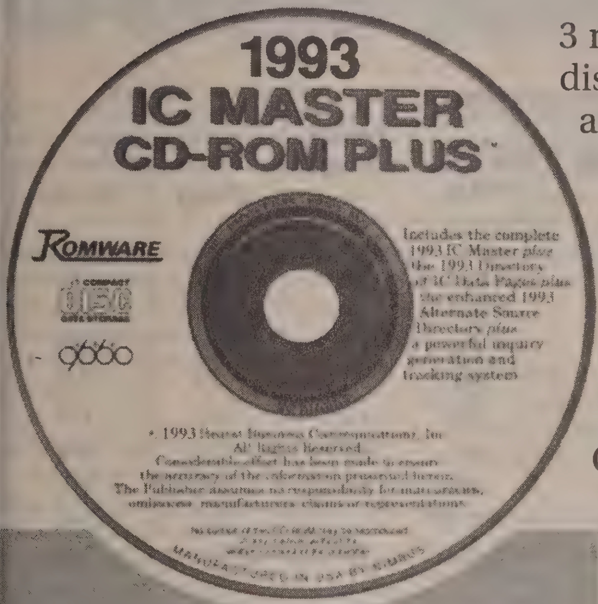
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CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm^3
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.

[b] Based on fuel consumption only.

[c] Weight of air not considered in computation of watt hours.

[d] Water-activated

[e] Automatically activated; high rate discharge; 2- to 10-min rate.

[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.

[g] Four-minute discharge rate.

[h] β-alumina electrolyte, 300°C operation.

[i] Fused salt; 350°C operation.

[j] Solid $RbAg_4I_5$ electrolyte.

[k] Several different cathode materials used.

[l] Fuel consumption is based on source of H_2.

[m] Based on methanol battery-fuel supply in situ.

MINIGLOSSARY
CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multi-plier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Signi-ficant Figure	Multi-plier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$$E = \tfrac{1}{2}\ CV^2$$

III. Linear charge of a capacitor (Amperes)

$$I = C\frac{dV}{dt}$$

IV. Total Impedance of a capacitor (ohms)

$$Z = \sqrt{R_s{}^2 + (X_C - X_L)^2}$$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$$X_C = \frac{1}{2\ \pi\ fC}$$

VI. Inductive Reactance (ohms)

$$X_L = 2\ \pi\ fL$$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta$ (loss angle) $= \frac{ESR}{X_c} =$ $(2\ \pi\ fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta$ (loss angle) $= \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$$ESR = (DF)\ (Xc) = (DF)\ (\tfrac{1}{2}\ \pi\ fC)$$

XII. Power Loss (watts)

Power loss $= (2\ \pi\ fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$$KVA = 2\ \pi\ fCV^2 \times 10^{-3}$$

XIV. Temperature Characteristic (ppm/°C)

$$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$$

XV. Cap Drift (%)

$$C.D. = \frac{C_1 - C_2}{C_1} \times 100$$

XVI. Reliability of Ceramic Capacitors

$$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^y$$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{ --- } + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\ C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$$C_T = C_1 + C_2 \text{ --- } + C_N$$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$$db = 20 \log \frac{V_1}{V_2}$$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^{3}
Mega	X 10^{6}
Giga	X 10^{9}
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area of electrode overlap
t_D = Dielectric thickness
V = Voltage (volts)
t = time (hours)
R_S = Series Resistance (ohms)
f = frequency (Hertz)
L = Inductance (henries)
δ = Loss angle
ø = Phase angle
x+y = Exponent effect of voltage and temperature
L_O = Operating life (hours)
L_t = Test life (hours)
V_t = Test voltage (volts)
V_o = Operating voltage (volts)
T_t = Test temperature (°C)
T_o = Operating temperature (°C)

MINIGLOSSARY
CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination.* This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float.* Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof.* May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card.* The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement.*

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage.* Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage.* The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MAXIMUM CURRENT CAPACITY— CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	. . .	. . .	. . .	. . .	. . .	0.2	0.4	. . .	0.20
28	. . .	. . .	. . .	. . .	. . .	0.4	0.6	. . .	0.32
26	. . .	. . .	. . .	. . .	. . .	0.6	1.0	. . .	0.51
24	. . .	. . .	. . .	. . .	. . .	1.0	1.6	. . .	0.81
22	9	5	. . .	. . .	. . .	1.6	2.5	. . .	1.28
20	11	7.5	. . .	. . .	. . .	2.5	4.0	3	2.04
18	16	10	. . .	. . .	6	4.0	6.0	5	3.24
16	22	13	. . .	. . .	10	6.0	10.0	7	5.16
14	32	17	. . .	. . .	20	10.0	16.0	15	8.22
12	41	23	. . .	. . .	30	16.0	26.0	20	13.05
10	55	33	. . .	. . .	35	. . .	. . .	25	20.8
8	73	46	58	36	50	. . .	. . .	35	33.0
6	101	60	86	51	70	. . .	. . .	50	52.6
4	135	80	108	64	90	. . .	. . .	70	83.4
2	181	100	149	82	125	. . .	. . .	90	132.8
1	211	125	177	105	150	. . .	. . .	100	167.5
0	245	150	204	125	200	. . .	. . .	125	212.0
00	283	175	237	146	225	. . .	. . .	150	266.0
000	328	200	. . .	. . .	275	. . .	. . .	175	336.0
0000	380	225	. . .	. . .	325	. . .	. . .	225	424.0

MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	Digit Punches
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7
			12				12				12	12		12	12	12		12	
				11				11				11	11	11		11	11	11	Zone Punches
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

① 12-0-9-8-1
② 12-11-9-8-1
③ 11-0-9-8-1
④ 12-11-0-9-8-1
⑤ No-Punches
⑥ 12
⑦ 11
⑧ 12-11-0
⑨ 12-0
⑩ 11-0
⑪ 0-8-2
⑫ 0
⑬ 0-1
⑭ 11-0-9-1
⑮ 12-11

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

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MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

MINIGLOSSARY
OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

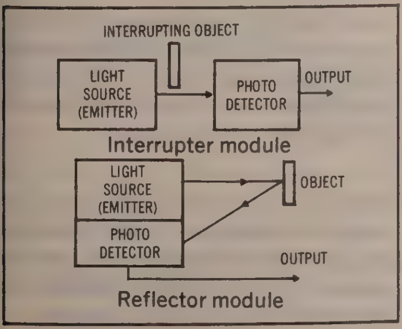
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

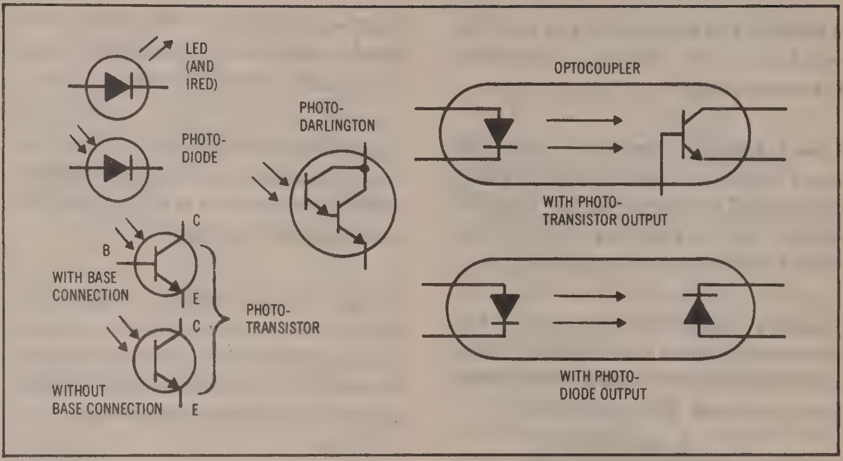
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

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MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

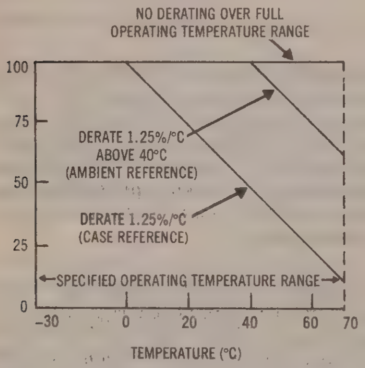

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

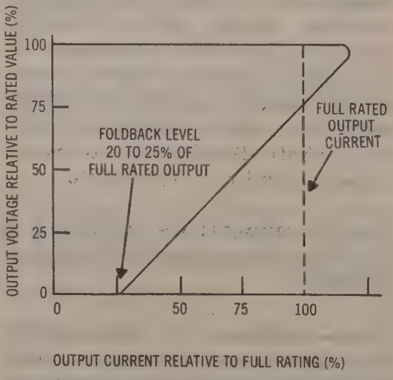

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

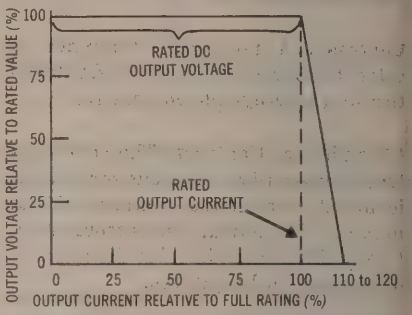

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

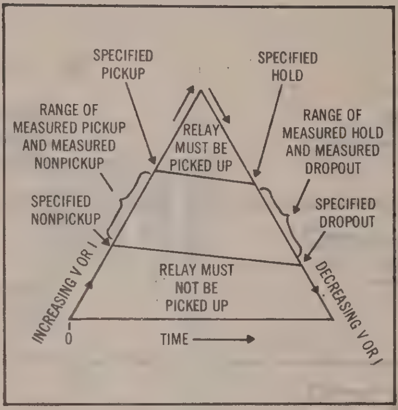
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.


SPECIFIED PICKUP
SPECIFIED HOLD
RANGE OF MEASURED PICKUP AND MEASURED NONPICKUP
RELAY MUST BE PICKED UP
RANGE OF MEASURED HOLD AND MEASURED DROPOUT
SPECIFIED NONPICKUP
SPECIFIED DROPOUT
RELAY MUST NOT BE PICKED UP
INCREASING V OR I
DECREASING V OR I
0
TIME ⟶

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

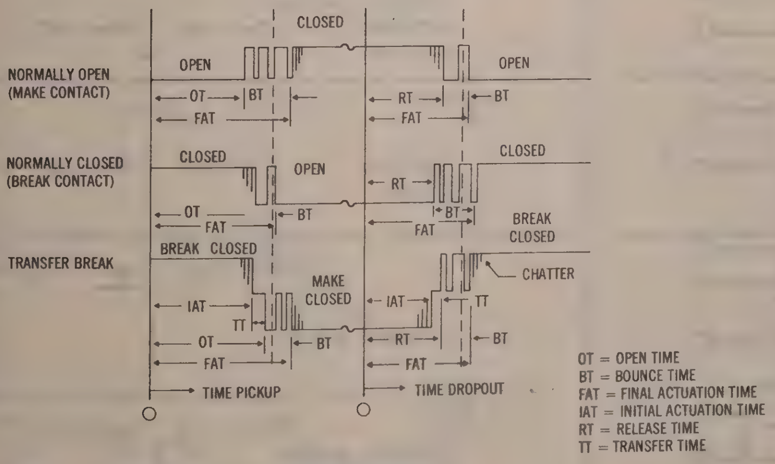
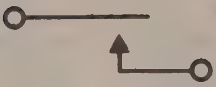

CLOSED
NORMALLY OPEN (MAKE CONTACT)
OPEN
OPEN
OT
BT
FAT
RT
BT
FAT
NORMALLY CLOSED (BREAK CONTACT)
CLOSED
OPEN
CLOSED
RT
OT
FAT
BT
BT
FAT
BREAK CLOSED
TRANSFER BREAK
BREAK CLOSED
MAKE CLOSED
CHATTER
IAT
TT
IAT
TT
OT
BT
RT
BT
FAT
FAT
TIME PICKUP
TIME DROPOUT
O
O
OT = OPEN TIME
BT = BOUNCE TIME
FAT = FINAL ACTUATION TIME
IAT = INITIAL ACTUATION TIME
RT = RELEASE TIME
TT = TRANSFER TIME

Fig. 2. Typical time vs. current (non-inductive load)

MINIGLOSSARY
RELAY CONTACT FORMS

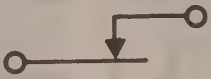
A

Make
SPST-NO



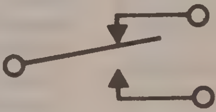
B

Break
SPST-NC



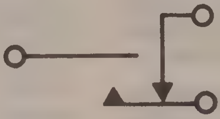
C

Break, Make
(Transfer)
SPDT



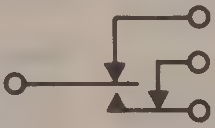
D

Make, Break
(Continuity
Transfer)



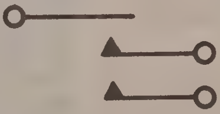
E

Break,
Make,
Break



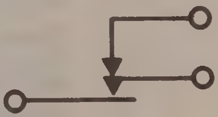
F

Make,
Make



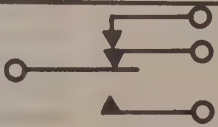
G

Break,
Make



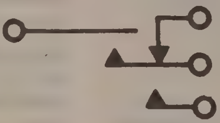
H

Break,
Break,
Make



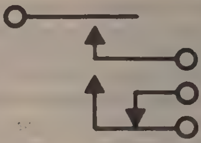
I

Make,
Break,
Make



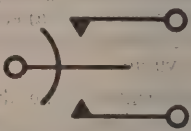
J

Make,
Make,
Break



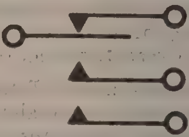
K

Center off
SPDT



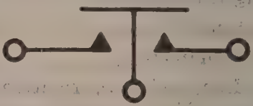
L

Break,
Make,
Make



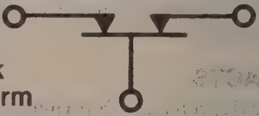
U

Double
make
Contact
on arm



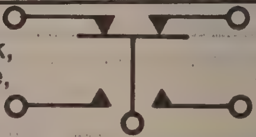
V

Double break
Contact on arm



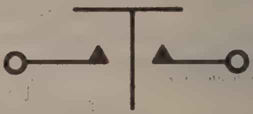
W

Double break,
Double make,
Contact
on arm



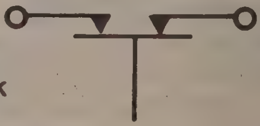
X

Double
make



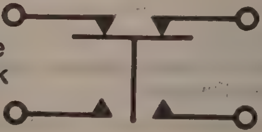
Y

Double break



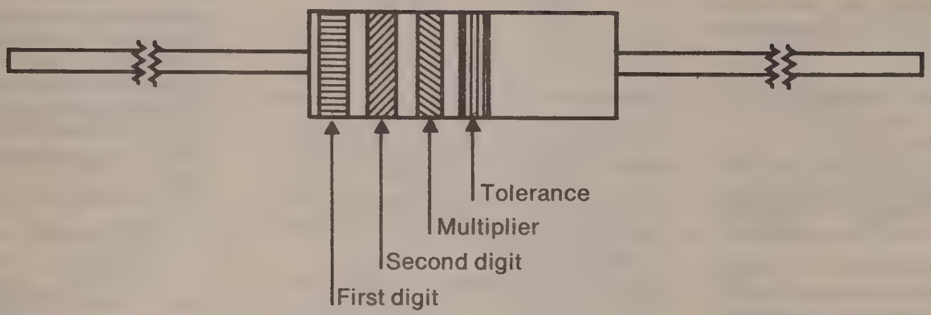
Z

Double make
Double break
SPDT-DB

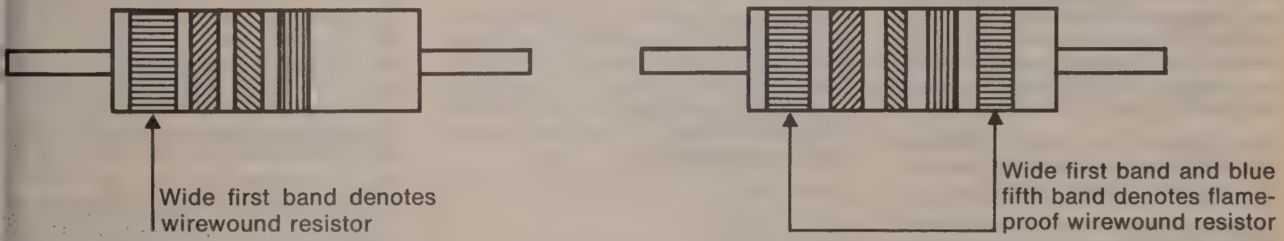


MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes


Tolerance
Multiplier
Second digit
First digit

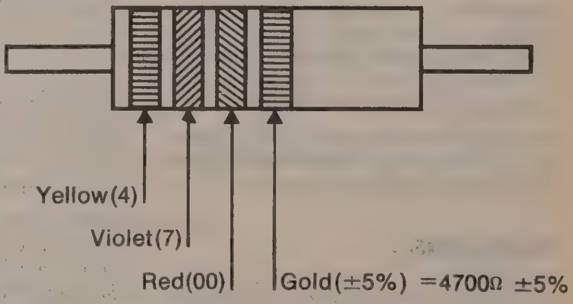
Color code for general-purpose industrial resistors


Wide first band denotes wirewound resistor
Wide first band and blue fifth band denotes flame-proof wirewound resistor

Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:


Yellow(4)
Violet(7)
Red(00)
Gold(±5%) =4700Ω ±5%

eem

MINIGLOSSARY SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

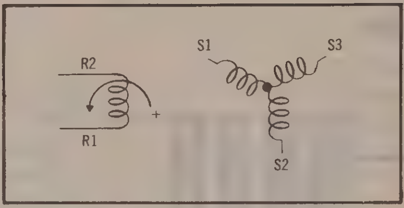
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

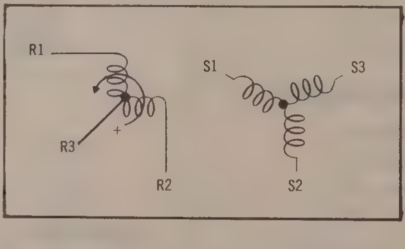
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

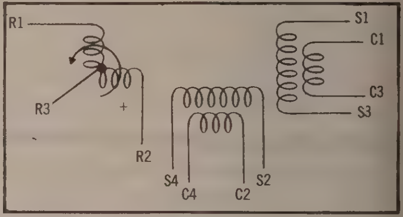
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

C Power Supplies, Product Selection Guide	D•2221
atteries, Product Selection Guide	D•1419
abinets, Enclosures, Racks & Chassis, Product Selection Guide	C•1003
apacitors, Product Selection Guide	A•1003
oils, Chokes, Inductors, Product Selection Guide	A•1179
onnectors, Terminals & Sockets, Product Selection Guide	C•1139
ores, Magnets & Ferrites	A•1317
rystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	A•1326
C-DC Converters	D•2049
C Power Supplies, Product Selection Guide	D•1488
elay Lines, Product Selection Guide	A•1513
iscrete Semiconductors, Product Selection Guide	A•2130
isplays, Readouts, & CRTs, Product Selection Guide	B•1017
ans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	C•1557
iber Optics, Product Selection Guide	B•1200
ilters, Power, Product Selection Guide	A•1584
ilters, Signal, Product Selection Guide	A•1617
nstruments, Test & Measuring, Product Selection Guide	D•1215
nterconnection Systems, Product Selection Guide	C•1670
Keyboards & Keypads, Product Selection Guide	B•1818
Lamps, Lights, & Indicators, Product Selection Guide	B•1131
Microwave Components, Product Selection Guide	A•1719
Military Qualified Products List	B•1002
Motors, Drives, & Rotating Components, Product Selection Guide	B•1231
Oscilloscopes, Product Selection Guide	D•1402
Panel Hardware, Product Selection Guide	C•1522
Panel Meters, Analog & Digital, Product Selection Guide	D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	A•2053
Power Supplies, AC, Product Selection Guide	D•2221
Power Supplies, DC, Product Selection Guide	D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	B•1341
Relays, Product Selection Guide	B•1401
Resistors, Product Selection Guide	A•1859
Solenoids, Product Selection Guide	B•1626
Switches, Product Selection Guide	B•1658
Thermal Components, Product Selection Guide	B•1857
Transducers & Encoders, Product Selection Guide	B•1911
Transformers, Product Selection Guide	A•2229
Wire & Cable, Product Selection Guide	C•1701

eem selection guide qualified products lists-2440

"Qualified Products Lists" are issued periodically by the U.S. Government as a guide for the procurement of electronic components by government contractors. Each list contains every separately designated part that has qualified under the latest Military Specification for its class and the name(s) of the manufacturer(s) of each.

EEM is publishing the names of those North American companies that are qualified producers of one or more products in each of the lists that apply to a selected group of electronic products normally cataloged in these pages. Addresses for these companies will be found in the EEM Yellow Pages.

For the complete QPLs and
update information write or call:
Naval Publication and Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120
(215) 697-3321

MIL-A-55339 FSC 5935
Adapters, Connector, Coaxial, Radio Frequency (between series and within series)

Amphenol RF Div.
AMP
Delta Electronics
RLC Electronics, Inc.

MIL-A-6752 FSC 6625
Ammeters, Voltmeters, and Loadmeters: DC

Arga Controls
Ballantine Labs., Inc.
Chace Precision Metals, Inc.
Honeywell, Inc.
Int'l Microtronics Corp.
Monroe Electronics, Inc.
North Atlantic Industries, Inc.
TIF Instruments
Weschler Instruments

MIL-B-18E FSC 6135
Batteries and Cells, Mercury Type

Alexander Batteries
Barth Electronics
Ideal Precision Meter Co.
Sencore

MIL-B-81757 FSC 6140
Batteries and Cells, Storage Nickel-Cadmium

Alexander Batteries
Avex Electronics Corp.
Chace Precision Metals, Inc.
Eagle Picher Industries
General Electric Co., Gainsville, FL
Lamp Technology, Inc.
Marathon Battery Co.
National Custom Enterprise
Rebling Plastics Co.
SAFT America, Inc.
Tauber Electronics Corp.

MIL-B-23071 FSC 4140
Blowers, Miniature, for cooling electronic equipment (10 to 500 CFM)

Chace Precision Metals, Inc.

MIL-B-5423 FSC 5930
Boots, Dust and Water Seal (for toggle and pushbutton switches and rotary-actuated parts)

A.P.M. Hexseal Corp.
Eaton Corp./Aerospace and Commercial Controls Div.
Machine Components Corp.

MIL-C-915 FSC 6145
Cable and Cord, Electrical

Anaconda-Ericsson, Inc., Continental Wire & Cable
Brand-Rex
Brim Electronics Inc.
Carol Cable
Carol Cable Co. West
Cerro Wire & Cable Co.
Chester Cable Corp.
Collyer Insulated Wire Co.
Consolidated Products Corp.
Daburn Electronics
General Cable Corp.
ITT Suprenant Div.
Marine Industrial Cable Corp.
Mohawk Wire & Cable Corp.
Monroe Wire & Cable Corp.
The Okonite Co.
Phalo Corp.
Pirelli Cable Corp.
Plastoid Corp.
Rome Cable Corp.
Teledyne Thermatics
Times Wire & Cable Co.
Vector Cable Co.

MIL-C-7974 FSC 5935
Cable Assemblies and Attachable Plugs, external electrical power, aircraft

Anderson Power Products
Carol Cable
Burton Electrical Engineering
FKS Engineering Co.
General Cable Co., Cornish Products Div.

MIL-C-22442 FSC 5965
Cable Assembly, Aircraft Audio

Astrocom Electronics, Inc.
Hiltronics Corp.
Roanwell
Telephonics

MIL-C-49055 FSC 6145
Cable, Power, Electrical (Flexible, Flat, Unshielded), (Round Conductor)

Brand-Rex Company
Chace Precision Metals, Inc.
Cooper Inds./Belden Div.
Temp-Flex Cable Inc.

MIL-C-27500 FSC 6145
Cable, Electrical, Shielded and Unshielded, Aerospace

Astro Cable Co., Inc.
Brand-Rex
Brim Electronics, Inc.
Cable USA, Inc.
Chace Precision Metals, Inc.
Cooper Inds./Belden Div.
Harbour Indl., Ltd., Canada
Judd Wire Inc.
Philadelphia Ins. Wire
Teledyne Thermatics
Tensolite Co.

MIL-C-13777 FSC 6145
Cable, Special Purpose

Brand-Rex
Chace Precision Metals, Inc.

MIL-C-17 FSC 6145
Cables, Radio Frequency: Flexible & Semirigid

Adams Russell Electronics Co. Inc.
Astro Cable Co., Inc.
Brim Electronics, Inc.
Cablewave Systems, Inc.
Carol Cable
Champlain Cable Corp.
Continental Microwave Technology, Inc.
Cooper Inds./Belden Div.
Daburn Electronics
Harbour Ind. Ltd., Canada
ITT Suprenant
Montrose Products
Penstock Inc.
Phalo Corp.
Plastoid Corp.
Precision Tube Co., Inc.
Saxton Wire and Cable
Storm Products Co.
Teledyne Thermatics
Tensolite Co.
Thermzx Wire Corp.
Times Fiber Communications, Inc.
Uniform Tubes, Inc.

MIL-C-55681 FSC 5910
Capacitors, Chip, Multiple Layer, Unencapsulated, Ceramic Dielectric

American Technical Ceramics
AVX Ceramics Corp.
Continental Microwave Technology, Inc.
Kemet Electronics
Microcap Inc.
Monolithic Components Corp.
Murata Erie North Amer., Inc.
Republic Electronics Corp.
San Fernando Electric Mfg. co.
Sprague Electric Co.
Union Carbide Corp., Greenville, SC
Unitrode Corp.
U.S. MIcrotek Components
Vitramon Inc.

MIL-C-11015 FSC 5910
Capacitors, Fixed, Ceramic-Dielectric (General Purpose)

Automation Components, Inc.
AVX Ceramics Corp.
Centralab, Los Angeles, CA
Cera-Mite Corp.
Corning Glass Works, Raleigh, NC
Kemet Electronics
Murata Erie North Amer., Inc.
North American Capacitor-Mallory
Republic Electronics Corp.
San Fernando Electric Mfg. Co.
Sprague Electric Co.
Tusonix, Inc.
Union Carbide Corp., Greenville, SC
Vitramon, Inc.

MIL-C-123 FSC 5910
Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable & General Purpose)

AVX Electronics Corp.
Kemet Electronics
San Fernando Electric Mfg. Co.

MIL-C-39018 FSC 5910
Capacitors, Fixed, Electrolytic (Aluminum Oxide)

Cornell Dubilier Electronics

MIL-C-62 FSC 5910
Capacitors, Fixed, Electrolytic (DC, Aluminum, Dry Electrolyte, Polarized)

Sprague Electric Co.

MIL-C-3965 FSC 5910
Capacitors, Fixed, Electrolytic, (Nonsolid Electrolyte), Tantalum

Continental Microwave Technology, Inc.
North American Capacitor-Mallory

MIL-C-39006 FSC 5910
Capacitors, Fixed, Electrolytic, Tantalum, Solid-Electrolyted

Continental Microwave Technology, Inc.
North American Capacitor-Mallory

MIL-C-83439 FSC 5910
Capacitors, Fixed, Feedthrough, EMI Suppression, (AC, DC, and AC-DC, Hermetically Sealed in Metal Cases)

Axel Electronics, Inc.
Murata Erie North Amer., Inc.
Tecknit, Eastern Facility

MIL-C-11272 FSC 5910
Capacitors, Fixed, Glass-Dielectric

American Technical Ceramics
Murata Erie North Amer., Inc.

MIL-C-23269 FSC 5910
Capacitors, Fixed, Glass-Dielectric

Corning Glass Works, Raleigh, NC
Vitramon, Inc.

MIL-C-39022 FSC 5910
Capacitors, Fixed, Metallized, Paper-Plastic Film, or Plastic Film Dielectric, DC and AC (Hermetically Sealed in Metal Cases)

Component Research
Electronic Concepts
Hi-Rel Capacitor, Inc.

MIL-C-5 FSC 5910
Capacitors, Fixed, Mica-Dielectric

Axel Electronics, Inc.
Cornell Dubilier Electronics

MIL-C-27287 FSC 5910
Capacitors, Fixed, Plastic Dielectric, DC (Nonmetallic Cases)

ASC Capacitors

MIL-C-55514 FSC 5910
Capacitors, Fixed, Plastic (or Metallized Plastic) Dielectric, in Nonmetal Cases

Electronic Concepts

MIL-C-19978 FSC 5910
Capacitors, Fixed, Plastic (or Paper-Plastic), Dielectric (Hermetically Sealed in Metal, Ceramic, or Glass Cases)

ASC Capacitors
Axel Electronics, Inc.
Chicago Condenser Corp.

MIL-C-83421 FSC 5910
Capacitors, Fixed, Supermetallized Plastic Film Dielectric (DC, AC or DC and AC)

Component Research Co., Inc.
Electronic Concepts
Hi-Rel Capacitor, Inc.

MIL-C-81 FSC 5910
Capacitors, Variable, Ceramic Dielectric

Murata Erie North Amer., Inc.
Tusonix, Inc.

MIL-C-14409 FSC 5910
Capacitors, Variable, (Piston-Type, Tubular Trimmer)

Murata Erie North Amer., Inc.
Sprague-Goodman Electronics, Inc.
Voltronics, Corp.

MIL-C-55629 FSC 5925
Circuit Breakers, Magnetic, Unsealed or Panel Seal, Trip Free

Chace Precision Metals, Inc.
Heinemann Electric Co.

MIL-C-5809 FSC 5925
Circuit Breakers, Trip Free

Chace Precision Metals, Inc.
E-T-A Circuit Breakers

MIL-C-7079 FSC 5925
Circuit Breakers, Non Trip Free

Chace Precision Metals, Inc.
Eaton Corp./Aerospace and Commercial
  Controls Div.

MIL-C-5015 FSC 5935
Circular Metal Shell Connectors

AMP Inc.
Trans Technology Electronics

MIL-C-85049 FSC 5935
Circular Connector Backshell Hardware

AMP Inc.

MIL-C-15305 FSC 5950
Coils, Fixed and Variable, Radio Frequency

CELCO
Piconics, Inc.
Standex Electronics
Torotel Products, Inc.
Vanguard Electronics Co., Inc.

MIL-C-83503 FSC 6145
Connector, Electrical, Flat Cable, and/or Printed Wiring Board, Nonenvironmental

AMP Inc.
CW Industries

MIL-C-25516 FSC 5935
Connector, Electrical, Miniature

Chace Precision Metals, Inc.

MIL-C-38999 FSC 5935
Connectors, Circular Metal Shell

AMP Inc.

MIL-C-83723 FSC 5935
Connectors, Circular Metal Shell

AMP Inc.

MIL-C-39012 FSC 5935
Connectors, Coaxial, Radio Frequency

Adams Russell Electronics Co. Inc.
AMP Inc.
Amphenol RF Div.
Amphenol, Wallingford, Conn.
Applied Engineering Products
Automatic Connector, Inc.
Bendix Corp., Electrical Components Div.
Cablewave Miniature Products
Continental Microwave Technology, Inc.
Delta Electronics Mfg. Corp.
ITT Cannon Electric, Phoenix, AZ
E. F. Johnson
Kings Electronics Co., Inc.
M/A COM OMNI Spectra, Inc., Microwave Connector Div.
Micro-Mode Products, Inc.
Midwest Microwave
Penstock Inc.
Radiall
Sealectro Corp.
Solitron/Microwave
Specialty Connector Co.

MIL-C-21097 FSC 5935
Connectors, Electrical, Printed Wiring Board

AMP Inc.
Chace Precision Metals, Inc.
Elco Corp.

MIL-C-28748 FSC 5935
Connectors, Electrical, Rectangular, Rack & Panel, Solder Type, & Crimp Type Contacts

Chace Precision Metals, Inc.
Hughes Aircraft Co., Interconnect Sys. Div.
Positronic Industries, Inc.

MIL-C-83513 FSC 5935
Connectors, Electrical, Rectangular, Microminiature, Polarized Shell

Air Born Inc.
Elco Corp.
Min-E-Con

MIL-C-22992 FSC 5935
Connectors, Electrical Waterproof, Quick Disconnect, Heavy Duty Type, & Accessories

Amphenol Corp./Bendix OPS.
Chace Precision Metals, Inc.

MIL-C-28804 FSC 5935
Connectors, Electric, Rectangular, High Density, Polarized Center Jackscrew

CW Industries
Hughes Aircraft Co., Interconnect Sys. Div.

MIL-C-24308 FSC 5935
Connectors, Electric Rectangular, Miniature Polarized Shell, Rack Panel

AMP Inc.
Amphenol Corp./Bendix OPS.
Continental Microwave Technology, Inc.
CW Industries
Lyn-Tron, Inc.
Positronic Industries, Inc.

MIL-C-26500 FSC 5935
Connectors, General Purpose, Electrical, Miniature, Circular

Chace Precision Metals, Inc.

MIL-C-55302 FSC 5935
Connectors, Printed Circuit Sub Assembly and Accessories

Air Born Inc.
AMP Inc.
Continental Microwave Technology, Inc.
Elco Corp.
ERNI Components
Hypertronics Corp.
Texas Instruments Inc.

MIL-C-26482 FSC 5935
Connectors, Series I

AMP Inc.
Array Connector Corp.

MIL-I-81969 FSC 5120
Contact Extraction Tools

AMP Inc.

MIL-C-39029 FSC 5935
Contacts, Pin and Socket

AMP Inc.

MIL-C-22520 FSC 5120
Crimping Tools

AMP Inc.
Elco Corp.

MIL-D-83532 FSC 5999
Delay Lines, Active

Datatronics, Inc.
Hytek Microsystems, Inc.
Technitrol

MIL-D-83531 FSC 5999
Delay Lines, Passive

Datatronics, Inc.
Technitrol

MIL-D-3954 FSC 5985
Dummy Load, Electrical, Waveguide

Antenna Specialists: The Allen Group
Barth Electronics
Coaxial Dynamics
Penta Labs
Struthers Electronics Corp.

MIL-E-1 FSC 5960
Electron Tubes

Amperex Electronic Corp., Hicksville Div.
Beam Tube Corp.
Cetron Electronics
Chace Precision Metals, Inc.
EG & G, Inc., Electro-Optic Div.
GEC Technology Corp.
General Atronics Corp.
General Electric Co., Microwave Tube Operation
General Electric Co., MIDPS
Imaging and Sensing Technology Corp.
ITT Electron Tube Div.
Litton Industries, Electron Tube Div., Williamsport, PA
LND, Inc.
Machlett Labs., Inc.
Microwave Assoc., Inc., Burlingame, MA
M.U. Incorporated
National Electronics, Inc.
OMNI-Wave Electronics corp.
Philips ECG, Inc., Altoona, PA
Raytheon Co., Quincy, MA
Raytheon, Waltham, MA
RCA Corp., Lancaster, PA
TGM Detectors, Inc.
Thomas Electronics, Inc.
Thomson-CSF Comps. Corp., Dover, NJ
Varian Assoc., Palo Alto, CA
Varian Canada, Inc., Georgetown, Ont.
Varo Electron Devices, Inc.
Watkins-Johnson Co., Stewart Div.
Western Electric Co., Inc.
Westinghouse Electric Corp., Electronic Tube Div.

MIL-F-15733 FSC 5915
Filters, Radio Interference

Axel Electronics, Inc.
BG Electronics, Div. of E.P.C. Corp.
Murata Erie North Amer., Inc.
Oxley Inc.
RFI Corp.
Spectrum Control, Inc.

MIL-F-18327 FSC 5915
Filters: High Pass, Low Pass, Band Suppression & Dual Functioning

ADC Products
AMP Incorporated
Alpha Components Inc.
BG Electronics
Coaxial Dynamics
Conolog Corp.
Damon Corp.
Electronic Precision Instruments
OPT Industries, Inc.
Piezp Technology
TRW Inductive Products Div.
Tycor International, Inc.
Zambre Co., Inc.

MIL-F-23419 FSC 5920
Fuses, Instrument Type

Bussman Mfg. Div., McGraw-Edison Co.
Littelfuse, Inc.

MIL-I-83287 FSC 6625
Indicators, Fault Locating

Lamp Technology, Inc.
Minelco, Inc.
Sencore

MIL-I-46058 FSC 5970
Insulating Compound, Electrical

Ausimont
Capsulated Systems, Inc.
Co-Polymet Chemicals Inc.
Conap Inc.
Continental Microwave Technology, Inc.
Dow Corning Corp.
Epic Resins
General Electric Co./Silicon Prods.
HumiSeal Div.
Hysol Div./Dexter Corp.
Loctite Corp.
M & T Chemicals Inc.
Markel Corp.
McGhan Nusil Corp.
Paraline Products/Union Carbide
Polyfibron Div./W. R. Grace & Co.
Products Research & Chemical Corp.
SWS Silicons Corp.
Westinghouse Electric Corp.
3M/Commerial Chemicals Div.

MIL-I-1361 FSC 6625
Instrument Auxiliaries, Electrical Measuring: Shunts, Resistors, & Transformers

Arga Controls
Ballantine Labs., Inc.
Jonard Inds. Corp.
Square D Co.

MIL-I-27273 FSC 6130
Inverter, Power, Static

Hamilton Standard Div., United Technologies Corp.
Magnetika, Inc.

MIL-J-641 FSC 5935
Jacks, Telephone

Adc Products
Kings Electronics Co., Inc.
Paladin Corp.
Switchcraft, Inc.

MIL-L-3661 FSC 6210, 6250
Lampholders, Indicator Lights, Indicator Light Housings, & Indicator Light Lenses

Chace Precision Metals, Inc.
Dialight Corp.
Lamp Technology, Inc.

MIL-M-3971 FSC 6644
Meters, Time Totalizing, Non-hermetically Sealed, Electrical

Chace Precision Metals, Inc.
Crompton Metermaster Inc.

MIL-M-10304 FSC 6625
Meters, Electrical Indicating, Panel Type, Ruggedized

Arga Controls
Ballantine Labs., Inc.
Chace Precision Metals, Inc.
Crompton Metermaster, Inc.
Ideal Precision Meter Co.
International Microtronics Corp.
Monroe Electronics, Inc.
Sencore
TIF Instruments
Weschler Instruments

MIL-O-55310 FSC 5955
Oscillators, Crystal

Continental Microwave Technology Inc.
Hyundai Electronics Semiconductor Ass'y Div.
Oscillatek
Q-Tech Corp.
Vectron Laboratories
XSIS Electronics, Inc.

MIL-P-55149 FSC 5935
Posts, 5-Way Binding

Superior Electric

MIL-P-26517 FSC 6130
Power Supply, Transformer-Rectifier, Aircraft

CELCO
CPS
Dynamic Power Sys.
Dynapower Corp.
Epsco Inc.
Power Conversion America/Computer Products
Powercube Corp.
Tecnetics

MIL-P-55110 FSC 5998
Printed Wiring Boards

AAA Circuits, Inc.
Basler Electric
Continental Microwave Technology Inc.
Digitran
General Technology Corp.
North Texas Circuit Board
Protosystems
RJ Bohacik
Speedy Circuits

MIL-C-81659 FSC 5935
Rack and Panel, Connectors,

AMP Inc.

MIL-R-28803 FSC 6240
Readouts, Segmented

Lumitron Corp.

MIL-R-19648 FSC 5945
Relays, Time Delay, Thermal

Chace Precision Metals, Inc.
Timeco, Inc.
Warren G-V

MIL-R-39016 FSC 5945
Relays, Electromagnetic

Chace Precision Metals, Inc.
Communications Instruments, Inc.
Deutsch Relays Inc.
Genicom Corp.
Ross Engineering Corp.
Struthers-Dunn, Inc.

MIL-R-83407 FSC 5945
Relays, Reed (Mercury Wetted)

Mepco/Centralab
Struthers-Dunn, Inc.

MIL-R-28750 FSC 5945
Relays, Solid State

Micropac Industries, Inc.
Timeco, Inc.

MIL-R-83726 FSC 5945
Relays, Time Delay, Electric & Electronic

Chace Precision Metals, Inc.
Deutsch Relays Inc.
Struthers-Dunn, Inc.
Timeco, Inc.

MIL-R-83401 FSC 5905
Resistor Networks, Fixed Film

Allen-Bradley Co.
Angstrohm Precsion Inc.
Bourns, Inc.
California Micro Devices, Inc.
Continental Microwave Technology, Inc.
Dale Electronics, Inc., Columbus, NE
Elliott/Jordan
Hycomp Inc.
IRC, Inc.
KDI Pyrofilm Corp.
Mepco/Electra, Inc., Morristown, NJ
Solitron Devices
Solitron/Microwave
Sprague Electric Co.
Techno-Comps. Corp.
TRW Resistors
Ultronix Inc.
Vishay Resistive Systems

MIL-R-39008 FSC 5909
Resistors, Fixed, Composition (Insulated)

Allen-Bradley Co.
Continental Microwave Technology, Inc.
Ohmite Mfg. Co.

MIL-R-55342 FSC 5905
Resistors, Fixed, Film, Chip

Amitron
Bourns, Inc.
Continental Microwave Technology Inc.
IRC, Inc.
Mini-Systems, Inc.
Solitron/Microwave
State-of-the-Art, Inc.

MIL-R-94 FSC 5905
Resistors, Variable, Composition

Allen-Bradley Co.
Angstrohm Precision Inc.
Clarostat Manufaturing Co., Inc.
Elliott/Jordan
Ohmite
Precision Electronic Components
Vishay Resistive Systems Group
CAL-R, Inc.
Dale Electronics, Inc., Columbus, NE
E-Systems, Inc., Memcor, Div.
Memcor-Truohm Group Inc.
Nytronics Components Group Inc.
Ohmite Mfg. Co.
Pacific Resistor Co.
RCL/Shallcross, Inc.
TEL-Labs, Inc.
Tepro of Florida, Inc.
Ultronix, Inc.
Vishay Resistive Systems Group
Ward Leonard Electric Co.

MIL-R-22097 FSC 5905
Resistors, Variable, Non-Wirewound (Adjustment)

Bourns, Inc.
Clarostat Manufaturing Co., Inc.

MIL-R-39035 FSC 5905
Resistors, Variable, Non-Wirewound (Adjustment)

Bourns, Inc.

MIL-R-27208 FSC 5905
Resistors, Variable, Wirewound (Adjustment)

Bourns, Inc.

MIL-R-39015 FSC 5905
Resistors, Variable, Wirewound (Lead Screw Actuated)

Bourns, Inc.
Continental Microwave Technology, Inc.

MIL-R-22 FSC 5905
Resistors, Variable (Wirewound, Power Type)

Angstrohm Precision Inc.
Elliott/Jordan
E-Systems, Inc., Memcor Div.
Memcor-Truohm, Inc.
  Litton Potentiometer Div.
Ohmite Mfg. Co.
Vishay Resistive Systems Group

MIL-S-19500 FSC 5961
Semiconductor Devices, General

Advanced Power Technology, Inc.
BKC Semiconductor Inc.
Centronic, Inc.
Compensated Devices Inc.
Fagor Electronics Components Inc.
General Semiconductor Industries, Inc.
International Rectifier
Lake Shore Cryotronics, Inc.
Micro Networks
Micropac Industries, Inc.
Microsemi Corp.-Scottsdale
New England Semi
Optek Technology, Inc.
PowerTech, Inc.
PPC Products Corp.
Semtech Corp.
Sensitron Semiconductor
Solid State Devices
Solid State Testing, Inc.
Solitron Devices, Inc.
Voltage Multipliers, Inc.

MIL-S-22432/9 FSC 6105
Servomotor, Type 18SM4c

Astromec, Inc.
Island Components Group
Starlust-Martin, Inc.
Tachtronic Instruments, Inc.

MIL-I-23053 FSC 5970
Shrink Tubing

AMP Inc.

MIL-S-12883 FSC 5935
Sockets & Accessories for Plug-in Electronic Components

Augat, Inc.
Deutsch Relays, Inc.
Eby Company

MIL-S-3928 FSC 5985
Switches (Coaxial), RF Transmission Line

Ampheonol, RF Operations
M/A COM OMNI Spectra Inc.
RLC Electronics Inc.
Transco Products, Inc.

MIL-S-83504 FSC 5930
Switches, Dual-In-Line Package (DIP)

Grayhill, Inc.

MIL-S-9395 FSC 5930
Switches, Pressure (Absolute, Gauge & Differential)

Chace Precision Metals, Inc.
Norgren

MIL-S-3786 FSC 5930
Switches, Rotary, Selector

Cole Instrument Corp.
Grayhill, Inc.

MIL-S-6807 FSC 5930
Switches, Rotary, Selector

Electro-Switch Corp.

MIL-S-15291 FSC 5930
Switches, Rotary, Snap-Action

Shallco, Inc.

MIL-S-8805 FSC 5930
Switches & Switch Assemblies, Sensitive & Push (Snap Action)

Eaton Corp./Aerospace and Commercial
  Controls Div.
Machine Components Corp.
Micro Switch, A Honeywell Div.
Staco Switch
Unimax, A Division of C & K

MIL-S-13625 FSC 5930
Switches, Pull; Switches, Push; Switches, Beam Selecting Headlight: Electrical (28 Volts Max., for Military Vehicles)

Accurate Electronics Corp.

MIL-S-22885 FSC 5930
Switches, Pushbutton, Illuminated

APM Hexseal Corp.
Eaton Corp./Aerospace and Commercial
  Controls Div.
Micro Switch, A Honeywell Div.
Staco Switch
Unimax, A Division of C & K

MIL-S-22710 FSC 5930
Switches, Rotary (Printed Circuit), (Thumbwheel, Inline & Pushbutton)

Digitran Div., Xcel Corp.
EECO, Inc.
Janco Corp.
Roanwell

MIL-T-7928 FSC 5940
Terminals & Splices (insulated/uninsulated)

AMP Inc.
Nichifu
Panduit Corp.

MIL-T-81714 FSC 5935
Terminal Junction Systems

AB Controls & Technology
AMP Inc.

MIL-T-23648 FSC 5905
Thermistor, (Thermally Sensitive, Resistor) Insulated

Ketema Rodan Div.
Quality Thermistor, Inc.
Victory Engineering Corp.
Yellow Springs Instrument Co.

MIL-T-27 FSC 5950
Transformers & Inductors (Audio, Power, & High-Power Pulse)

Abbott Technologies, Inc.
Axel Electronics, Inc.
Berkshire Transformer
BG Laboratories, Inc.
Coast Magnetics (0103168)
Coast Magnetics (0103360)
Datatronics, Inc.
EG & G Electro-Optics
Electronic Transformer Corp.
Fernwood Transformer
Freed Transformer Co.
ILC Data Devices Corp.
Keytronics, Inc.
Magnetic Circuit Elements
Magnetico Inc.
Microtran Co., Inc.
OPT Industries Inc.
Pico Electronics, Inc.
Premier Magnetics, Inc.
Robert M. Hadley Co., Inc.
Schott Corp. (0424320)
Torotel Products, Inc.
Trans American

MIL-T-27535 FSC 5950
Transformer, Power, Isolation, Series Circuit

Chace Precision Metals, Inc.
ILC Data Devices Corp.
Tycor International, Inc.

MIL-T-21038 FSC 5950
Transformers, Pulse, Low Power

Axel Electronics, Inc.
Coast Magnetics
Datatronics, Inc.
ILC Data Devices Corp.
OPT Industries Inc.
Pico Electronics
Technitrol

MIL-V-9999 FSC 6625
Voltmeters, Electronic

Arga Controls
Ballantine Labs., Inc.
Chace Precision Metals, Inc.
Electro-Tech Systems, Inc.
Monroe Electronics, Inc.
Senocore
TIF Instruments

MIL-W-16878 FSC 6145
Wire, Electric, Polyvinyl Chloride Insulated

Brand-Rex
Brim Electronics, Inc.
Continental Microwave Technology Inc.
Judd Wire Inc.
Markel Corp.
Montrose Products
National Wire & Cable Corp.

MIL-W-22759 FSC 6145
Wire, Electric, Crosslinked, Fluoropolymer Insulated, Modified ETFE, Normal Weight, Nickel Coated, High Strength Copper Alloy, 200 Deg. C, 600 Volt

Brand-Rex
Brim Electronics, Inc.
Cable USA, Inc.
Cooper Inds./Belden Div.
Judd Wire Inc.
Montrose Products
Teledyne Thermatics
Tensolite Co.

MIL-W-81381 FSC 6145
Wire, Electric, Polymide-Insulated, Copper or Copper Alloy

Brim Electronics, Inc.
Judd Wire Inc.
Teledyne Thermatics
Tensolite Co.

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- what you call them
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- glossaries
- nomographs
- charts
- product selection guides

Write to the editor: The Editor
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MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

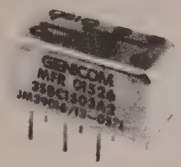
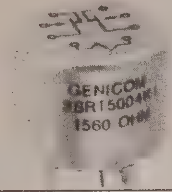
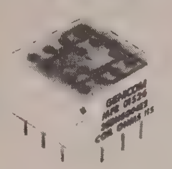
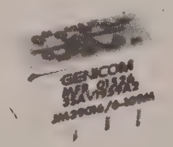
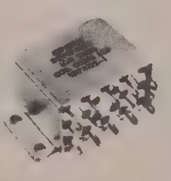
Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

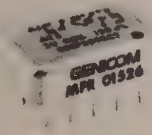
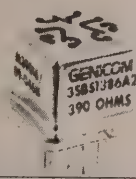
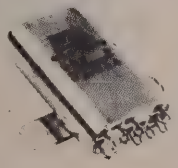
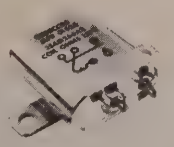
SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE		SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-39016	SHOCK	VIBRATION	TEMPERATURE RANGE	GENI 500 CATALOG PAGE
			CURRENT LEVELS AT 28 VDC AT 115 VAC*	OPERATIONS							
3SBC 1/5 Size Two Pole 150 Grid Hybrid		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 10^6	Size .61 × .31 × .32 Weight 0.13	135 mW	/13 /37 /38	100G @ 11 ms	30G 55- 3000 Hz	−65C +125C Special +200C	12 13
3SRT Round to ^{5} Relay		2PDT	1A-DC .2A-DC IND Low Level	10^5 10^6	Size .370 Dia. x.280 Weight .09 oz.	120 mW	/9 /15	100G @ 11 ms	30G 55- 3000 Hz	-65C +125C	
3SBH 1/5 Size Four Pole 150 Grid Hybrid		4PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 10^6	Size .61 × .61 × .32 Weight 0.24	250 mW	/14 /53 /54	100G @ 11 ms	30G 55- 3000 Hz	−65C +125C Special +200C	16 17
3SBM 1/2 Size 150 Grid Latching Hybrid		4PDT	2A DC Res .5A DC Ind .5A-DC Low Level	10^5 10^6	Size .61 × .61 × .32 Weight 0.28	100mW Single Coil or 180mW Dual Coil	/31 /35 /36	150G @ 11 ms	30G 55- 3000 Hz	−65C +125C Special +200C	20 21
3SAV Half-Size Sensitive R.F.		2PDT	2A DC Res .5A DC Ind .75 A-AC Low Level	10^5 10^6	Size .80 × .40 × .40 Weight 0.30	100mW to 260mW	/6 /22 /33 /44 /55	100G @ 11ms	20G 10- 2000 Hz **	−65C +125C Special +200C	23 24
3SAH Four Pole Grid		4PDT	2A DC Res .5A DC Ind 1A-AC Low Level	1 × 10^5 at 2A dc at 1A AC 1 × 10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW	/39	50G @ 11ms	30G 55- 3000 Hz	−65C +125C Special +200C	27
3SCM DeciGrid® Mag- Latch 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	105 mW	/47	100G @ 6ms	30G 55- 3000 Hz	−65C +125C	6

**30G 55-3000 Hz Available

*Single-phase load, case not grounded

*®GENICOM Corporation, Relays, 1 Genicom Drive
Waynesboro, VA 22980, 1-703-949-1471

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE		SIZE NO MOUNT L"×W"×H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-39016	SHOCK	VIBRATION	TEMPERATURE RANGE	GENI 500 CATALOG PAGE
			CURRENT LEVELS AT 28 VDC AT 115 VAC*	OPERATIONS							
3SCP DeciGrid® Mono-stable 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	68 mW	/48	100G @ 6ms	30G 55-3000 Hz	−65C +125C	7
3SAM Mag-Latch Grid-Space		2PDT	2A DC Res .5A DC Ind 1A-AC Low Level	10^5 at 2A DC at 1A AC 10^6	Size .80 × .40 × .90 Weight 0.60	50mW Single Coil 75mW Dual Coil	/32	150G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C	34
3SAF Grid Spaced Micro Crystal Can		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC 10^6	Size .80 × .40 × .90 Weight 0.50	300 mW		100G @ 11 ms	30G 55-2000 Hz	−65C +125C	30
3SBS Transistor Size Relay		2PDT	1A DC Res .2A DC Ind Low Level	10^5 10^6	Size .37 × .37 × .275 Weight 0.09	120 mW	/9 /15 /20	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C	9
3SAC Crystal Can "S" Header		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 2A DC at 1A AC 10^6	Size .797 × .359 × 1.187 Weight 0.90	200 mW		50G @ 11ms	10G 55-2000 Hz	−65C +125C	38
3SAE Crystal Can "S" Header		2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × .875 Weight 0.45	330mW		100G @ 11ms	20G 55-2000 Hz	−65C +125C	38
3SAV-RF with Co-ax Cables		2PDT 1PDT	25 Watts 10 Watts Low Level	10^5 10^6	Size .86 × .40 × .46 Weight .35 oz. max	260 mW 100 mW	/33	100G @ 11ms	20G 10–2000Hz **	−65C +125C	44

*Single-phase load, case not grounded **30G 55-3000 Hz Available

Continued on next page.

INFODEX

DISPLAY SYSTEMS TECHNOLOGIES

CRT DISPLAYS

FOR LAND • SEA • AIR BASED SYSTEMS

- **Responsive to your needs**
- **Cost effective and price competitive**
- **Limited quantity and large volume production**

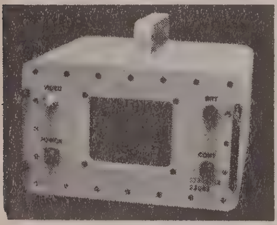
U.S. Army Communications Jamming System

XY05-M-21
5" diagonal CRT; electrostatic stroke deflection; MIL qualified; 2MHz vertical response; 28vdc

U.S. Army Radar Bomb Training System

RD12-M5-145
12" diagonal raster CRT; MIL compliant; 15.75KHz horizontal scan; ruggedized unit; EMI/antireflective bonded face panel; 115V 60Hz

U.S. Army Hawk System

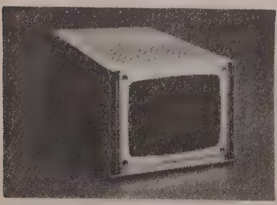


RD06-M5-280
6" diagonal raster CRT; MIL compliant, 15.75KHz horizontal scan; sunlight readable; high resolution; 28vdc

U.S. Navy Shipboard Computer Display

RD17-M10-214
17" diagonal raster CRT: 45MHz video BW; high resolution; MIL compliant; 50kHz horizontal scan; 115V 60Hz

U.S. Navy Shipboard Test Set

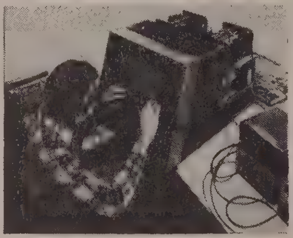


RD06-M5-138
6" diagonal raster CRT; MIL compliant; 15.75KHz horizontal scan; sunlight readable; high resolution; 15 vdc

U.S. Navy Active Emission Sonar Display

RD09-M8-238
9" diagonal raster; MIL compliant; 26.25KHz horizontal scan; 25MHz video BW; 115V 3Ø 60Hz

U.S. Navy Automated Carrier Landing Display

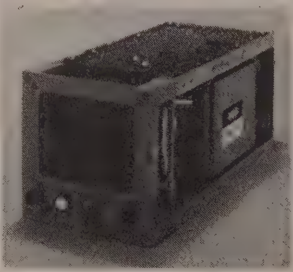


XY21-M-135
21" diagonal; both electrostatic and magnetic deflection system for vector, character and radar display; MIL qualified; 10MHz vertical, 3.5MHz horizontal scan response; 208V 3Ø 60Hz

NASA Space Shuttle Simulator Display

RD09-J5-160
9" diagonal raster CRT; ruggedized unit; 15.75KHz horizontal scan; sunlight readable; 28vdc

U.S. Air Force Flight Line Tester



RD06J5X-276
6" diagonal display with selectable 15.75kHz, 26.25kHz horizontal scan rates or stroke mode; 20MHz video BW; high resolution; 28/300vdc

INFODEX

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INFODEX

DISPLAY SYSTEMS TECHNOLOGIES

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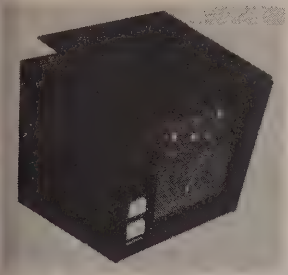
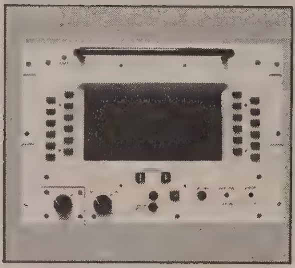
- Lightweight, compact units for military and industrial applications
- MIL STD 2000 and 810 complaint
- Integrated IR Touch System
- Alpha numeric and graphics up to 38K baud rate
- Keypads and keyboard
- Custom Design available

U.S. Army Vulcan Gun



EL66M44
High brightness; Custom interface; Used in rugged conditions: dust, rain & vibration

U.S. Air Force Joint Tactical Information Display



EL66M48M-049
Standard bright; TTL interface

U.S. Marine Corp. Ground Mobile Jamming Equipment

EL66J44A-062
High brightness; alpha numeric and graphic controller

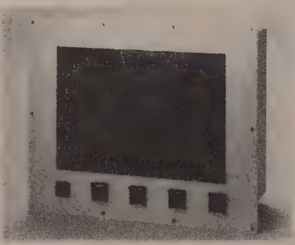
U.S. Navy EA6B Communication Jamming System

EL66J44A-064
High brightness; alpha numeric and graphic controller

U.S. Navy Electronic Surveillance System

EL66M48
High brightness; 4 level gray scale; MIL STD 1553B compatible; integral alphanumeric controller

Foreign Navy Decoy Launching System



EL831S58AT-071
Standard bright; alpha numeric and graphic controller; IR touch panel.

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eem

MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

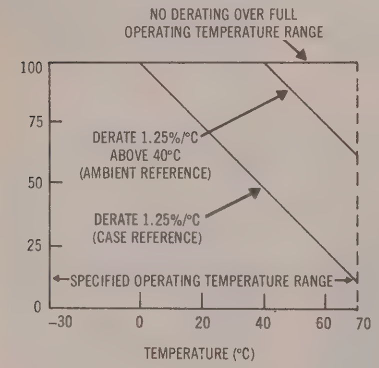

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

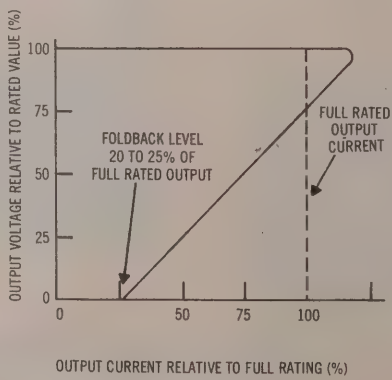

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

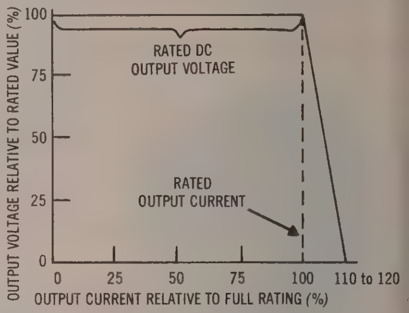

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

Philips Components

Discrete Products Division

A North American Philips Company

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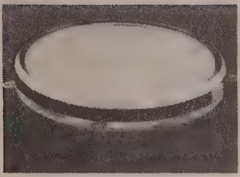
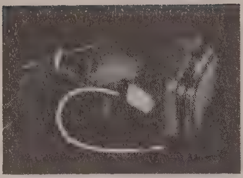
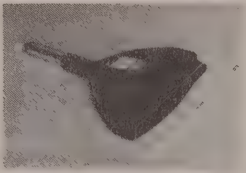
STANDARD CAPACITOR MIL SPECIFICATION APPROVALS

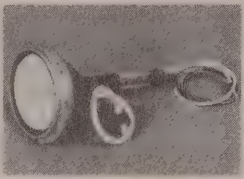
TANTALUM:	Wet Slug		MIL-C-3965
	CL14/CL16	hermetic seal, screw mount, cylindrical case	
	CL17/CL18	hermetic seal, stud mount, cylindrical case	
	CL55	hermetic seal, rectangular module	
	CL64/CL65	elastomer seal, axial lead, tubular case	
	CL66/CL67	hermetic seal, axial lead, tubular case	
	Wet Slug, established reliability		MIL-C-39006
	CLR10	extended range, axial lead, tubular case	
	CLR14	extended range, cylindrical case, solder lug terminal	
	CLR17	extended range, cylindrical case, solder lug terminal	
	CLR65	glass-to-tantalum hermetic seal, axial lead, tubular case	
	CLR79	hermetic seal, tantalum case, axial lead, tubular case	
	CLR81	extended range, hermetic seal, tantalum case, axial lead, tubular case	
	Solid Slug		MIL-C-26655
	CS12/CS13	hermetic seal, axial lead, tubular case	
	Solid Slug, established reliability		MIL-C-39003
	CSR13	polar, hermetic seal, axial lead, tubular case	
	CSR21	polar, high frequency, hermetic, tubular case, axial lead	
	CSR23	polar, extended range, hermetic seal, axial lead, tubular case	
	CSR33	polar, extended range, hermetic seal, for low impedance application	
	CSR91	non-polar, hermetic seal, axial lead, tubular case	
	Solid Chip, established reliability		MIL-C-55365
	CWR06	polar, hybrid tantalum chip	
	CWR11	molded tantalum chip, polar	MIL-C-55365

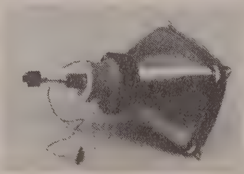
Raytheon

When Your Cathode Ray Tube Needs Are Very Special







Come to Raytheon for a wide range of special-purpose, high-performance Cathode Ray Tubes (CRTs), custom-designed for specific applications. Raytheon's Quincy Display Devices group can meet the most difficult specifications. CRTs for all military environments, air traffic control, simulators, projectors, marine radar and other high-performance commercial end uses are our specialty.

Raytheon offers extensive applications engineering expertise to tailor existing CRTs to meet your requirements, or to design various elements to meet your exacting specification.

Raytheon CRTs are available in quantities of one to thousands; from 'bare bulb' to packaged assemblies containing any of the following elements:

- Magnetic shield
- Contrast-enhancement filter
- Focus coil
- Flying leads
- Multi-pin connectors
- Protective panel
- Magnetic deflection coil
- Beam centering devices
- Encapsulation
- Input circuitry for arc protection
- Tension band or other implosion protection feature

Each of these features is carefully selected from standard product, or custom-designed to satisfy the user's requirements. Encapsulation may include two or more shock-absorbing materials (such as silicon) of differing densities, resilience, thermal conductivity and energy absorbing properties arranged to control weight distribution, minimize mechanical resonances, prevent electrical leakage and breakdown, facilitate heat dissipation, allow for differential thermal expansion, and cushion the CRT against shock and vibration.

Raytheon's RAYVUE™ organically compounded, narrow-pass contrast enhancement filters offer bandpass tailoring to match phosphor spectral response, providing the highest efficiency available.

Raytheon CRT assemblies are installed in nearly every military aircraft of the United States, NATO, and several other countries, as well as on surface ships, submarines, land vehicles and fixed ground-based installations, such as Patriot missile launchers.

Raytheon provides the 23-inch diameter tubes for the en-route air traffic control centers and the 16-inch CRTs for airport control towers ("BRITE") displays. Recently, Raytheon designed and built the high brightness ten and fourteen-inch-square "Tower Monitors" for the FAA Advanced Automation System air traffic control system. Many foreign governments also utilize Raytheon CRTs in their air traffic control systems.

Raytheon's Product Assurance department administers systems for rigorously maintaining the highest quality, reliability and safety for all its display products. The Quincy manufacturing plant is qualified to MIL-Q-9858A and MIL-1772. Our extensive in-house processes include an environmental laboratory for computer-controlled tests of shock, vibration (including random), humidity, temperature, altitude, pressure, salt spray, and solar radiation exposure. Nearby laboratories assist with tests of explosive atmosphere, sand and fungus growth.

Raytheon company is a Massachusetts-based Fortune-50 Company with operations equally divided between defense and commercial electronics, manufacturing, aircraft, major home appliances, construction and pollution control systems.

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We Thrive On Challenges.

Raytheon

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617.479.5300 FAX 617.984.4196

Representation in: England • Netherlands • Israel • Italy • Japan • Korea • Germany

DISPLAYS

Manufacturer	Starting EEM Page No.	Single Character	Multi-Character	Multi-line	Height: 1/2" or less	Height: >1/2" <1 in.	Height: 1 in. or more	Segmented	Dot Matrix	Graphics	Light Type: Electro-magnetic	Light Type: Incandescent	Light Type: LED	Light Type: LCD	Light Type: Plasma Planar Gas Discharge	Light Type: Vacuum Fluorescent	Light Type: Electro-luminescent	Custom Design	CRT	Panels: Back/Edge Lighted
American Control Technology	B•1665	√	√	√	√	√	√	√	√	√			√	√				√		√
Apollo Display Technology	B•1019		√	√	√	√	√	√	√	√				√		√		√		√
Applied Display & Control	B•1020		√	√	√	√	√	√	√	√	√		√	√	√	√	√	√		√
Babcock Display Products	B•1021		√	√				√	√	√					√	√		√		
Canyon Electronics	B•1022	√	√		√	√	√	√	√				√		√			√		
Cherry Electrical Products	B•1023		√	√	√	√	√	√	√						√			√		
C-Itoh	B•1027	√	√							√			√	√						
Dale Electronics	B•1024	√	√	√	√	√	√	√	√						√			√		√
Data Ray Corp.	B•1028																		√	
DCI Inc.	B•1032	√	√	√	√	√	√	√	√					√				√		√
Densitron Corp.	B•1033									√				√	√		√			√
Digitran	B•1035	√	√		√	√	√						√	√	√	√	√	√	√	√
Dio-Rey/Info-Lite Corp.	B•1036	√	√				√	√	√	√			√					√		√
Electronic Displays, Inc.	B•1043	√	√	√	√	√	√	√	√				√	√		√		√		
Endicott Research Group	B•1045													√	√	√				√
Epson America	B•1050	√	√							√				√			√			√
Excel Technology International	B•1062	√	√	√	√	√	√	√	√					√				√		√
Fema Electronics Corp.	B•1063	√	√	√	√	√	√	√	√	√			√	√				√		√
Fox Meter	B•1065		√	√	√	√	√	√	√	√			√					√		
FP Electronics	B•1066	√	√	√		√	√	√	√	√	√	√	√	√			√	√		
Hantronix Inc.	B•1070		√	√	√	√	√	√	√	√			√				√	√		√
The Hirol Co.	B•1072																	√		
Hitachi America	B•1073		√	√		√	√		√		√			√				√		√
Homalite	B•1077											√	√	√	√	√	√	√	√	√
IEE (Industrial Electronics Engineering)	B•1078	√	√	√	√	√	√	√	√			√	√	√	√	√	√	√		√
Infodex	B•1080						√										√	√	√	
Intronics	B•1081	√	√			√	√	√	√					√						
Ledtech Electronics	B•1082	√	√		√	√	√	√	√				√			√		√		√
LXD Inc.	B•1086	√	√	√	√	√	√	√	√					√				√		
Multinational Resources	B•1044																			√
NEC Electronics Inc.	B•1088		√	√	√			√	√	√						√		√		
Nissei Electronics Inc.	B•1091	√	√	√	√	√	√	√	√	√			√	√				√		√
Noritake Company	B•1094	√	√	√	√	√	√	√	√	√						√		√		
Ocular Inc.	B•1096	√	√	√	√	√	√	√	√				√				√			√
Okaya Electric America	B•1098	√	√	√	√	√	√	√	√	√			√	√	√			√		√
Omega Engineering, Inc.	B•1796		√	√	√	√	√	√	√				√	√		√	√			
Omnivision	B•1101																		√	
Optrex/Satori	B•1102		√	√	√	√	√		√	√				√						√
Polytronix	B•1106	√	√		√	√	√	√						√				√	√	
Raytheon/MSD	B•1108									√								√	√	

DISPLAYS (cont'd)

Manufacturer	Starting EEM Page No.	Single Character	Multi-Character	Multi-line	Height: 1/2" or less	Height: >1/2" <1 in.	Height: 1 in. or more	Segmented	Dot Matrix	Graphics	Light Type: Electromagnetic	Light Type: Incandescent	Light Type: LED	Light Type: LCD	Light Type: Plasma Planar Gas Discharge	Light Type: Vacuum Fluorescent	Light Type: Electroluminescent	Custom Design	CRT	Panels: Back/ Edge Lighted
Samtron Displays	B•1110	√	√	√	√	√	√			√				√				√		
Seiko Instruments	B•1113		√	√	√			√	√	√				√				√		√
Shelly Associates Inc.	B•1114	√	√	√	√	√	√	√	√	√			√	√				√		√
Standish Industries	B•1118	√	√	√	√	√	√	√	√	√				√				√		√
The Staver Co. Inc.	B•1119	√	√	√			√	√	√		√							√		√
Three-Five Systems	B•1124	√	√		√	√		√	√				√	√				√		
Transparent Devices	B•1126																			√
VL Electronics	B•1127	√	√	√	√	√	√	√	√	√		√	√	√			√	√		
World Products	B•1128	√	√	√	√	√	√	√	√	√				√				√		

BACK LIGHT PANELS FOR DISPLAYS

Manufacturer	Starting EEM Page No.	Type: Electroluminescent	Type: Fluorescent	Type: LED	Colors Available	Brightness (Cd/M^2)	Thickness (mm)	Length (mm)	Current (mA)	Voltage (Vrms)	Life (hours)	Applications
Applied Display & Control	B•1020		√		White		Vary	Vary			10-20K	CFL side (edge) lighting of LCDs
DCI Inc.	B•1032		√	√	Red, Green, Amber, White							
Electronic Displays Inc.	B•1043			√	Red, Green, Amber							
Endicott Research Group	B•1045	√	√		N/A							ERG builds the inverters for these backlights… (Power Supplies)
Epson America	B•1050	√			Blue, White							
Fema Electronics Corp.	B•1063	√	√	√	Green, Red, Blue,Yellow, etc.							
Hantronix, Inc.	B•1070	√	√	√	Blue, White, Yellow/Green							
IEE (Industrial Electronic Engineering)	B•1078	√	√	√	Varies according to display							
Ledtech Electronics	B•1082			√	Blue, Red, Green, Yellow,	N/A	2-3	40-142	20-200	2.0 VDC	100,000+	Legends/LCD's instrumentation
Okaya Electric America	B•1098	√	√	√	Red, Green, Yellow, Amber, White							
Optrex/Satori	B•1102	√	√	√	White, Red, Green	Depends upon B/C	2.0mm to 6mm	Any	5-250	5V-110V	2K-100K	
Pacific Industrial Components	B•1104		√		White, Blue						20K	Slide and document scanners
Shelly Associates	B•1114	√	√	√	Red, Green, White, Amber, Blue							
Three-Five Systems	B•1124			√	Yellow-Amber, Yellow-Green AlGa As Red	2.3-45.0 fl	0.150mm	2.00mm	28-300	5.0 VDC	100,000	Microcontroller Driven Instruments, Test & Measurement; Equipment, Status Indicators, Control Panels, Industrial Control Systems
Transparent Devices	B•1126											Touch screens

OPTREX LCD...***OPTREX*** LCD...***OPTREX*** LCD...***OPTREX*** LCD

Since the beginning of the LCD module industry, Apollo Display Technologies has served the OEM Market as a technical, stocking distributor, manufacturer, and value-added manufacturer of LCD products and services. A wide range of industry-standard LCD modules are stocked in depth for immediate delivery. Our New York based value-added, semi-custom and custom manufacturing capabilities broaden the variety of viewing and performance characteristics to better suit customer's special needs. It is our unique combination of low-cost standard product, local in-depth stocking, technical assistance and value-added services that have made our company the first choice of so many display engineers.

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- Display Engineers to Answer Your Technical Questions
- Stock......Stock......Stock......Stock......Stock
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CHARACTER MODULES Including Character Generator

ROWS X CHARACTERS

1 x 16	2 x 16	4 x 16	8 x 16	16 x 24	25 x 80
1 x 20	2 x 20	4 x 20	8 x 20	16 x 20	
1 x 24	2 x 24	4 x 40	8 x 30	16 x 32	
1 x 32	2 x 32		8 x 40	16 x 40	
1 x 40	2 x 40		8 x 80	16 x 80	

NEW : European character set and faster bus interface available.

GRAPHIC MODULES Combined Character & Graphic

PIXEL COLUMN X PIXEL ROW

128 x 64	240 x 64*	320 x 200	480 x 128	640 x 200
128 x 112*	240 x 128	320 x 240	480 x 320	640 x 400
160 x 128*	256 x 128	480 x 64	640 x 64	640 x 480

* Includes on-board controller IC. Discreet controllers IC's and controller boards available for all modules.

* Many new models available.

* Call for latest catalog

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Multi-Color Backlighting
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CONTROLLERS

CONTROLLER IC
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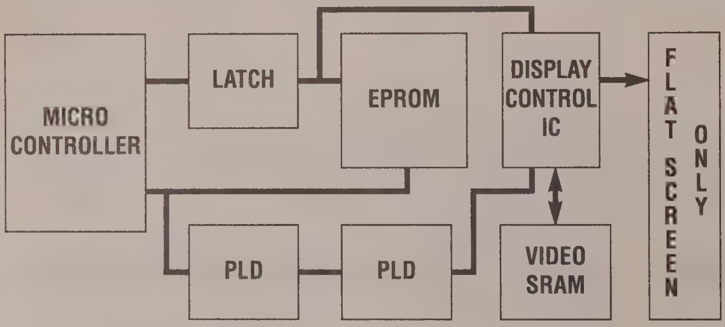
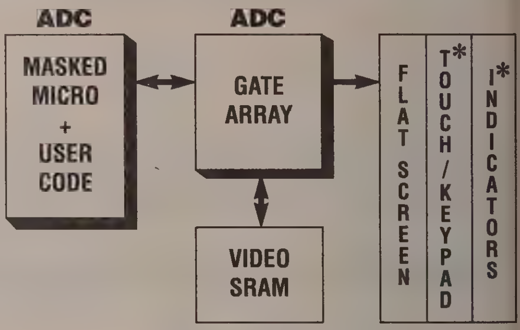
FOCUS: *Small Graphic Displays HIGHLIGHT today's "Smart" Instruments. Display Control chips exist – but NEGLECT **all** other panel functions. ADC Boards/Chip-Sets provide feature-packed, economical, WHOLE-PANEL SOLUTIONS! Beyond Full-Control – our many functions target INSTRUMENT needs – unlike PC graphic packages. Graphic Design is awash with pitfalls – often hidden, cumulative, and detected late. ADC provides a SAFE, Predictable – Comfortable and Convenient – DEVELOPMENT ENVIRONMENT – enabling you to rapidly create, analyze, then optimize your Graphic-Design.*



TYPICAL CONTROLLER



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FEATURES

*Uniquely – ADC provides you a Progression-Path. Choose our Control-Board for evaluation or low-volume. Our Chip-set – PRE-PROGRAMMED MICRO and GATE ARRAY (both QFP) provide the lowest cost, minimal size/power – FULL Graphic Solution. Our DEVELOPMENT TOOLS allow you to CREATE, SCAN/CAPTURE, and MODIFY Graphic screens INSTANTLY – using simple PC Drawing programs. Hooked to your PC's serial port – our INTERACTIVE, Detailed DEVELOPMENT – System provides unmatched AID. Freed from arcane, tedious Graphic-Coding – your Team can focus on FEATURES – Building **Better** products, ON-TIME!*

Panel Assembly

Designed / Stocked for most popular, small displays. Includes custom machined mounting Panel (FR4 or AL), Display, Control-Board, and protective, screened Overlay. May include Keypad (to12x8), "Soft-Keys" and LED Indicators (to 16). Customs invited.

Custom Design

We can adapt Displays to most any industry interface. Custom Software specialists - attractive pricing. Fast turn-around on your DEMO and PROTOTYPE requirements.

Graphic Displays

LCD: 32x120, 64x128, 64x240, 128x240, 200x320, 240x320. MINI Lcd: 32x128, 64x128. EL: 64x240, 128x320, 240x320, 256x320. We test/select the highest contrast - best performers.

LCD Accessories

Mated Touch-Screens, "LCD-Safe" mini. Negative Bias Supplies, CFL and EL supplies, Temperature Compensation circuit/module, "Soft" Contrast Set circuit/module, standard and custom Panel Overlays, user-configured Keypad arrays (any matrix).

Programmable Fonts

Custom designed, 10 Size/Formats, maximum "punch" and density for Small Graphic Displays! Includes 90° rotation. Saves weeks of tedious development. Available on Eprom or Disk. Compatible with most any Display Controller.

Character Modules

LOWEST HEIGHT - 16MM! Lo-pwr LED, 1x8 - 1x40. LCD: 2x16, 4x20. Large CHAR: 1x16. ***RS232 Board/Chip converters.***

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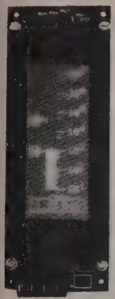
DC PLASMA & VACUUM FLUORESCENT DISPLAYS & MODULES

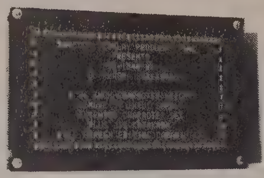
Line-text, and graphic dc plasma displays and subsystems, plus a wide variety of Vacuum Fluorescent 14 segment and dot matrix subsystems are available in many configurations.

64X160



SP-410-003

DM-1240



GD-64X128

VF-6X40

PLASMA SCREENED IMAGE DISPLAYS

FULLY POPULATED DOT MATRIX

Model	Rows/ Columns	Dot Size	Dot Pitch	Package Dimensions
GP-032X128-01	32X128	.05"	.10"	13.925"X4.14"X.269"
GP-064X128-01	64X128	.020"	.040"	6.75"X3.675"X.236"
GP-064X128-02	64X128	.05"	.10"	13.925"X7.34"X.269"
GP064X160-01	64X160	.016"	.020"	4.45"X2.0"X.222"
GP-128X128-01	128X128	.013"	.020"	3.725"X3.725"X.222"
GP-128X256-01	128X256	.013"	.023"	7.35"X4.0"X.222"
SP-481-005	48X96	.020"	.040"	4.625"X2.62"X.204"
SP-481-009	24X64	.027"	.055"	4.5"X2.2"X.269"
SP-482-002	480X640	.0067"	.013"	11.5"X7.8"X1.5"

DUAL BARGRAPHS

Model	# of Elements	Bar Size (Each)	Overall Size
SP-410-002	101	5.0"x0.25"	6.0"x1.45"x.294"
SP-410-003	201	4.0"x0.10"	4.5"x1.2"x.175"

5X7 LINE-TEXT

Model	# of Characters	Character Height	Package Dimensions
SP-480-001	40	6.1mm (0.24")	9.75"X1.625"X.269"
SP-480-002	20	11.9mm (0.47")	9.75"X1.625"X.269"
SP-480-006	8	25.4mm (1.00")	8.35"X1.725"X.269"
SP-481-002	64	9.96mm (.392")	6.10"X2.90"X.228"
SP-481-003	256	6.6mm (.260")	8.20"X4.30"X.228"
SP-481-006	480	6.6mm (.260")	9.58"X5.68"X.228"
SP-481-007	80	5mm (.200")	4.75"X2.30"X.228"
SP-481-008	256	6.6mm (.260")	9.90"X4.75"X.228"
SP-481-010	240	6.5mm (.257")	9.85"X3.375"X.269"
		14-SEGMENT	
SP-452	16	12.7mm (0.50")	8.90"X1.55"X.269"
SP-462	4	50.8mm (2.00")	9.00"X3.25"X.269"
SP-450-018-01	20	12.7mm (0.50")	11.56"X1.62"X.269"
SP-450-026-02	16	12.7mm (0.50")	8.90"X1.55"X.269"
		7-SEGMENT	
SP-431-001-01	4	50.8mm (2.00")	9.00"X3.25"X.269"
SP-432	6	50.8mm (2.00")	11.65"X3.25"X.269"

PLASMA DISPLAY MODULES

5X7 LINE TEXT

Model	Rows/ Columns	Character Height	Package Dimensions
SM-810-001	1X40	6.1mm (0.24")	10.75"X3.00"X2.00"
SM-810-002	1X20	11.9mm (0.47")	10.75"X3.00"X2.00"
SM-810-004	1X20	11.9mm (0.47")	10.75"X1.96"X3.85"
DM-4X16	4X16	9.96mm (0.39")	7.10"X3.10"X2.075"
DM-6X40	6X40	6.5mm (.257")	11.00"X4.80"X1.91"
DM-8X32	8X32	6.6mm (0.26")	9.45"X4.30"X2.22"
DM-12X40	12X40	6.6mm (0.26")	11.07"X5.825"X2.00"

GRAPHIC MODULES

Model	Rows/ Columns	Dot Size	Dot Pitch	Package Dimensions
GD-32D128	32x128	.05"	.10"	14.8"X4.925"X.895"
GD-64D160	64x160	.012"	.02"	6.55"X2.775"X.825"
GD-64D128	64x128	.02"	.04"	8.0"X5.0"X.85"

VACUUM FLUORESCENT MODULES

14-SEGMENT

Model	Rows/ Columns	Character Height	Package Dimensions
VS-1X16	1X16	9mm (0.35")	8"X2.15"X.91"
VS-1X20	1X20	9mm (0.35")	9"X2.15"X.91"
VS-1X32	1X32	6mm (0.24")	9.07"X2.15"X.90"
		5X7 LINE TEXT	
VF-1X20	1X20	5mm (0.20")	6.2"X1.60"X1.50"
VF-1X20	1X20	9mm (0.35")	9.2"X1.90"X.94"
VF-1X20	1X20	15mm (0.57")	13.80"X2.25"X1.65"
VF-1X40	1X40	5mm (0.20")	10"X1.85"X.95"
VF-2X20	2X20	5mm (0.20")	5.80"X2.40"X.74"
VF-2X20	2X20	11mm (0.43")	10.75"X3.00"X1.05"
VF-2X40	2X40	5mm (0.20")	7.85"X2.50"X1.10"
VF-4X20	4X20	11mm (0.43")	10"X4.75"X1.38"
VF-6X40	6X40	5mm (0.20")	12"X5.70"X1.95"

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READOUT ASSEMBLIES

MINI-PAK DISPLAY ASSEMBLIES

The MINI-PAK^R series are gas discharge or LED readout modules, specifically designed for use on low-to-medium volume industrial or commercial instruments. The display and associated electronic drive are packaged in a black thermoplastic case available in two styles; a rear panel mount and a front panel mount. The modules are available in 1½-, 2-, 2½ and 3-digit configuration that can be mounted individually or stacked horizontally to form any number of digits. The MINI-PAK^R series are designed for direct interface compatibility with TTL or LSI integrated circuits with 4 line output information in the 8-4-2-1 BCD code format.

GAS DISCHARGE SERIES CE-1000/CE-2000

The MINI-PAK^R series CE-1000/CE-2000 include a 0.55" high character gas discharge display and the BCD to seven segments Decoder/Driver. The interface terminals are brought out to 14 pin dual-in-line header or socket. All components are soldered to the P.C. Board.

GAS DISCHARGE SERIES CE-3000/CE-4000

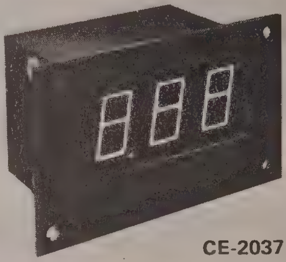
The MINI-PAK^R series CE-3000/CE-4000 include a 0.55" high character gas discharge display and socket mounted BCD to seven segments Decoder/Driver. The interface terminals are brought out to wire wrap pins. The gas discharge display can be very easily and efficiently replaced, thereby, minimizing down time.

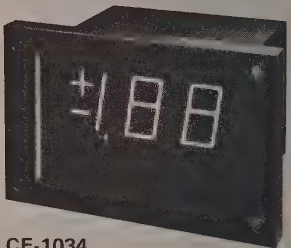
LED SERIES CE-5000/CE-6000

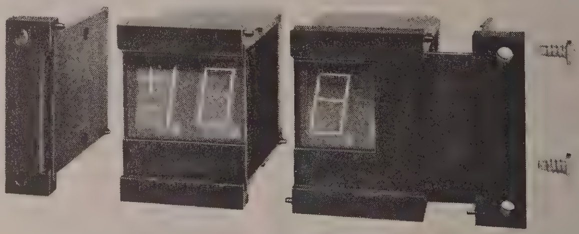
The MINI-PAK^R series CE-5000/CE-6000 include a socket mounted 0.43", 0.625" or 0.8" character high LED display, a socket mounted BCD to seven segments Decoder/Driver and current limitting resistors, whenever applicable. The interface terminals are brought out to wire wrap pins. The series is available with or without latch or in 5 mA, 15 mA or 20 mA per segment.

FOR CUSTOM MADE ASSEMBLIES, LARGER CHARACTERS OR OTHER REQUIREMENTS, CONSULT FACTORY

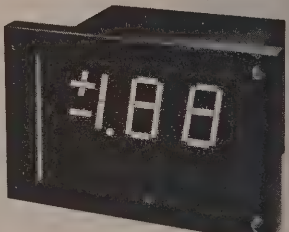
DOUBLES YOUR OPTION TO YOUR PANEL DESIGN WITH THE MINI-PAK^R LED AND GAS DISCHARGE DISPLAYS.


CE-2037


CE-1034


INSTALLATION DRAWING

CE-6037


CE-5034

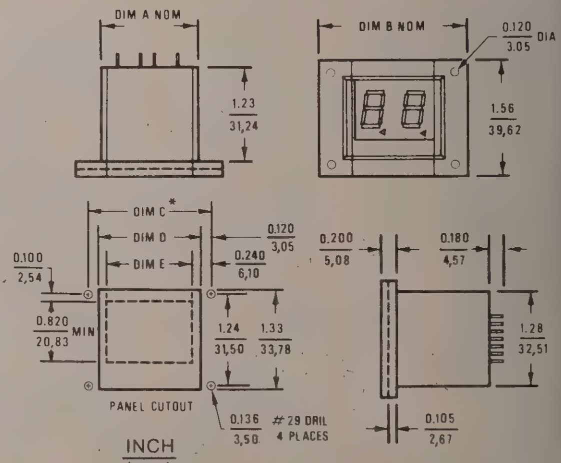
MECHANICAL SPECIFICATIONS

NO DIGITS	BEZEL WIDTH DIM. B NOM.		PANEL CUTOUT † DIM. D		PANEL CUTOUT †† DIM. E	
2	1.94	49,28	1.38	35,1	1.14	28,96
3	2.48	62,99	1.92	48,8	1.68	42,68
4	3.04	77,22	2.48	63,0	2.24	56,90
5	3.58	90,93	3.02	76,70	2.78	70,62
▲ 6	4.12	104,65	3.56	90,42	3.32	84,33
7	4.68	118,87	4.12	104,7	3.88	98,56
▲ 8	5.22	132,59	4.66	118,4	4.42	112,27

▲ Assumes maximum 3 digits modules per assembly.

† D Dimension applies to CE-1000/3000/5000 series.

†† E Dimension applies to CE-2000/4000/6000 series.



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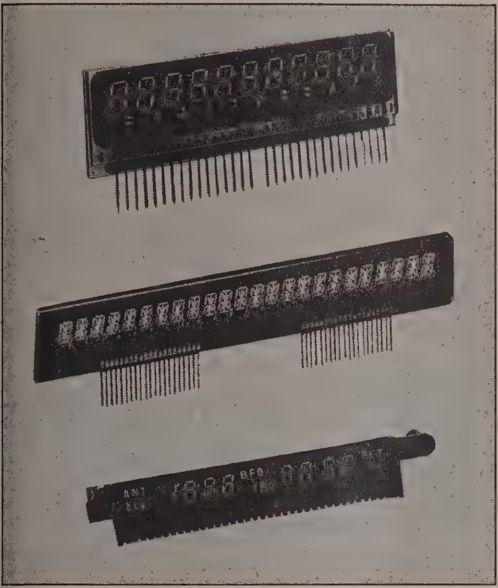
PLASMADOT™ Gas Plasma Dot Matrix Displays



PRODUCT FEATURES

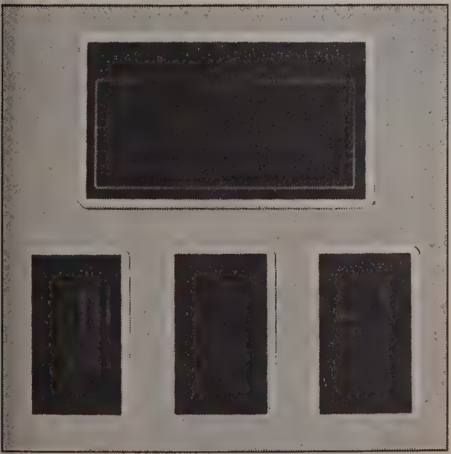
- Eye pleasing soft neon orange color is consistent, attractive, easy on the eyes and readily filterable with red, amber or neutral (grey)
- Flicker free uniform high brightness pixels with excellent contrast, wide viewing angle and long distance readability
- Reliable, rugged internal structure . . . no delicate filaments or complex layers
- Glass construction, no plastic or metal parts
- Slim profile flat panel for packaging flexibility
- Low power consumption and 50,000 hour life
- Directly PCB mountable with solderable connection pins on standard 0.100 inch centers

STANDARD P/N	PD01-A220	PD02-A100	PD03-A220	PD04-A220	PD05-A220
Configuration:					
Rows	32	64	9	24	32
Columns	128	128	106	106	106
Pixels:					
Shape	Round	Square	Round	Round	Round
Size	.050″	.020″	.050″	.050″	.050″
Row Pitch	0.1″	.040″	0.1″	0.1″	0.1″
Column Pitch	0.1″	.040″	0.1″	0.1″	0.1″

DESIGN CAPABILITIES

- Round, square or rectangular pixel shapes
- Pixel sizes from 0.015 inches minimum to 0.100 maximum
- Inter-pixel spacing of 0.010 inches minimum
- Glass panel sizes up to 18 inches by 24 inches

Segmented and Custom Graphics Gas Plasma Displays



7, 14, 16 SEGMENT MULTI-DIGIT CHARACTERS — .25″ to 2″ High

Especially designed and engineered for your industrial, commercial or consumer product application requiring the highest possible quality displays and lowest possible cost.

7 SEGMENT NUMERIC — 4 to 11 Digits
14 SEGMENT ALPHANUMERIC — to 24 Characters

- All at low cost per digit
- Flicker-free uniform brightness
- Eye-pleasing soft neon orange color is attractive, easy on the eyes, easy to read, readily filtered with red, amber or neutral (gray).
- All glass construction
- Low power ratio to character size
- Quick, easy connection

When it comes to versatility, gas plasma is tough to beat! Anything a printing press can apply to paper, we can apply to glass.

Just look at gas plasma advantages . . .

- **Custom Display capability** — Segments with legends, logos, bar graphs can be combined.
- **Uniform Color** — Excellent. And its neon orange color is filterable to red or amber.
- **Uniform High Brightness** — Excellent. It's viewable in dim or high brightness ambients.
- **Wide Viewing Angles** — Excellent.
- **Readability** — Easier to read at great distances. No more squinting.
- **Multiplexibility** — Excellent capability.
- **Long Life Expectancy.**
- **Rugged Mechanically** — Good for large area displays.
- **Direct PC Board Mounting** — with attached solder leads.

Gas Plasma Displays

	Gas Discharge
1. Appearance	Active light emitter
2. Color	Neon orange filterable to red or amber, excellent uniformity
3. Brightness	Viewable in dim as well as high brightness ambients; excellent uniformity
4. Power Consumption	Moderate
5. Voltage (Operating)	180 Volts
6. Multiplexing Capability	Excellent
7. Typically Packaged	Multi-digits in one envelope
8. Package Configuration	Flat glass
9. Technology (Fabrication)	Printing (no internal structure) plus gas medium
10. Advantages	Custom capability for digits, legends, symbols, special fronts; excellent viewing angle, mechanically rugged, good for large area displays
11. Disadvantages	Not suited to less than ¼-inch characters
12. Life Expectancy	100,000 hours typically

DOT MATRIX PLASMA DISPLAY
Quick Reference Guide

A COMPANY OF
VISHAY
DALE®

MODEL	APD-064M033	APD-064M033-1	APD-016M040	APD-222G007	APD-080M025-1	APD-128G128	APD-192G096
No. of Characters	64	64	16	32	80	192	256
Configuration	4 x 16	4 x 16	1 x 16	222 x 7	4 x 20	128 x 128	192 x 96
Display Format	Character	Character	Character	Graphic	Character	Graphics	Graphics
Character Height	0.33	0.33	0.40	0.20	0.25	0.17	0.17
Pixel Size (W x H)	0.030 (Dia.)	0.030 (Dia.)	0.036 (Dia.)	0.019 x 0.017	0.018 x 0.018	0.015 (Dia.)	0.017 (Dia.)
Pixel Pitch (W x H)	0.050 x 0.050	0.050 x 0.050	0.061 x 0.061	0.030 x 0.030	0.034 x 0.038	0.025 x 0.025	0.026 x 0.026
Display Area (W x H)	4.76 x 2.00	4.76 x 2.00	7.15 x 0.40	7.15 x 0.20	4.03 x 1.46	3.24 x 3.24	4.96 x 2.47
Outline Dim. (W x H x D)	8.00 x 3.48 x 2.33	8.00 x 3.48 x 2.33	8.50 x 2.25 x 1.96	8.50 x 2.25 x 0.98	6.25 x 3.00 x 1.75	4.62 x 4.72 x 3.75	6.0 x 4.5 x 1.95
Luminance (fL)	80	80	80	35	80	80	70
Interface *	ASCII (P)	ASCII (S)	ASCII (P&S)	Special	ASCII (S)	ASCII (S)	ASCII (S)
Supply Voltage	+ 5, + 185	+ 5	5.0	+ 5, + 250	+ 5	+ 5, + 12	+ 5
Power Consumption (Max)	6.45	7.50	6.25	9.90	5.00	8.5	12
Viewing Angle (Degrees)	150°	150°	150°	150°	150°	120°	120°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 15°C to + 55°C	0°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C

MODEL	APD-240M026A	APD-240M026A-1	APD-240M019	APD-240M021	APD-256M026	APD-256M026-1	APD-256M025A
No. of Characters	240	240	240	240	256	256	256
Configuration	6 x 40	6 x 40	6 x 40	6 x 40	8 x 32	8 x 32	8 x 32
Display Format	Character	Character	Character	Character	Character	Character	Character
Character Height	0.26	0.26	0.196	0.21	0.26	0.26	0.25
Pixel Size (W x H)	0.020 (Dia.)	0.020 (Dia.)	0.019 x 0.019	0.018 (Dia.)	0.020 (Dia.)	0.020 (Dia.)	0.018 x 0.018
Pixel Pitch (W x H)	0.030 x 0.040	0.030 x 0.040	0.030 x 0.030	0.032 x 0.032	0.040 x 0.040	0.040 x 0.040	0.032 x 0.039
Display Area (W x H)	8.33 x 2.26	8.33 x 2.26	7.43 x 1.83	7.52 x 2.15	7.62 x 3.30	7.62 x 3.30	7.00 x 3.05
Outline Dim. (W x H x D)	11.0 x 4.3 x 1.21	11.0 x 4.3 x 1.91	10.63 x 4.33 x 1.85	10.00 x 4.30 x 1.7	9.15 x 6.10	11.0 x 6.10 x 2.2	9.45 x 4.72 x 2.28
Luminance (fL)	100	100	100	100	100	100	70
Interface *	CRT	ASCII (P&S)	ASCII (S)	ASCII (P)	CRT	ASCII (P&S)	ASCII (P)
Supply Voltage	+ 5, + 12, + 65, - 115	+ 5, + 12	+ 5	+ 5, + 12 to + 30	+ 5, + 12, + 95, - 90	+ 5, + 12	+ 5, + 185
Power Consumption (Max)	14.00	15.50	12.50	11.10	14.00	15.50	12.00
Viewing Angle (Degrees)	150°	150°	150°	150°	150°	150°	150°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 5°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C

MODEL	APD-480M021	APD-480M021-1	APD-480M021-2	APD-336M019	APD-336M019-2	APD-192G088	APD-240G120
No. of Characters	480	480	480	336	336	352	480
Configuration	12 x 40	12 x 40	12 x 40	14 x 24	14 x 24	192 x 88	240 x 120
Display Format	Character	Character	Character	Character	Character	Graphics	Graphics
Character Height	0.21	0.21	0.21	0.19	0.19	0.26	0.21
Pixel Size (W x H)	0.018 x 0.018	0.018 x 0.018	0.018 x 0.018	0.013 (Dia.)	0.013 (Dia.)	0.020 (Dia.)	0.018 x 0.018
Pixel Pitch (W x H)	0.032 x 0.032	0.032 x 0.032	0.032 x 0.032	0.023 x 0.030	0.023 x 0.030	0.040 x 0.040	0.032 x 0.031
Display Area (W x H)	7.56 x 3.74	7.56 x 3.74	7.56 x 3.74	3.27 x 3.30	3.27 x 3.30	7.66 x 3.50	7.55 x 3.74
Outline Dim. (W x H x D)	10.87 x 5.91 x 1.77	10.87 x 5.91 x 1.77	10.87 x 5.91 x 1.77	4.40 x 4.60 x 3.0	4.40 x 4.60 x 3.0	10.87 x 6.00 x 2.25	10.87 x 5.91 x 1.77
Luminance (fL)	60	60	60	80	80	80	40
Interface *	ASCII (P)	ASCII (S)	ASCII (P)	ASCII (P)	ASCII (P)	ASCII (P & S)	ASCII (P & S)
Supply Voltage	+ 5, + 185	+ 5, + 12	+ 5, + 12	+ 5, + 15	+ 5, + 15	+ 5, + 12	+ 5, + 12
Power Consumption (Max)	10.00	12.20	12.40	10.00	10.00	15.50	13.50
Viewing Angle (Degrees)	150°	150°	150°	120°	120°	150°	150°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 15°C to + 70°C	0°C to + 55°C	0°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C

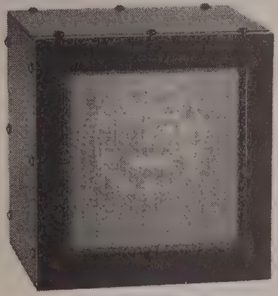
* (P) = Parallel Interface. (S) = Serial (RS-232) Interface.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

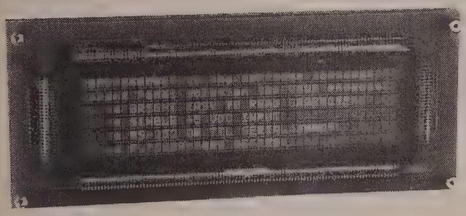
DC PLASMA DISPLAY

A COMPANY OF
VISHAY
DALE®

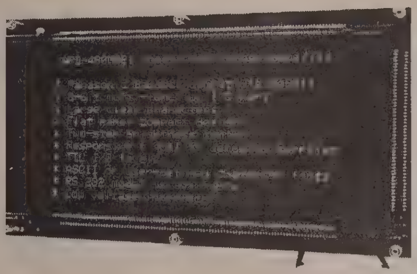
APD-128G128



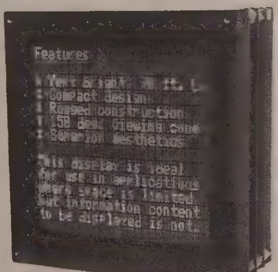
APD-240M019



APD-480M021-1



APD-336M019



FEATURES

- **Viewing Angle:** Dale's patented "open" construction method provides superior viewing angles that are unsurpassed by any display technology.
- **Brightness:** Dale displays are designed to exploit the inherent high brightness capability of DC Plasma displays to make them excellent choices for practically any application, whether it is in sunlight, brightly lit factories, or total darkness. The nature of the plasma glow make the display characters or graphics appear much larger than they actually are. The brightness is also extremely uniform since there are no internal filaments or grids that affect the light output.
- **Compact Size:** State-of-the-art design using the latest SMT components and DC/DC converters result in modules that provide minimum front panel space and depth.
- **Flexibility:** Dale excels in building display modules that allow the user to personalize their products at affordable prices. Our screened image display technology allows maximum freedom to design a display module that is application specific with interface circuitry that is synergistic to the end system.
- **High Speed Data Input:** Dale's creative interfaces allow high speed data input without display flickering or difficult handshaking schemes.
- **Rugged Design:** Shock and Vibration (non operating and operating) are no problem, as there are no fragile filaments or grids that may break.
- **Made in USA:** Dale Plasma display modules are completely manufactured in the USA by Dale which insures total control over all aspects of design and manufacturing to provide the utmost in customer service and support.

THE SELECTION PROCESS

- **Call Dale:** We have designed hundreds of application specific displays which enable us to give you an objective analysis of your needs and options.
- **Type and Amount of Information to be Displayed:** This will define whether a graphics or character format is required, and the minimum size of the format.
- **Viewing Distance Range:** This will determine the size of the characters from which the pixel pitch and size will be derived.
- **Ambient Lighting Conditions:** The lighting conditions will dictate the display luminance, whether or not dimming is required, and the type of contrast enhancement filter.
- **Power and Voltage Available:** Through the use of efficient DC/DC converters, Dale can design modules compatible with practically any power and voltage source. Dale Plasma display power requirements are competitive with any light emissive display technology.
- **Overall Size:** Dale is adept at designing packages to fit your space budget.
- **Interface:** Three basic interface levels are available: (1) ASCII - Parallel or serial (RS-232), (2) CRT controller (user supplies sync, pixel data, and clock signals) or (3) Display glass only (Dale will gladly provide application assistance).
- **Operating Environment:** The operating conditions may affect the component selection and whether special packaging is required for hostile environments.

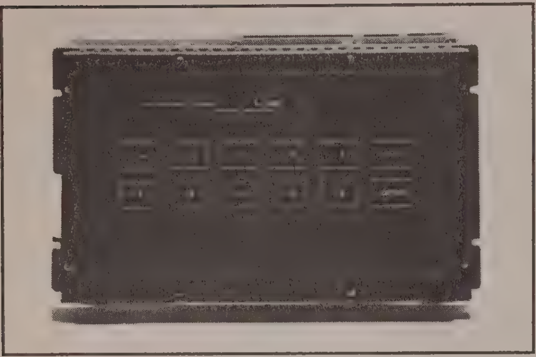
DALE'S GOAL

- To help you select the best display for your application - the first time.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

MODEL TIP
Infrared Touch Panels
With Controller

A COMPANY OF VISHAY
DALE®



TIP products are infrared touch panels designed to fit most flat panel display technologies. The touch panels are a matrix of infrared diodes and detectors, scanning electronics, microprocessor controller, bezel/optical filter assembly and hardware to mount the touch panel and controller to the flat panel display. These touch panels are ideal for many applications including medical instrumentation, machine or process controls, point of sale devices, public information displays, banking and military.

Optional PC based ezTouch® software provides simple touch panel integration, facilitating the creation of user keypads. ezTouch® is a resident program and is language independent. Commands are executed by writing to the screen and touch information is read from the keyboard buffer.

FEATURES

- Fast response time
- Flexible operating modes
- User transparent
- Rugged construction
- Sealed for environmental resistance
- Immune to high or changing ambient light
- RS-232C interface
- Pre-assembled - no assembly or disassembly required to mount display

ELECTRICAL SPECIFICATIONS

Voltage: + 12 VDC ± 5%.
Current: 400 mA typical.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.
Storage Temperature: - 55°C to + 85°C.
Relative Humidity: 10-90% non-condensing.

INTERFACE SPECIFICATIONS

Type: RS-232C.
Data Rate: 300, 1200, 9600 baud and auto baud.
Word Format: 8 bits, no parity, 1 start bit, 1 stop bit.

HOW TO ORDER

TIP	3216	FA	A	##
MODEL	MATRIX	DISPLAY DESIGNATOR	FILTER * DESIGNATOR	DASH NUMBER (If Required)

TOUCH PANEL		DISPLAY				
MATRIX	TOUCH POINTS	PIXELS	TECHNOLOGY	MANUFACTURER	PART NUMBER	DESIGNATOR
3216	63 x 31	512 x 256	ELD	Finlux Planar	MD512.256 EL6648MSS	FA PA
3220	63 x 39	640 x 400	ELD	Finlux Planar Sharp	MD640.400 EL8358HR LJ640U27	FB PB SA
3224	63 x 47	640 x 480	ELD	Sharp	LJ64ZU49	SB
3526	69 x 51	640 x 480	ELD	Planar	EL7768(G/M)S	PC
5648	111 x 95	1024 x 864	ELD	Planar	EL751214MS	PD

A = Non polarized, gray
B = Polarized, gray
C = Non polarized, amber
D = Polarized, amber
S = Special - Contact factory

NOTES:

1. A dash number suffix will be factory assigned for modifications or "S" type filters.
2. Contact factory for other touch panel and display combinations.

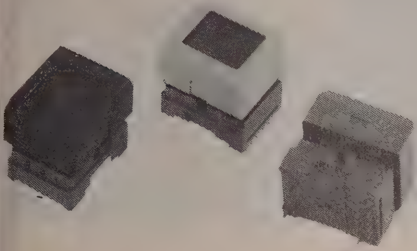
* Other user specified filters will be designated as "S". Contact factory for availability. Any "S" filter designation will require a factory assigned dash number suffix.

Filters A-D are plastic. Glass filters may be available on selected models.

C.ITOH
ITOCHU Technology, Inc.

D880 GLM
GRAPHIC LCD MODULE

The Multifunction Programmable Graphic LCD Module



NEW ADDITIONAL FEATURES: **Panel Mount** housing available.
Water Proof transparent cover for stringent NEMA requirements.
Heater Element brings operating temperature down to -55°C.

A unique LCD keyswitch which puts a simple man-machine interface at your fingertips. Communication is simplified through the use of this compact size programmable graphic module with multicolor backlight.

The D880 integrates a low power graphic LCD, utilizing supertwist technology, with a custom IC driver with multi-color backlighting - all on a key cap of a single pole, single throw, momentary contact switch with dimensions of less than one square inch.

The graphic LCD consists of 864 pixels in a 24 x 36 matrix which provides full screen graphics. 18 characters (3 lines x 6 characters) can be displayed using a 5 x 7 font.

The backlighting is suitable for any ambient lighting and the multicolor allows for many modes of operation (ie: Red = stop, Amber* = caution, Green = operational, blinking, etc). Red and green backlighting can be changed by reversing the 5V applied to the LED terminals and amber by using an AC voltage across the LED terminals.

* Amber hue may vary slightly from switch to switch.

Mechanical Specifications

Pixels:
864 (24x36) LCD display with super-twist.
Characters:
18 (using 5x7 font)
3 lines by 6 digits
Pixel Size:
.014 inches square
Viewing Area:
.490 x .590 inches.

Switch Characteristics

Circuit: Single pole, single throw.
Rating: 12VDC 10mA.
Contact Resistance:
Maximum 200 Ohm (190g)
Bounce: Maximum 10 msec.
Dielectric Potential:
250VAC, one minute.
Insulation Resistance:
> 50 meg Ohm (200V DC)
Operating Stroke: 1.8+0.1/-0.3 mm
Actuation Force: 150 ± 40 gr.
Mechanical Life: > 1 Million cycles.

Absolute Maximum Ratings

	Item	Symbol	Rating	Unit
Display Area	Logic Circuit	V_{DD}	-0.3 to + 7.0	V
	LCD Driver Circuit	V_{LC}	V_{DD} - 13.5 to V_{DD} +0.3	V
	Input Voltage	V_{TI}	-0.3 to V_{DD} +0.3	V
LED Backlight	Forward Current	I_F	40	mA
	Forward Pulse Current	I_{FP} *1	120	mA
	Reverse Voltage	V_R	8	V
	Power Dissipation	P_D	200	mW
Operating Temp. Range		T opr	0 to +40	°C
Storage Temperature Range		T stg	-40 to +80	°C

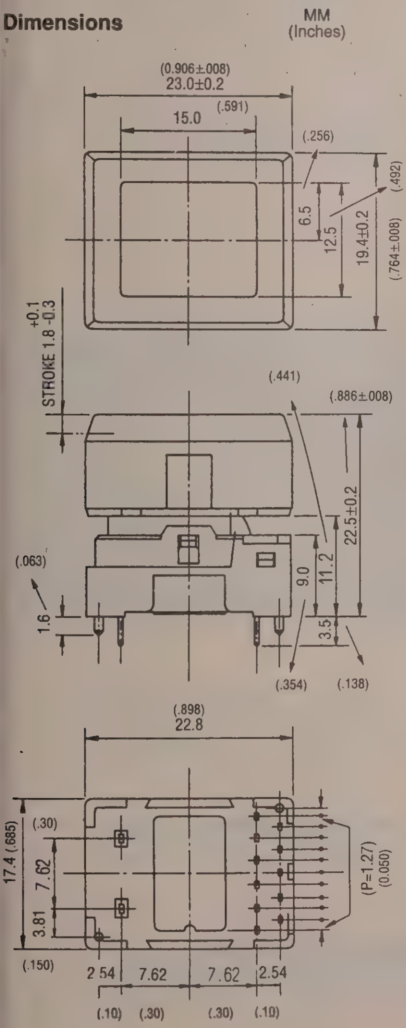
*1 Pulse Width: 1.0 ms Duty ratio: 1/10

New Products
- Intelligent Controllers
- 48 Switch Industrial Keyboard
- 3U Rack & Panel - 48 switches
- 1U Rack & Panel - 8 switches
- Development Systems - complete turnkey with software.

Support Products
- Panel mount housing
- Splash proof cover
- Low profile sockets
- PCBs - 4 x 4
- Development module
- All cables & Power supplies required

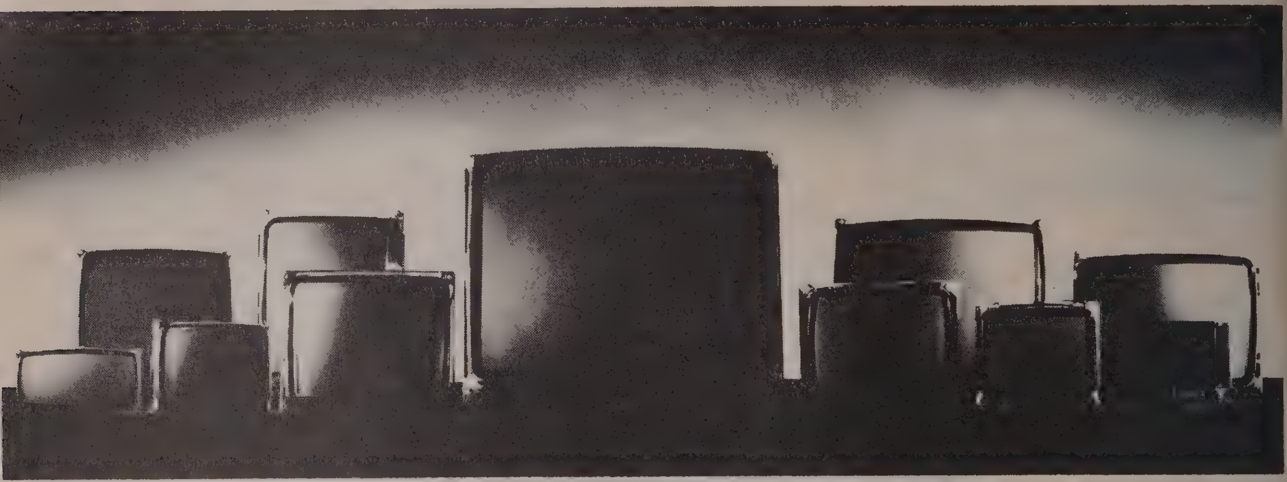
Call for Free Demonstration Unit.
Technical support and design assistance available.

Dimensions



C.ITOH
ITOCHU Technology, Inc.
2515 McCabe Way • P.O.Box 19657, Irvine, CA 92713-9657
(800) 347-2484, Ext. 4529 • Direct: (714) 757-4529 • FAX: (714) 757-4423

More Than The Eye Can See



At Data Ray Corporation, we offer more than high performance monitors with outstanding image quality. From our facilities located near Denver, Colorado, we are dedicated to:

- **SERVING A WIDE RANGE OF OEM APPLICATIONS**
  Data Ray's versatile color and monochrome monitors allow us to serve a wide range of OEM applications, including medical and industrial imaging, high resolution graphics, flight simulation, training, and data display. This design flexibility means shorter approval cycles and more competitive pricing for you.
- **CLOSE ENGINEERING INTERFACE**
  Our experienced engineering staff works closely with you to ensure that your particular electrical and mechanical specifications are met.
- **FLEXIBLE MANUFACTURING CAPABILITIES**
  We strive to accommodate our customers' varying volume requirements and different product configurations — kit, open frame chassis or enclosures where available. Our 65,000 sq. ft. manufacturing and R&D facility was specifically designed to accommodate the unique requirements of display manufacturing. Our modern production techniques allow us to maximize our responsiveness to our customers.
- **HIGH QUALITY STANDARDS**
  From design conception through production, Data Ray incorporates a philosophy of total quality control to ensure the highest degree of quality and reliability in our products.
- **RESPONSIVE CUSTOMER SUPPORT**
  Data Ray recognizes that the OEM markets we serve are dynamic and demanding. We are dedicated to providing the ongoing technical and customer service support critical to a successful OEM partnership.

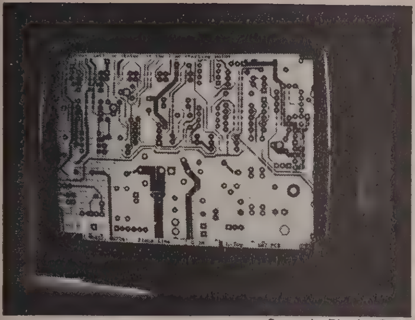
Call us today to discuss your particular color or monochrome monitor requirements. Not only will you find the best-looking images in the industry, you'll discover that Data Ray offers *much more than the eye can see.*

DATA RAY
CORPORATION

12300 Pecos
Westminster, CO 80234
800-926-5556
303-451-1300 Fax: 303-451-1143

DATA RAY CORPORATION

HIGH PERFORMANCE COLOR & MONOCHROME MONITORS
More Than The Eye Can See . . .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DR50/DR55 SERIES
HIGH RESOLUTION LARGE SCREEN COLOR MONITORS

- 20", 26" and 29" monitors
- Ideal for High-Res Applications including: Simulation, Training, Engineering Workstations, and Pre-publishing
- Excellent Focus with DAF System and Invar Mask
- High Voltage Regulation Better than .1%
- Low Power Consumption
- Available in Open Frame or Enclosure

CRT
Type: Shadow Mask
Size: 20" (DR50 Series)
26", 29" (DR55 Series)
Electron Gun: In-Line (DR50 Series)
In-Line, DAF System (DR55 Series)
Dot Pitch: .31 mm (DR50 Series)
.31 mm (26"); .37 mm (29") (DR55 Series)

VIDEO INPUT
Type: Analog RGB
Level: Composite: 1.0V p-p
Non-composite: .7V p-p
Signal Polarity: Positive
Termination Impedance: .75 Ohms (switchable)

SYNC
Type: Composite: TTL; or Sync on Green
Level: 0.5 to 1.0V p-p @ 75 Ohms
Signal Polarity: Negative or Positive

ELECTRICAL PERFORMANCE
Resolution: Up to 1280 x 1024
Scanning Frequency:
Horizontal: 30-64 kHz
Vertical: 50-120 Hz
High Voltage Regulation: ≤.5%

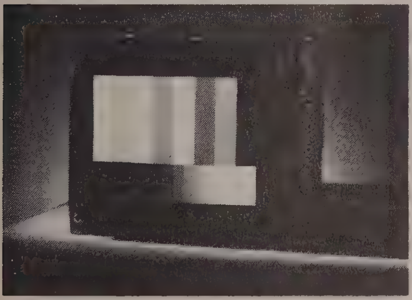
POWER REQUIREMENTS
Voltage: 110/220 VAC
Frequency: 47-63 Hz
Power Consumption:
Nominal: 115 watts
Max: 135 watts

VIDEO
Bandwidth: 130 MHz/-3dB

ENVIRONMENT
Operating: 0° to 40°C
Storage: -30° to 65°C
Humidity: 10-90% Non-condensing
Altitude: Operating: 10,000 ft.

AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS

MECHANICAL
DR50 Series: Available in chassis (Standard or Custom)
DR55 Series: Available in chassis or enclosure
Rack -mountable options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DR53/DR54 SERIES
HIGH PERFORMANCE SMALL SCREEN COLOR MONITORS

- Ideal for Medical Diagnostic Imaging
- Automatic White Balance/High Bandwidth
- 7.5", 10", or 14" Displays
- Excellent Geometry and High Voltage Regulation
- Switches Automatically between NTSC and PAL
- Excellent VCR Playback
- UL 544 Approvable

CRT
Type: Shadow Mask (DR53 Series)
Trinitron (DR54 Series)
Size: 14" (DR53 Series)
7.5", 10", 14" (DR54 Series)
Electron Gun: In-Line
Dot Pitch: .28mm (DR53 Series)
Stripe: .26mm (DR54 Series)

VIDEO INPUT
Type: Analog RGB
Level: 1.0V p-p
Signal Polarity: Positive
Termination Impedance: 75 Ohms (16 and 64-clor TTL available)

SYNC
Type: Composite, Separate, or Sync on Green
Level: 0.3 to 5.0V p-p @ 75 Ohms; or TTL
Signal Polarity: Negative (Analog Video)
Negative or Positive (TTL Video)

ELECTRICAL PERFORMANCE
Resolution: Up to 640 x 480 (Non-Interlaced)
Scanning Frequency: Horizontal: 15.75-35 kHz (fixed); Vertical: 50-72 Hz
High Voltage Regulation: 1% Standard

POWER REQUIREMENTS
Voltage: 110/220 VAC
(DC Input Available)
Frequency: 47-63 Hz
Consumption: Nominal; 75 watts

VIDEO
Bandwidth: Up to 50 MHz

ENVIRONMENT
Operating: 0° to 50°C
Storage: -20° to 65°C
Humidity: 10-95% Non-condensing
Altitude: Operating 10,000 ft.

AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, PTB, FCC, DHHS

MECHANICAL
Available in chassis (Standard or Custom)

*Specifications subject to change.

CALL US TODAY TO DISCUSS YOUR OEM REQUIREMENTS!

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DATA RAY

HIGH PERFORMANCE COLOR & MONOCHROME MONITORS
More Than The Eye Can See . . .

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DR56 SERIES
COLOR MONITORS FOR INDUSTRIAL IMAGING

- Ideal for Industrial and Monitoring Applications
- Ruggedized to withstand harsh environments (shock, vibration, and temperature)
- Compatible with CGA, EGA, VGA
- Price Competitive

CRT
Shadow Mask or Trinitron
Size: 7.5", 10", 14"
Electron Gun: In-Line
Dot Pitch: .28mm (Shadow Mask)
Stripe: .26 mm (Trinitron)

VIDEO INPUT
Type: TTL or Analog
Signal Polarity: Positive

SYNC
Type: TTL or Analog
Signal Polarity: TTL Positive

ELECTRICAL PERFORMANCE
Resolution:
Up to 1024 x 768
Scanning Frequency:
Horizontal: 15-35 kHz (fixed)
Vertical: 50 or 60 Hz

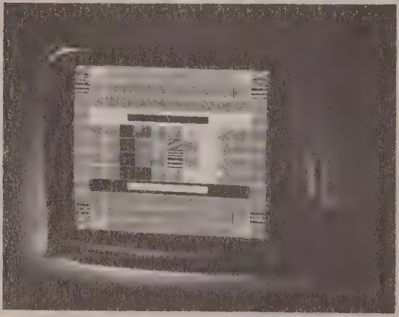
POWER REQUIREMENTS
Voltage:
110 or 220 VAC
(DC Inputs Available)
Frequency:
47-63 Hz
Consumption: 60 watts typical

VIDEO
Bandwidth: Up to 50 MHz

ENVIRONMENT
Operating: -5°C to 55°C
Storage: -20°C to 65°C
Humidity:
10%-90% Non-condensing (Operating)
Altitude:
Operating 10,000 ft.

AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS, PTB

MECHANICAL
Available in chassis (standard or custom)
Some enclosures available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DR60/DR70 SERIES
HIGH PERFORMANCE MONOCHROME MONITORS

- Engineered for high performance, the DR60/DR70 Series is especially suited to meet the demanding requirements of the medical and industrial imaging industries.
- Dual Axis Dynamic Focus
- Backporch Clamping
- Capable of Excellent Linearity

CRT
Size: 7" to 20"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 20 mm/29 mm

DISPLAY
Resolution: Up to 1024 x 1024
Linearity:
10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration:
Portrait or Landscape
Dynamic Focus:
Horizontal and Vertical
High Voltage Regulation:
3% Standard
(Tighter tolerances available)

VIDEO INPUT
Bandwidth: 75 MHz/-3dB
Input Signal: TTL Composite or Analog
Polarity: Positive = White

HORIZONTAL SYNC
Frequency: 15-64 kHz (fixed)
Input: TTL
Polarity: Positive or Negative

VERTICAL SYNC
Frequency: 30-120 Hz
Input: TTL
Polarity: Positive or Negative

POWER REQUIREMENTS
Input Voltage:
12-24 VDC nominal or
110/220 VAC (Automatic Switching)
Power Consumption:
15 watts typical (DR60 Series w/9" CRT)
36 watts typical (DR70 Series w/15" CRT)

ENVIRONMENT
Operating:
0° to 50°C
Storage:
-20° to 65°C
Humidity:
10-90% Non-condensing
Altitude:
10,000 ft. Operating

AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS, PTB

MECHANICAL
Available in kit or chassis (standard or custom)
Some enclosures available

* Specifications subject to change.

CALL US TODAY TO DISCUSS YOUR OEM REQUIREMENTS!

12300 Pecos, Westminister, CO 80234 TEL 303-451-1300 FAX 303-451-1143

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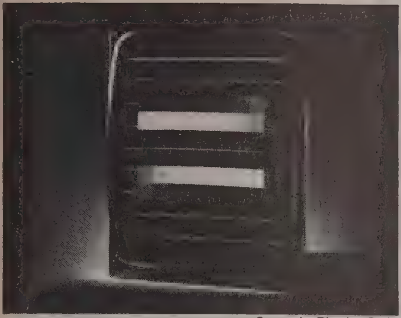

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DR31 SERIES
HIGH RESOLUTION MONOCHROME MONITOR

- Ideal for High-Resolution Computer Graphics and Data Display Applications
- Better than .5% High Voltage Regulation
- Wide Video Bandwidth for High-Res Graphics
- High Reliability
- Switches Automatically Between 50 and 60 Hz

CRT
Size: 15", 16" Square, 17"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 29 mm

DISPLAY
Resolution: Up to 1280 x 1024
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal and Vertical
High Voltage Regulation: Better than .5%

VIDEO INPUT
Bandwidth: 130 MHz/-3dB
Input Signal:
ECL TTL (1 or 2-bit) or Analog
Polarity:
Positive or Negative (TTL ECL)
Positive = White (Analog)

HORIZONTAL SYNC
Frequency: 30-64 kHz (fixed)
Input: TTL
Polarity: Positive or Negative

VERTICAL SYNC
Frequency: 50-120 Hz
Input: TTL
Polarity: Positive or Negative

POWER REQUIREMENTS
Input Voltage: 24 VDC nominal
115/230 VAC Available (Automatic Switch)
Power Consumption: 55 watts typical w/15" CRT

ENVIRONMENT
Operating: 0° to 50°C
Storage: -20° to 65°C
Humidity: 10-90% Non-condensing
Altitude: 10,000 ft. Operating

AGENCY APPROVABLE
Designed to comply with UL, CSA, TUV, FCC, DHHS

MECHANICAL
Available in kit or chassis (standard or custom) Some enclosures available

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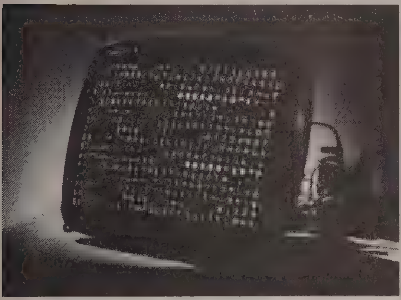

Sample Photo Only

DR10/DR15 SERIES
MONOCHROME DATA DISPLAY

- Ideal for Instrumentation and Data Display Applications
- Cost-effective
- High Reliability
- Compact Design

CRT
Size: 7" to 14"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 20 mm

DISPLAY
Resolution: Up to 640 x 480
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal
High Voltage Regulation: 5% Standard

VIDEO INPUT
Bandwidth: Up to 30mHz
Input Signal: TTL, Analog, or Composite
Polarity: Positive = White

HORIZONTAL SYNC
Frequency: 15.75/31.5 kHz (fixed)
Input: TTL or Sync on video
Polarity:
Positive or Negative

VERTICAL SYNC
Frequency: 50-60 Hz
Input: TTL or Sync on video
Polarity:
Positive or Negative

POWER REQUIREMENTS
Input Voltage:
12 VDC nominal
115/230 VAC Available (Automatic Switch)
Power Consumption:
20 watts typical

ENVIRONMENT
Operating: 0° to 50°C
Storage: -20° to 65°C
Humidity:
10-90% Non-condensing
Altitude: 10,000 ft. Operating

AGENCY APPROVABLE
Designed to comply with
UL, CSA, TUV, FCC, DHHS, PTB

MECHANICAL
Available in kit or chassis
(standard or custom)
Some enclosures available

* Specifications subject to change.

CALL US TODAY TO DISCUSS YOUR OEM REQUIREMENTS!

12300 Pecos, Westminister, CO 80234 TEL 303-451-1300 FAX 303-451-1143
800-926-5556

CUSTOM DISPLAYS

SYSTOLIC
DIASTOLIC
124/83.6
MEAN
84.2
TIME
38:59
HEART RATE
93

WITH CUSTOM DESIGN SUPPORT

Liquid crystal technology is ideal for creative visual displays of all kinds. Our engineers can help you design indicators which are alpha, numeric, pictorial or any combination of these. Discuss your ideas with our friendly engineers—we'll help you create the display you have in mind.

Advanced LCD technology

DCI uses the latest production methods and fabrication techniques to produce displays with:

- Wide Temperature Range
- Excellent visual Contrast
- Broad viewing angle
- Low power consumption
- High Reliability
- Tremendous design latitude

Specification experts

Whether you have defined requirements or only an idea you'll find our engineers ready and able to help. Regardless of how unique, different or unusual your need we can custom-make a display for your application. Call Larry Shelton or Bill Cook at (913) 782-5672 for the support you need.

The custom specialists

DCI INCORPORATED

14812 WEST 117TH STREET / OLATHE, KANSAS 66062
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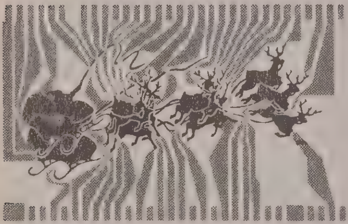
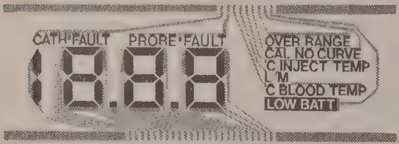


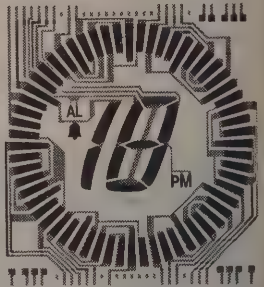
Display graphics are limited only by your imagination.


CATH FAULT
PROBE FAULT
18.8.8
OVER RANGE
CAL NO CURVE
C INJECT TEMP
L M
C BLOOD TEMP
LOW BATT

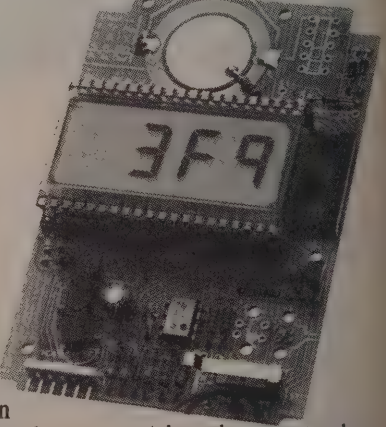
An alpha-numeric instrument display with switchable legends.

CENTENNIAL
100
CELEBRATION

Use graphic elements for emphasis.

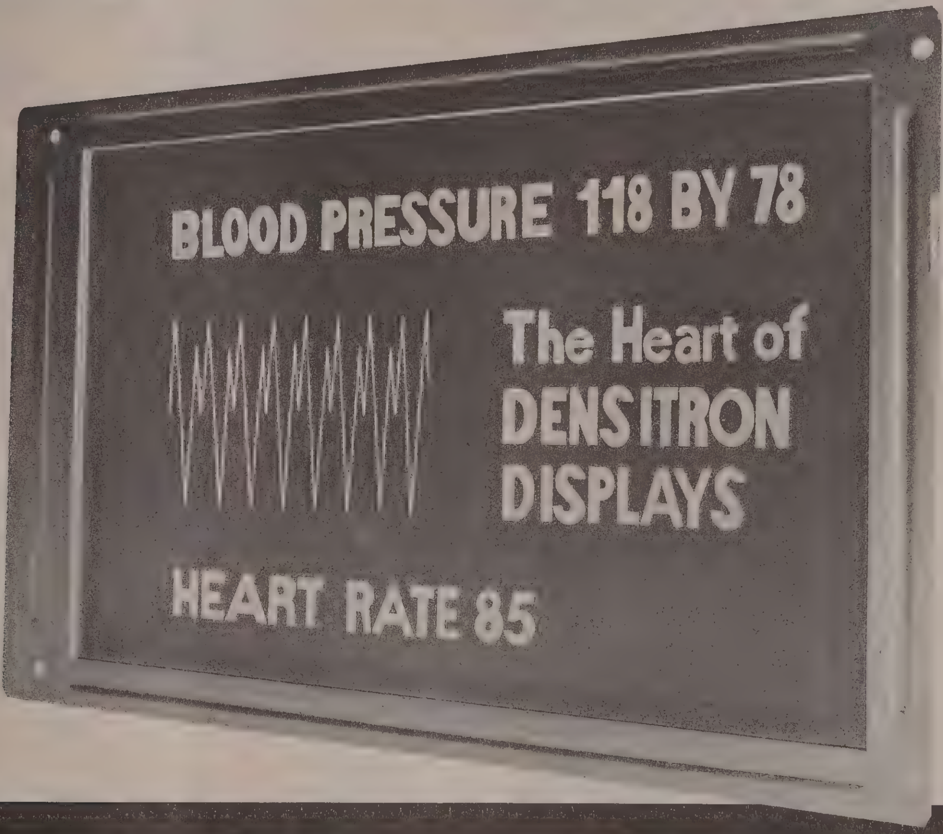


A clock display with digital hours and analog minutes.



Ask us about our turnkey production capability: circuit design, prototype, assembly and packaging.

A CLEAR VIEW OF SMALL GRAPHIC DISPLAYS



Densitron is a world leader in displays and display technologies. We have just completed a major expansion of our small graphics LCD product line. We now have 31 models available, with a wide list of features and options.

- Low power with high contrast STN technology
- EL, CFL, LED and fiber optics backlighting options
- Choice of "on board" graphics controllers
- Pixel formats range from 32 x 80 to 200 x 320
- The widest choice of formats, polarizer options, and colors in the industry
- Value added features or customized displays are our specialty
- In addition to small graphics we offer an extensive range of A/N LCD character modules, large graphics LCD modules and VGA plasma displays. We have the display solution.

DENSITRON

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Phone: (803) 432-5008 Fax: (803) 432-1165
DENSITRON CORPORATION AMERICA, WESTERN REGION, 3425 W. Lomita Blvd., Torrance, CA 90505
Phone: (310) 530-3530 Fax: (310) 534-8419

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm^3
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.

[b] Based on fuel consumption only.

[c] Weight of air not considered in computation of watt hours.

[d] Water-activated

[e] Automatically activated; high rate discharge; 2- to 10-min rate.

[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.

[g] Four-minute discharge rate.

[h] β-alumina electrolyte, 300°C operation.

[i] Fused salt; 350°C operation.

[j] Solid $RbAg_4I_5$ electrolyte.

[k] Several different cathode materials used.

[l] Fuel consumption is based on source of H_2.

[m] Based on methanol battery-fuel supply in situ.

Now Available
10", 12" and 14" color!

High Performance CRT Monitors For Medical, Military Industrial and All High Resolution Applications

GENERAL DESCRIPTION—Model 130DMX
Militarized Video Monitor.

The 130DMX is a state of the art militarized performance for rugged environments. This line of monitors features high brightness P43 phosphor, sunlight readability, EMI/RFI shielding, low power consumption and splashproof front panel mounting. This line is available with flat screen in a variety of sizes. All monitors are built to custom specifications. This line of monitors is designed to meet or exceed the following military specifications; MIL-E-6051D, MIL-P-11268, MIL-C-14806A, MIL-STD-461B, MIL-STD-810D.

Specifications:

Electrical:

Signal Interface: RS170A/RS375A composite BNC
Power Input: 15VDC @ 1.2 Amp nominal
CRT Type: 6 inch/20mm Display grade
P43 Phosphor color
OCLI optical notch filter
EMI/RFI Mil-C-14806A
Front panel splashproof seal
Operating Humidity Range: 100% non-condensing
Operating Temp Range: −33°C to +71°C
Temperature Shock Range: −46°C to +71°C
Operating Altitude: 25,000 feet
MECHANICAL (6 inch display)
Overall Length: 10.2″ (260mm)
Overall Width: 5.9″ (151mm)
Overall Height: 4.9″ (125mm)
Weight: 6 LBS

GENERAL DESCRIPTION—Model 118DMX-110°
Monochrome Display Module

Model 118 is designed for high density, large screen, monochrome applications where superb performance, wide deflection angle CRT's are required. Landscape or portrait formats are available.

Performance Characteristics:

- Time Base Range: Horiz.; 15KHz to 35KHz
  Vert.; 40Hz to 100Hz
- Video System
  - Bandwidth to 50MHz
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels
- Deflection System
  - CRT high acceleration voltage range from 12 to 18KV.
  - Dual axis dynamic focus correction.
  - Linearity 10% or better, horizontal and vertical axis.
- HV fault sensing auto shutdown.
- System power requirement
  24VDC at 1.0-1.5 A max.

GENERAL DESCRIPTION—Model 115DMX-90°
Monochrome Display Module

Model 115 is a high performance, general purpose monitor compatible with the full range of 20mm CRT's Landscape or portrait formats are available.

Performance Characteristics:

- Time base range:
  - Vertical: 40-100Hz
  - Horizontal: 15-40 KHz (see options)
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels
- Video System
  - Bandwidth; 50MHz (min).
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes
  - Discrete dual intensity capability
- Deflection System
  - CRT high acceleration voltage range from 9 to 16KV
  - Linearity 10% or better, horizontal and vertical axis.
  - HV fault sensing auto shutdown
- System power requirement
  12-15V DC at 700mA to 1.5 A max.

Mechanical:

CRT Satellite PCB (circular)
Model 115DMX 2.0″ (50.8mm)
118DMX 2.1″ (53.34mm)
Main Sweep PCB+ (rectangular)
Model 115DMX 5.7″ (144.8mm)×4.55″ (114.3mm)
Model 118DMX 7.00″ (77.80mm)×4.55″ (115.57mm)
Model 130DMX 7.2″ (182.7mm)×5.60″ (142.13mm)

Safety:

- All models are UL, CSA, DHHS, FCC certifiable

Environmental Specification: (115DMX and 118DMX)

- Operating temperature: 65°C to −20°C
- Storage temperature: 80°C to −55°C
- Operating altitude: 20,000 ft. max.

Configurations:

- Kit form—Pre-aligned CRT packaged with display electronics circuit (PCB) board
- Chassis assembly—As above with standard or custom sheet metal designs
- Cabinet model—Complete display and power electronics integrated and supplied in a finished housing.

Available Options:

- All Standard video formats available: VGA, EGA, Hercules, CGA, Super VGA, etc.
- Bipolar sync interface: Provides buffered sync compatibility to any combination of positive or negative going signals.
- Composite signal interface: Provides A/D conversion of low level composite sync and video wave forms and adds vertical and horizontal retrace blanking signals.
- CRT Options (Model 115DMX)
  Data Grade 5″, 7″, 8″, 9″, 10″, 12″ and 14″
- CRT Options (Model 118DMX)
  Data Grade 12″, 15″, 17″, 19″ and 23″ sizes
- CRT Options (Model 130DMX)
  Data Grade 5″, 7″, 8″, 9″, 10″, 12″, and 14″
- CRT options—all units
  - High contrast optical enhancements
  - All EIA and special phosphors

Optional Power Supply(s)

- Hybrid single rail switcher
  120/240V AC (selectable), 50/60Hz compatibility
- Output: single output regulated for 12, 15, 18, or 24 VDC
- Full range international switcher
  - Input: 90-265 VAC continuous
    Available as single or multiple (4) outputs with up to 120 watts total
- Additional features:
  - Soft start limits in-rush current
  - Over voltage and current foldback protection
  - Input line filter limits EMI to meet FCC20780 Class B
  - High efficiency operation 75-80% typical.

Above specifications represent nominal performance. Please check for current performance capability.

*Price for monitor and kit configuration subject to change. Consult factory.

†The unit can be signal driven through a standard card edge connector or alternately via 10-pin or 20-pin square wire terminals.

COMPUTRON DISPLAY SYSTEMS

A DIVISION OF
XCEL CORPORATION

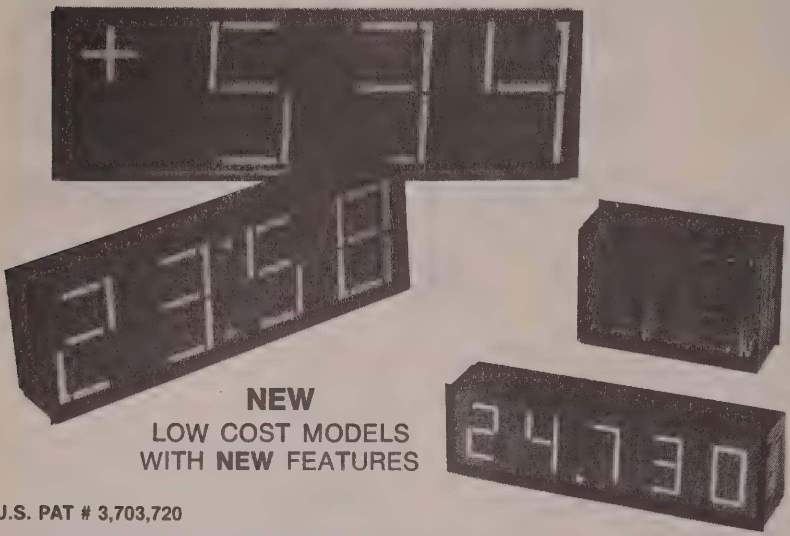
845 Bonnie Lane, Elk Grove Village, IL 60007
FAX (708) 952-0832 Tel: (708) 952-8800

Let Computron integrate your monitors into your subassembly. Contact Computron's Subsystem Engineering and Manufacturing Services Center at (909) 391-4321. Also see our keyboards (5150) and switches (5100).

DIO-REY

THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

LARGE NUMERICS
1", 2", 3", 5½" & 9¾"



NEW
LOW COST MODELS
WITH **NEW** FEATURES

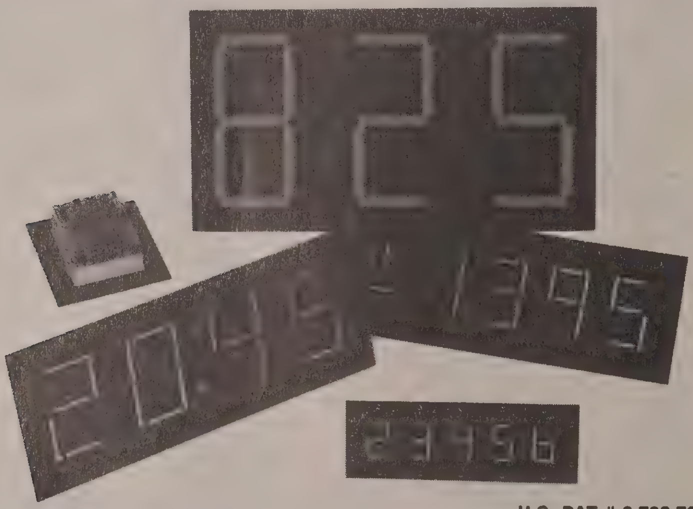
U.S. PAT # 3,703,720

DESIGNER SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68631	1.0 IN.	30 FT.
68632	2.0 IN.	60 FT.
68633	2.8 IN.	85 FT.

FEATURES

- Supplied in attractive, multi-digit assemblies
- Ready to install into rectangular panel cutout
- Assembly includes bezel & anti-glare front panel
- High-Efficiency Red Std; yellow & green optional
- Low power (Avg watts/digit): .6 / 1" digit; 1.5/ 2" & 3"; 3.0 / 5½"; 7.4 / 9¾"
- TTL or CMOS logic is part of assembly-Memory opt'l
- ± sign, colons, fixed or floating decimal are standard options
- Logic Socketed: Plug-in I/O
- 1 year parts & labor warranty



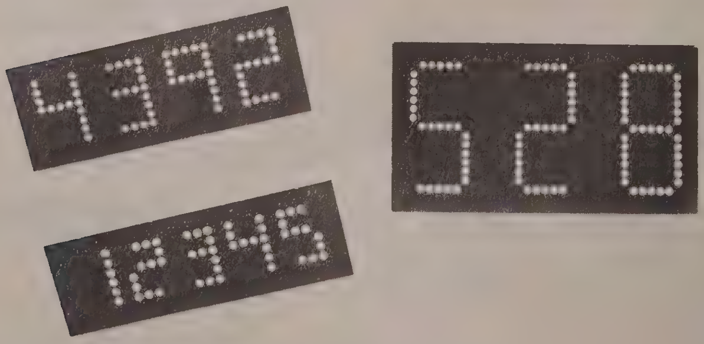
U.S. PAT # 3,703,720

INDUSTRIAL SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68731	1.0 IN.	30 FT.
68732	2.0 IN.	60 FT.
68733	2.8 IN.	85 FT.
68736	5.6 IN.	170 FT.
68739	9.8 IN.	290 FT.

FEATURES

- Supplied in multi-digit assemblies w/anti-glare front panel
- Flange mounting w/gasket for NEMA environments
- TTL or CMOS drive logic boards are part of assembly–Memory opt'l
- High-Efficiency Red Std; yellow & green optional
- ± sign, colons, fixed or floating decimal are standard options
- Logic Socketed
- Solderless, plug-in I/O
- 1 year parts & labor warranty



NEW
LOW COST
MODELS
WITH **NEW**
FEATURES

U.S. PAT # 3,703,720

OUTDOOR SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68832	2.0 IN.	60 FT.
68833	2.7 IN.	80 FT.
68836	5.5 IN.	150 FT.
68839	9.8 IN.	290 FT.

FEATURES

- Multi-digit assemblies w/anti-glare front panel
- Hi brightness Red AlGaAs LEDs for sunlight uses
- Hi efficiency yellow for stage light applications
- ± 20° & ± 60° viewing models available
- Flange mounting w/gasket for NEMA environments
- TTL or CMOS drive logic is std-Memory opt'l
- ± sign , colons, fixed or floating decimal opt'l
- Logic socket mounted; Plug-in I/O

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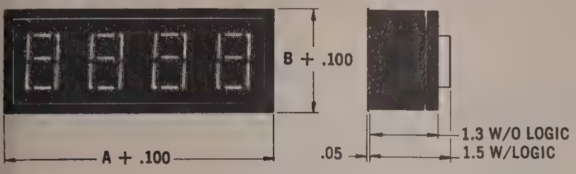
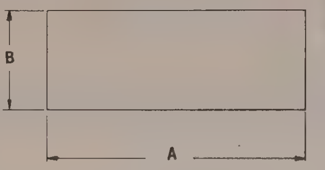
MOUNTING INFORMATION

68632-XX-4D-X-X DESIGNER SERIES





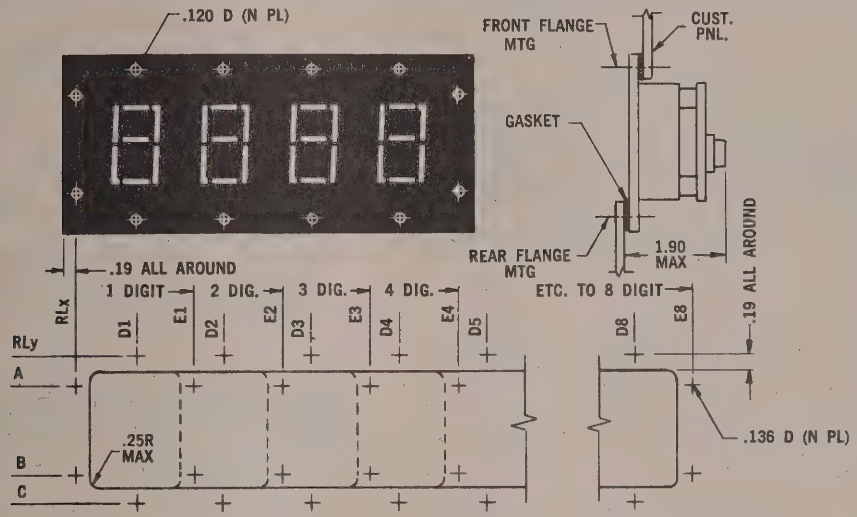
EXAMPLE: 68632-XX-4D-X-X (±8.8.8.8 F'mat)

Would have a cutout of: $2.380\,^{+015}_{-000}$ H × $9.157\,^{+015}_{-000}$ W

CUTOUT DIMENSIONS
ALL TOLERANCES +.015, −.000
* ± sign equals one digit

No. of Digits In Assy*	Series 68631 B=1.630	Series 68632 B=2.380	Series 68633 B=3.130
	A	A	A
1	1.253	1.629	2.010
2	2.381	3.511	4.650
3	3.509	5.393	7.290
4	4.637	7.275	9.930
5	5.765	9.157	12.570
6	6.893	11.039	15.210
7	8.021	12.921	17.850
8	9.149	14.803	20.490

6873X INDUSTRIAL SERIES & 6883X OUTDOOR SERIES



NOTES:

(1) Segments on all OUTDOOR Series are dot type. See photos.

(2) Two dimensions for a given Dim. Code indicate 2 mounting hole locations.

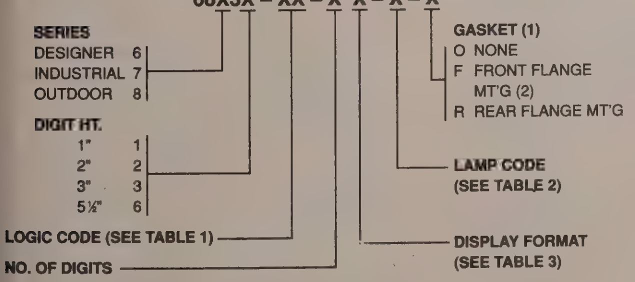
(3) ± sign equals one digit.

EXAMPLE:
68733-XX-2A-X-X
(88 F'mat)
Would have 8 holes .136D; Mtg. hole centers would be defined by: A=.750, B=3.375, C=4.125, D1=1.500, D2=4.125, E2=5.625; The cutout size will be: 3.75 H × 5.25 W

CUT OUT DIMENSIONS
ALL DIMENSIONS OFF RLX & RLY

DIM. CODE (2)	SERIES 68731	SERIES 68732 & 68832	SERIES 68733 & 68833	SERIES 68739 & 68839
A	.375	.750	.750	.37, 3.00
B	1.500	2.625	3.375	5.62, 8.25 & 10.87
C	1.875	3.375	4.125	11.62
D1	.750	1.500	1.500	.75, 3.37 & 6.00
D2	1.875	3.375	4.125	8.62, 11.25 & 13.87
D3	3.000	5.250	6.750	16.50, 19.12 & 21.75
D4	4.125	7.125	9.375	24.37, 27.00 & 29.62
D5	5.250	9.000	12.000	32.25, 34.87 37.50
D6	6.375	10.875	14.625	40.12, 42.75 & 45.37
D7	7.500	12.750	17.250	48.00, 50.62 53.25
D8	8.625	14.625	19.875	55.87, 58.50 61.12, 63.75
E1	1.500	2.625	3.000	6.37
E2	2.625	4.500	5.625	14.62
E3	3.750	6.375	8.250	22.87
E4	4.875	8.250	10.875	31.12
E5	6.000	10.125	13.500	39.37
E6	7.125	12.000	16.125	47.62
E7	8.250	13.875	18.750	55.87
E8	9.375	15.750	21.375	64.12
NO. of DIGITS	N (Qty. of Mtg. Holes)			
1	6	6	6	16
2	8	8	8	22
3	10	10	10	28
4	12	12	12	34
5	14	14	14	40
6	16	16	16	46
7	18	18	18	52
8	20	20	20	58

GENERATING PART NUMBERS



68X3X – XX – X X – X – X

SERIES
DESIGNER 6
INDUSTRIAL 7
OUTDOOR 8

DIGIT HT.
1" 1
2" 2
3" 3
5½" 6

LOGIC CODE (SEE TABLE 1)

NO. OF DIGITS

GASKET (1)
O NONE
F FRONT FLANGE MT'G (2)
R REAR FLANGE MT'G

LAMP CODE (SEE TABLE 2)

DISPLAY FORMAT (SEE TABLE 3)

TABLE 3

CODE	DISPLAY FORMAT	
A	88	8
B	8.8.	.8
C	± 88...............	8
D	± 8.8.	.8
E	88:88:88 or 88:88	
F	88	80
X	OTHER F'MATS	

NOTES:

(1) Gasket not available on Designer Series.

(2) Not availble on 68731 Series.

EXAMPLE: A Designer Series with 2" digits; TTL, BCD to 7-Bar decoder-drivers without leading zero blanking; 3 digits; ± sign and floating decimal point (± 8.8.8 format); and, red LEDs would have part #68632-D1-3D-P-0. If the unit had a single decimal to the left of the least significant digit, it would be called out as: "#68632-D1-3X-P-0; ±88.8 format."

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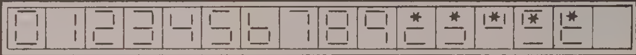
DIO-REY
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

DRIVE OPTION, LED & HOOK UP DATA

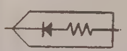
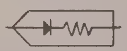
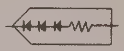
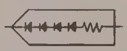
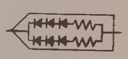
TABLE 1

LOGIC TYPE	TTL		CMOS W/LATCH MEMORY								CMOS				NONE
LOGIC CODE DASH NO.	-D1	-D2	-M1	-M2	-M3	-M4	-M5	-M6	-M7	-M8	-C1	-C2	-C3	-C4	-00
W/O Lead'g Zero Blank'g	●														
W/Lead'g Zero Blank'g		●													W/O LOGIC
1 Latch Per Digit			●	●	●	●									
1 Latch Per Display							●	●	●	●					
Latch Inactive											●	●	●	●	
Blanking User Driven					●	●			●	●			●	●	
Blanking Inactive			●	●			●	●			●	●			
Test User Driven				●		●		●		●		●		●	
Test Inactive			●		●		●		●		●		●		
Requires External Connections ✚		●					●	●	●	●					
Bridge "T" Condition	R	R	C	R	C	R	C	R	C	R	C	R	C	R	
Bridge "B" Condition	R	✚	C	C	R	R	C	C	R	R	C	C	R	R	
Bridge "S" Condition	R	✚	R	R	R	R	R	R	R	R	C	C	C	C	
DIP Plug Cable Type	XPOO		XPMX				XPOO				XPOO				

DISPLAY



BINARY INPUTS																
8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
1 = High 4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
0 = Low 2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

TABLE 5 LED SCHEMATICS	1" TTL SEGM'T; 1"- 5 1/2" DEC. PT.	1" CMOS SEGM'T OR DEC. PT.	2" SEGMENT	3" SEGM'T; 9 3/4" DEC. PT.	5 1/2" SEGMENT
					
	9 3/4" SEGM'T IS THE SAME AS THE 5 1/2" SEGM'T EXCEPT THAT THERE ARE 20 LEDs/SEGM'T ARRANGED IN 4 PARALLEL LINES W/5 LEDs/LINE.				

DRIVE LOGIC NOTES

The 68X31 Series use SN7447A (TTL) or 4511B (CMOS), BCD to 7 Bar decoder drivers. The 68X32, 68X33 & 68 × 36 Series use SN74LS48 (TTL) or 4511B (CMOS), decoders which drive ULN2003A, 7 channel darlington drivers.

As with all CMOS devices, options with user driven inputs must be switched high or low during operation.

The logic supply current for TTL options is 30ma, typ., per digit except for the 68X31 Series where 55ma per digit is required.

TABLE CODES

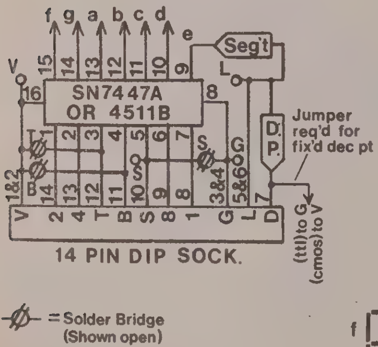
*	*With CMOS logic options, the display will blank if BCD input is greater than 9.*
●	*Has the function.*
Blank	*Does not have the function.*
C	*Closed.*
R	*Open.*
✚	*See DIP PLUG CABLE schematics.*

NOTES:
(1) P, Q & R LEDs are GaAsP/GaP; S LED is AlGaAs.
(2) 5V req'd for 1" model; 12V req'd for 2", 3" & 5½" models; 15V req'd for 9¾".
(3) Max amps/digit (w/figure 8 on): 1", 2" & 3" req'r .175; 5½" req's .350; 9¾" req's .700 - Type is 70% of max.
(4) Std LED orientation is common anode except for 1" displays w/CMOS decoders.
(5) A 5V logic power, regulator is optional on units with 12 or 15V LEDs.
(6) Provides ± 20° view'g for outdoor applic'ns.
(7) Provides ± 60° view'g for outdoor applic'ns.

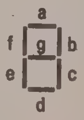
TABLE 2	LED LAMP DATA			
LED COLOR	RED	GREEN	YELLOW	RED
PT. NO. CODE (1) (2) (3)	P(6)	Q	R	S

1"

68631 & 68731 SERIES

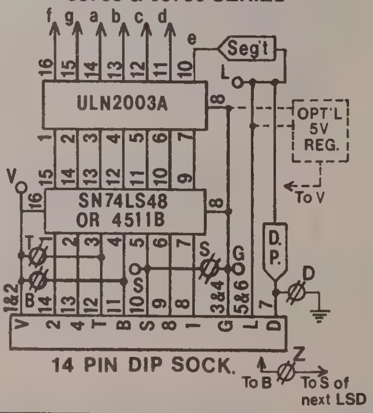


* SEE TABLE 4



2", 3", 5½" and 9¾"

68632, 68732, 68633
68733 & 68736 SERIES



DRIVE LOGIC SCHEMATICS

The 1" LED display is supplied w/comm. anode for TTL decoders or comm. cathode for CMOS decod-ers. Common anode LED's are used in 2", 3", and 5½" units with either type of logic because the ULN2003A, 7 channel, Darlington driver is em-ployed.—TTL or 5V CMOS logic is Std. for 1" displays: TTL or 5-15V CMOS logic is standard for the 2", 3", 5½" & 9¾". Latch memory is Std. on all CMOS displays. The schematics for the LED lamps used are shown in Table 5. The Std termination for each digit is a 14 pin DIP socket. This I/Os the BCD, logic & lamp power, and when specified, strobe, blanking, lamp test & decimal point. Additional connection points for logic & lamp power, strobe & decimal point are provided on the drive logic board for applications requiring larger power lines or separate strobe &/or decimal point inputs (-M1 thru-M4). The L, V & G lines are bussed for all digits on ea. P.C. Bd. The BCD and Latch are positive true (high = function); Test and Blanking are negative true (GND = function).

TABLE 4 DRIVE LOGIC TERMINAL DESIGNATIONS & DIP PLUG DATA

TERMINAL CODE	TTL (1) (68X3X-DX-X Series)	CMOS (3) (8) (68X3X-CX&-MX Series)	FLAT CABLE COLOR/LINE#	PLUG PIN#
1, 2, 4 & 8	BCD Inputs	BCD Inputs	OR13, BR1, OR3 & BR11	8, 14, 13 & 9
B	Blank'g Input (2) (6)	Blank'g Input (4) (6)	Violet 7	11
D	Decimal Point (10)	Decimal Point (10)	Yellow 14	7
G	Ground (L & V Return)	Ground (L & V Return)	Blue 6 & Grey 8	3 & 4
L	Lamp Pos. Common	Lamp Common (5)	Black 10 & Red 12	5 & 6
S	Zero Blanking Input	Latch (11)	White 9	10
T	Lamp Test	Lamp Test (4) (6)	Green 5	12
V	Logic Positive	Logic Positive	Red 2 & Yellow 4	1 & 2

NOTES:
(1) See specifications of SN7447A or SN74LS48 for details.
(2) Not available if leading zero suppression is specified.
(3) See specifications of 4511B for details
(4) The T and/or B inputs are strapped high for CMOS logic options calling for inactive test and/or blanking.
(5) Positive EXCEPT for 68X31-MX where L is Gnd.
(6) Test & Blanking are active low functions if specified "User Driven".
(7) Regulated power supplies recommended for lamps & logic.
(8) Handle CMOS logic at a conductive work station until wired into system.
(9) For ± sign: BCD 7 = +, BCD 6 = – (Control w/1 bit: Strap 2 & 4 bits high & 8 Bit low.)
(10) Dec. pts. are user driven thru term'l D. Connect D to G on all series except 1" w/CMOS where D goes to V.
(11) S input is strapped low for CMOS logic without memory.
(12) For additional information, see notes in "DIP PLUG CABLES".

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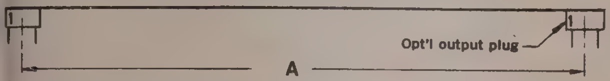
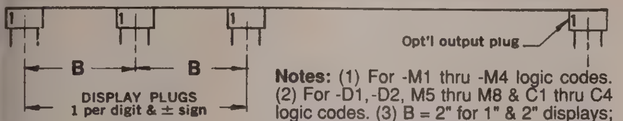
DIP PLUG CABLES

PARALLEL BCD, TYPE XPOO–#14-2POO-1-36 shown (If A = 36).

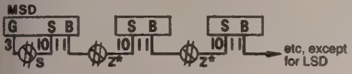


STROBED BCD, TYPE XPMX–#14-2PM1-3-XX shown. Strobe &/or Dec. Pt. connections made by Type XPOO DIP Plug Cable. See Serial Reciever Displays.

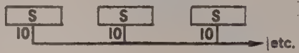


Notes: (1) For -M1 thru -M4 logic codes. (2) For -D1, -D2, M5 thru M8 & C1 thru C4 logic codes. (3) B = 2" for 1" & 2" displays; B = 4⅝" for 3" & 5½" displays. (4) ± sign counts as one digit.

EXTERNAL CONNECTIONS REQ'D FOR -D2 LOGIC



EXTERNAL CONNECTIONS REQ'D for -M5 THRU -M8 LOGIC



STANDARD INTERFACE CABLES

Interface Type	Cable Type
820 Serial Receiver	14-2PMX-X-XX-CS001**
821 A/D Converter	14-2POO-X-XX-CS003
822 Decade Counter	14-2POO-X-XX-CS004
823 Clocks & Timers	14-2POO-X-XX-CS004

* 1" display does not have Z bridge.
** Includes Type XPOO
RE: Multidrop, 1" & 2" (1)(3)

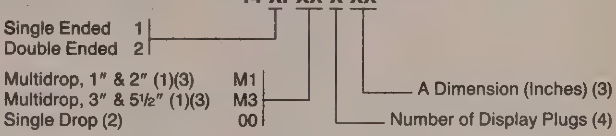
GENERAL: Using type XPOO & XPMX DIP Plug Cables will simplify the installation of the 68X3X Series Displays. This leads to lower installed cost & ease of servicing. They include 14 pin DIP plugs to mate with the drive logic board & optional output plugs, assembled to color coded flat cable (See Table).

EXTERNAL CONNECTIONS IN XPOO & XPMX DIP PLUG CABLES

-D2 Logic Code (XPOO Plug Cable) For -D2 Logic Code (Leading zero blanking): Strap S Term'l of MSD (1) to G (If -D2 Logic Code is specified for display this has been done by closing Bridge S). The B line of the MSD (1) is connected to the S line of the next LSD (1). This B to S connection is repeated on the following digits except the LSD (1) of the display assembly (If -D2 Logic Code is specified for 2', 3" or 5½" displays, Solder Bridges Z are closed between all digits except the last two LSDs).—See schematic "External Connections Req'd for -D2 Logic," to the left.)
-M5 thru -M8 Logic Codes (XPOO Plug Cable) Buss the S Lines from ea. digit (2).
-M1 thru -M4 Logic Codes (XPMX Plug Cable) As supplied, pins 10 (S) & 7 (D) are removed from all the plugs in these cable assy's. Strobe &/or dec. pts. may be brought out by #14-1-POO-XX.

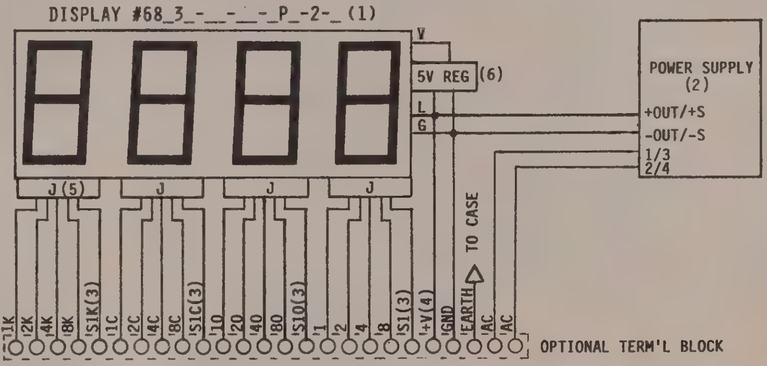
(1) MSD = Most significant digit (L.H. digit); LSD = Least significant digit (R.H. digit).
(2) All V, G & L lines are bussed on board to facilitate powering the display. If the T &/or B functions are user driven, they should be bussed.

GENERATING PART NUMBERS
14-XPXX-X-XX


Single Ended 1
Double Ended 2
Multidrop, 1" & 2" (1)(3) M1
Multidrop, 3" & 5½" (1)(3) M3
Single Drop (2) 00
A Dimension (Inches) (3)
Number of Display Plugs (4)

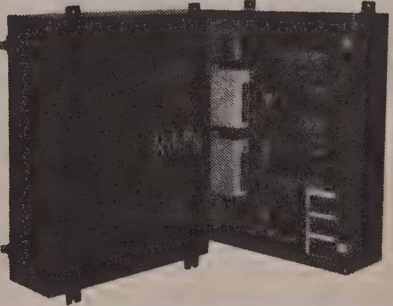
SCHEMATIC OF TYPICAL DISPLAY WITH PARALLEL BCD INPUTS (STROBE OPTIONAL)

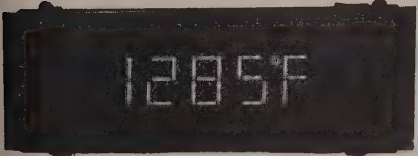
NOTES:
(1) See "GENERATING PART NUMBERS".
(2) For 1" units, 5VDC supply #HB5-3 is used; for 2", 3" & 5½"* units, 12VDC supply #HB12-1.7 is used.
(3) Strobe outputs are provided for displays with -MX Logic Codes only.
(4) +5V for 1" units; +12V for 2", 3" & 5½" units.
(5) J is a 14 pin DIP socket on the display & a 14 pin DIP Plug Cable (#14-1POO-1-36) between the display & Term'l Block.—See Table 4 for pin-out details.
(6) The 5V Regulator option is not required for 1" displays since lamps & logic require 5VDC or for larger displays where 12V, CMOS logic is to be utilized.
(7) All DIO-REY Products carry our 1 year parts and labor warranty.



LARGE DIGITAL INSTRUMENTS

SERIAL INTERFACE DISPLAYS, DIGITAL METERS, COUNTERS, CLOCKS & TIMERS



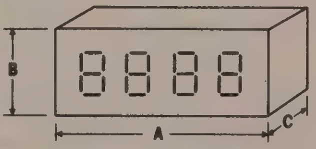


FEATURES
- Large, easy to read LED displays for high reliability (1", 2", 3", 5½" adn 9¾")
- Available in rugged industrial or attractive Designer packages
- Designed for long, trouble-free service
- Suitable for a wide variety of applications
- Serial interface EIA RS422, RS232 or current loop compatible
- Analog to digital interfaces are voltage, current, temperature, load-cell and tachometer compatible
- Counters, clocks and timers in most popular configurations are available
- Powered from 110/220V, 50/60 Hz
- All wear and calibration components easily accessible

SPECIFICATIONS
- For Displays, see "Large Character Digital Display" spec. sht.
- For Interfaces, see this & next page.
- For Enclosures, see table.
- Termination: barrier terminal block std.

DIGIT HT.	NO. of DIGITS*	ENCLOSURE SIZE (IN)		
		A	B	C
1"	to 6	7.2	3.6	8.5
2"/3"	to 6/to 4	12.0	10.0	4.0
3"/5½"	5 to 8/to 6	26.6	7.1	5.2
9¾"	to 4	36.0	12.0	12.0
9¾"	5 to 7	60.0	12.0	12.0

* ± sign equals one digit.



Std finish is grey enamel

If you have a special requirement for lighted displays, please call us for applications engineering assistance. – We will be happy to help you.

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DIO-REY
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

SYSTEM INTERFACES GENERATING PT. NO's.

GENERAL

DIO-REY has developed a wide variety of standard system interfaces for its numeric alpha-numeric redouts and lighted indicator annunciators. These are the result of over 20 years experience in serving a broad spectrum of industries including instrumentation process control, communications, metals, chemicals, data processing, agriculture, security, office equipment, petroleum, auto, aerospace, textile, packaging, paper, transportation, governmental agencies and military.

These products may also be used in systems which do not require displays. In addition, custom interface electronics, designed to perform outside the specifications or capabilities of our standard units are available. Contact our sales department for technical application assistance.

821 SERIES ANALOG TO DIGITAL CONVERTERS

The DIO-REY 821 Series are bipolar A/D's with up to 4½ digit output capacity • BCD output ranges are: ±1999, ±3999, ±19999 and ±39999.

All feature state-of-the-art technology at competitive cost • Input impedance >100 mΩ • Common mode rejection is 110 dB for DC; 90 dB for AC • Accuracy is ±0.05%, ±1 count • Auto zero and zero offset available • Ranging and zero adjustments conveniently located • 5 VDC and 110/220, 47-500 Hz input, depending on model • −10°C to +65°C; 0-90% RH non-condensing operating environment • ½″ LED display available • 100 K hr MTBF.

Size: 3.75″ × 4.88″ × 1.88″

PART NUMBER	INTER FACE CODE	RANGE (SCALING)	ADJUSTABLE RANGE	ZERO OFFSET
821-1A	—21A	0-2V=0-1999	NO	NO
821-1B	—21B	0-.2V=0-1999	NO	NO
821-1C	—21C	0-XV=0-XXX (1999MAX)	YES	NO
821-2X	—22X	THERMOCOUPLE INPUT	NO	NO
821-3X	—23X	TACHOMETER INPUT	NO	NO
821-4A	—24A	0-5V=X-1999MAX	YES	YES
821-4B	—24B	1-5V=X-1999MAX	YES	YES
821-4C	—24C	0-10V=X-1999MAX	YES	YES
821-5A	—25A	4-20MA=X-1999MAX	YES	YES
821-5B	—25B	0-20MA=X-1999MAX	YES	YES
821-6A	—26A	0-10V=X-9999MAX	YES	YES
821-6B	—26B	0-10MA=X-9999MAX	YES	YES

822 SERIES DECADE COUNTERS

Size: 5.5″ × 2.0″ × .6″

Stds available up to 5 decades, opt'l units available up to 10 decades. This series of counters includes Up, Down, Bi-Directional and Presetable (or combinations of these) units. All have TTL BCD outputs, compatible with DIO-REY displays. — Reset, count and power (5 VDC) are brought in via a terminal block. Outputs terminate through a header.

CONTACT DEBOUNCER IS STD OPTION.

Part Number	Inter-face Code	X = No. of decades Description
822-X-1	—41	X Decade, Up Counter
822-X-2	—42	X Decade, Down Counter
822-X-3	—43	X Decade, Up-Down Counter
822-X-4	—44	X Decade, Present Up Counter
822-X-5	—45	X Decade, Preset Down Counter
822-X-6	—46	X Decade, Preset Up-Down Counter

823 SERIES CLOCKS & TIMERS

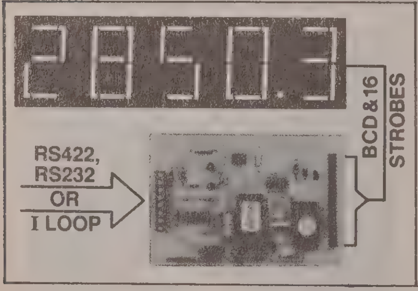
Standard clock Interfaces are supplied in 4 or 6 digit, 12 or 24 hour formats. Calendar and decimal formats are available. Fast and Slow set inputs are standard; hold is optional. ⁽¹⁾ As with the timers, all have BCD outputs compatible with Dio-Rey's Numeric Readouts. Timer interfaces that are available include count up, count down, both with preset options. Switch operation at a specified time optional.

⁽¹⁾ 50/60 Hz and crystal oscillation time bases are optional as are master/slave systems.

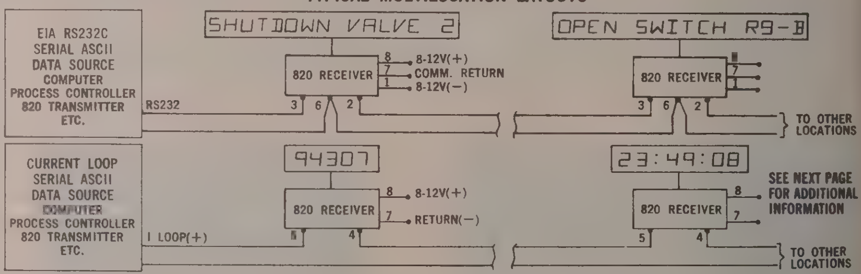
Part Number	Inter-face Code	Description
823-1	—61	4/6 Digit, 12 Hr Clock
823-2	—62	4/6 Digit, 24 Hr Clock
823-3	—63	Up Timer
823-4	—64	Down Timer

If you have a special requirement for lighted displays, please call us for applications engineering assistance.
– We will be happy to help you.

SERIAL ASCII RECEIVERS
FOR REMOTE DISPLAYS, CONTROLS & TELEMETRY


2850.3
RS422, RS232 OR I LOOP
BCD&16 STROBES

TYPICAL MULTILOCATION LAYOUTS


EIA RS232C SERIAL ASCII DATA SOURCE COMPUTER PROCESS CONTROLLER 820 TRANSMITTER ETC.
RS232
SHUTDOWN VALVE 2
820 RECEIVER
8 8-12V(+)
7 COMM. RETURN
1 8-12V(−)
3 6 2
OPEN SWITCH R9-B
820 RECEIVER
7
1
3 6 2
TO OTHER LOCATIONS
CURRENT LOOP SERIAL ASCII DATA SOURCE COMPUTER PROCESS CONTROLLER 820 TRANSMITTER ETC.
I LOOP(+)
94307
820 RECEIVER
8 8-12V(+)
7 RETURN(−)
5 4
23:49:08
820 RECEIVER
8
7
5 4
SEE NEXT PAGE FOR ADDITIONAL INFORMATION
TO OTHER LOCATIONS

The DIO-REY 820 Series Serial to Parallel and Parallel to Serial Converters are microprocessor based and are primarily intended for driving remote display decoders.

The input to the 820 Receiver is a Serial ASCII coded data stream at either RS232 or current loop levels. The 820 Receiver automatically adapts itself to incoming data rates over the range of 110 to 1200 baud. In addition it features a six position DIP switch which allows selective addressing of up to 64 separate receivers on one data link. The output of the receiver is six bits of data and sixteen strobe lines. The receiver, therefore, can drive either sixteen numeric or alphanumeric displays per receiver or up to 96 points in an annunciator system.

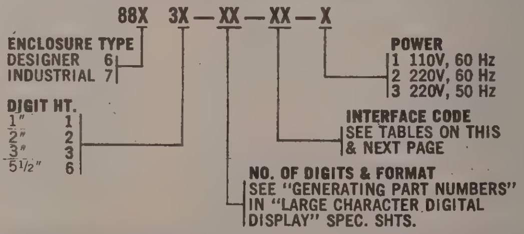
An array of sixteen, 6-bit registers may be sequentially inputted to the 820 Transmitter and converted to a serial output, for annunciator systems.

COMMON STANDARD DIGITAL INSTRUMENT PART NUMBERS

"A" & "E" display formats & 115VAC power option shown.

DESCRIPTION	PART NUMBER
4 digit display w/TTL BCD inputs, in designer box.	8863X-4A-DX-1
6 digit display w/CMOS BCD inputs, in NEMA 12 box.	8873X-6A-CX-1
4 digit display w/strobed BCD inputs, in NEMA 12 box.	8873X-4A-MX-1
4 digit display w/1200 baud RS232, in designer box.	8863X-4A-11-1
6 digit w/1200 baud RS232-repeater, in NEMA 12 box.	8873X-6A-11B-1
4 digit display w/0-2V=0−1999 A/D, in NEMA 12 box.	8873X-4A-21A-1
4 digit display w/4-20ma=0−1999 A/D, in NEMA 12 box.	8873X-4A-25A-1
5 digit display w/up counter, in designer box.	8863X-5A-41-1
5 digit display w/preset down counter, in NEMA 12 box.	8873X-5A-45-1
6 digit, 24hr, free running clock, in NEMA 12 box.	8873X-6E-62-1
4 digit (Min:Sec) preset down timer, in NEMA 12 box.	8873X-4E-64-1

GENERATING PART NUMBERS


88X 3X — XX — XX — X
ENCLOSURE TYPE
DESIGNER 6
INDUSTRIAL 7
DIGIT HT.
1″ 1
2″ 2
3″ 3
5½″ 6
POWER
1 110V, 60 Hz
2 220V, 60 Hz
3 220V, 50 Hz
INTERFACE CODE
SEE TABLES ON THIS & NEXT PAGE
NO. OF DIGITS & FORMAT
SEE "GENERATING PART NUMBERS" IN "LARGE CHARACTER DIGITAL DISPLAY" SPEC. SHTS.

EXAMPLE: A 4 digit, 3″; designer unit w/serial RS232 receiver having 110V, 60 Hz power would have pt. no. 88633-4A-11-1.

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SERIAL ASCII INTERFACE DISPLAYS – SERIES 88X3X-XX-1X-X

FOR REMOTE READOUTS – TWO LINE COMMUNICATION – DAISY CHAINED DISPLAYS

Serial ASCII receiver displays provide freedom in placing display units at remote locations (up to approx. 1000 ft.) from the data source. A two wire connection is all that's required. Multiple displays may be daisy chained off the same data link. Each display location (820C Receiver) is addressable by DIP switch to 64 locations and may drive up to 16 digits (2 x 8 digits, 4 x 4 digits, etc.). Systems using RS232 may be supplied with a repeater option where multi-dropping of displays is required. For longer distances and for noise immunity, RS422/RS485 lines may be used & have up to 32 receivers (512) digits) daisy chained off a single data link.

USER DATA FOR 820C-X SERIAL RECEIVERS - FOR #88X3X-XX-1X-X UNITS

1- GENERAL: The 820C Receiver is a microprocessor based serial to parallel converter for driving remote display decoders. The 820C-X input is serial ASCII at RS232, RS422/485 or I loop levels. The 820C-1X, -2 & -9 adapts to data rates from 110 to 1200 baud while the 820C-5X & -10 are supplied with a fixed rate of 1200, 2400 or 4800 baud. A DIP switch allows addressing to 64 receivers on a data link. The receiver output is 6 bit data & 16 strobes. Each receiver can drive up to 16 numeric or alphanumeric characters or 96 annunciator points.

2- BASIC PT. NOs. W/DESCRIPTION

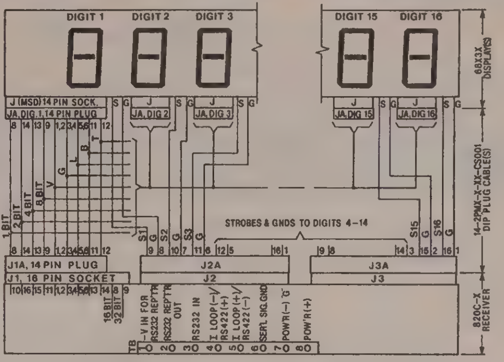
PART NUMBER	SIG. TYPE	BAUD RANGE	OTHER FEATURES	INTERFACE CODE
820C-1	RS232	110-1200	–	-11
820C-1B	RS232	110-1200	RS232 repeater & V inverter	-11B
820C-2	I LOOP	110-1200	–	-12
820C-5	RS232	1200-4800	–	-13
820C-5B	RS232	1200-4800	RS232 repeater & V inverter	-13B
820C-9	RS422/485	110-1200	–	-14
820C-10	RS422/485	1200-4800	–	-15

3- INPUT LEVELS:
a-RS232: ±5 - 12V nom.
b-RS422: ±5V
c-RS485: +12 to -7V
d-I loop: 15-100ma, w/o adjust't; 2.0V drop, typ; 20ma recommended.

4- OUTPUT DATA SPECS: a-DATA: 6 bit ASCII w/16 strobes - These are the 64 character subset from Hex 20 to Hex 5F (0-9, A-Z and certain symbols); 10ma sink @ 1.0V max; .4 ma source @ 2.4 volts min **b**-STROBES: 16 active low sig'ls; 4ma sink at .4 volts max; .4 ma source @ 2.7V min. **c**-STROBE TIMING: 60 usec width & spacing, nom. **d**-DATA SETUP TIME: 5 usec, min.

5- INPUT DATA FORMAT: a-WORD F'MAT: 7 bit ASCII, 1 or 2 stop bits (2 stop bits reg'd @ 4800 baud), even parity. **b**-INTERMESSAGE GAP: 4 msec, min or send HEX FF (2 req'd @ 2400 w/2 stop bits or @ 4800 baud). **c**-MESSAGE FORMAT: (/[char no.] word descript'n/): /[1] SOH (HEX 01)/[2] Most significant address digit/[3] Least significant address digit/[4] Most significant data character/[5 to 19] ...up to 16 data characters/[4 to 20] CR (HEX 0D)/ **d**-TYPICAL MESSAGE TO 820-C W/00 ADDRESS TO DISPLAY NUMERALS 123456 is (in BASIC): CHR$(1) + “00” + “1 2 3 4 5 6” + CHR$(13) - (in HEX): 01 30 30 31 32 33 34 35 36 0D. **e**-MESSAGE LENGTHS: Min message is: (SOH), (A), (A), (CR) & will cause a blank numeric display. Max message is 20 characters. Nom message is flush left & leading zero blanked. To override this blanking, transmit false zeros (HEX 20, 40 or 50) for most significant digit (MSD) or do not use Digit 1 stobe & transmit a filler word, other than ASCII zero for the MSD.

820-X SERIAL ASCII RECEIVER TO NUMERIC READOUT SCHEMATIC (UP TO 16 DIGITS)



6- ADDRESS SELECTION: The 820C may be set to 1 of 64 addresses from 00 to 63 (shipped w/00). Selection is made by setting the DIP switch on board to the 6 bit binary value desired (CLOSED or ON = 0 state). This feature is used where multiple receivers are on one data link & it is desired to send different messages to each.

7- SIZE-POWER-I/O: a-SIZE: 5.3"x3.6"x.6" **b**-MT'G: Req's 4, #4x½" screws w/nuts & ¼" th'k standoffs. **c**-SCHEMATIC: See dwg B820C-X. **d**-INPUT POWER OPTIONS: Regulated 5VDC, unregulated but filtered 8-12VDC or 24VDC @ 140 ma. **e**-I/O CONNECTIONS: Term'l bl'k in/DIP sockets out.

8- THEORY OF OPERATION: The 820C-X is a single chip microprocessor & 1 or 2 support chips. For the -2 (I loop) chip IC5 provides isolation for the current loop input. For the -9X & -10, chip IC6 provides buffering for the RS422/485 signal. Chip IC2 expands the microprocessor's output to provide the address strobes. - Incoming data is received as current loop, via IC5 isolator, thru the RS422/485 buffer, IC6, or the RS232 input network. Then the processor reads & stores the incoming data stream. If the address code agrees with the DIP switch address, the number of characters is correct & all data & control characters are “legal” & in the proper sequence (See par 4 & 5), the stored message is outputted sequentially for one cycle of up to 16 words & strobes, starting with the MSD. i.e.: Left justified. But, if the incoming message has more than 16 data characters, parity errors, or contains any “illegal” words, the stored message is not outputted. The next error free message, properly addressed will be displayed. – For units with 110-1200 baud (-1X, -2 & -9X), the receiver computes the baud of the data stream by measuring the first character start bit width “SOH” (HEX 01). The higher baud units, (-5X, -6 & -10), utilize hardware for baud selection. – Note: The unit will blank until receiving the first valid, displayable message.

DIGITAL COUNTERS - SERIES 88X3X-XX-4X-X

FOR UP, UP-DOWN & PRESET-DOWN COUNTING

FEATURES: Bright, 1", 2", 3", 5 1/2" or 9 3/4" digits for 30-300 ft. viewing • Contact debouncer std • 1 to 10 decades • Designer or NEMA 12 enclosures (NEMA 4 optional) • Red, Green or Yellow digits available • Outdoor models with Red A1GaAs • 110vac power std; 220vac & 12VDC optional • Ter'l bl'k connections • IC's socket mounted.

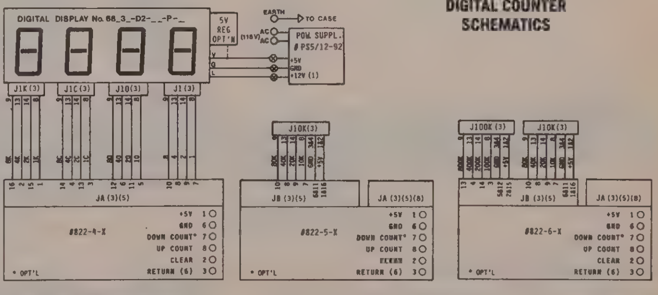
APPLICATIONS: Production line rate displays • Totalizing counters • Productivity displays • Safety days readouts • Tally displays.

USER DATA FOR 822-X-X DECADE COUNTERS USED IN 88X3X-XX-4X-X

The 822-X-X Decade Counter is TTL, bi-directional & presetable. Current inputs may be from uncommitted, N.O. contacts or transistor open collectors. Switch closure inputs are debounced.The debounced or open collector pulses are inverted so that the count increments upon the switch closure or upon the collector going to ground. Reset is done by bringing the CLEAR input terminal to ground, usually via push button switch. Presetable models have thumbwheel or leverwheel switches to select the desired number and a push button switch to enter or load it. The BCD outputs are terminated via 16 pin DIP sockets. Inputs are via strip & screw-clamps terminal blocks. Power required is 5v @ 200ma for a 4 decade unit. The size for up to 6 decades is 5.5" x 2.0" x 1.0".

PART NUMBER	DESCRIPTION (X = No of Decades)	INTERFACE CODE
822-X-1	X Decade, Up Counter	-41
822-X-2	X Decade, Down Counter	-42
822-X-3	X Decade, Up-Down Counter	-43
822-X-4	X Decade, Preset Up Counter	-44
822-X-5	X Decade, Preset Down Counter	-45
822-X-6	X Decade, Preset Up-Down Counter	-46

DIGITAL COUNTER SCHEMATICS



88X3X-4A-4X-1, 4 DIGIT COUNTER SCHEMATIC

88X3X-5A-4X-1, 5 DIGIT COUNTER SCHEMATIC

88X3X-6A-4X-1, 6 DIGIT COUNTER SCHEMATIC

NOTES:
(1) +5V for 1" Model (68631 & 68731 Series)
(2) Not required for 1" Model or with PS5/12-92.
(3) J1 thru J100K are 14 PIN DIP Plugs; JA & JB are 16 PIN DIP Plugs.
(4) ○ = Screw Terminal Block Point.
(5) DIP Plug Cable No. 14-2P00-X-24-CS004. X = No. of Display Digits.
5 Digit Cable Includes JB-J10K; 6 Digit Includes JB-J10K/J100K.
(6) Ground Return for Up Count, Down Count & Clear.
(7) For 220V, 50/60Hz or DC Power, Consult the Factory.
(8) Pinouts for JA, J1-J1K are the same as for #88X3X-4A-4X-1.

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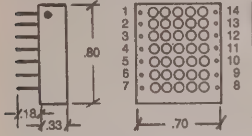
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

ALPHANUMERICS
LIGHTED INDICATORS

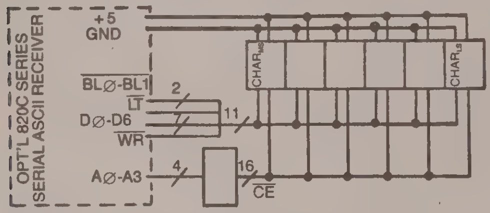
ALPHANUMERICS—0.7″, 2.0″ & 4.0″ 5×7 DOT MATRIX

SINGLE CHARACTER 0.7″ LED, DLX-713X SERIES
FEATURES: Integral Memory, Character Generator, Multiplex LED Drive Circuit & Lamp Test • ±75° Viewing Angle • 4 Level Intensity Control (500ucd, Min. at full brightness) • 96 Character ASCII Repertoire • Inputs are TTL and microprocessor buss compatible • May be stacked to provide multi-character displays • 630nm Red-Orange Std (#DLO-7135), 565nm Green Optl (DLG-7137) • 5VDC at 200ma Max. Power • Rated Viewing: 20 Feet.

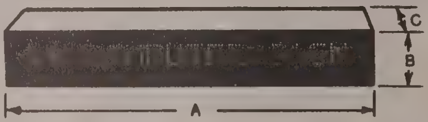
LOADING DATA: Chip enable ($\overline{\mathrm{CE}}$) to be present & stable during write pulse ($\overline{\mathrm{WR}}$). Parallel data to be stable for 200ns min. & held for 100ns after write goes high (latched). No sync is req'd & each character latches until replaced with another. Multiple displays may be stacked together with a binary address as shown or one $\overline{\mathrm{CE}}$ per character may be used.



Pin Function	Pin Function
1 VCC	14 D6 Data input MSB
2 $\overline{\mathrm{LT}}$ Lamp test	13 D5 Data input
3 $\overline{\mathrm{CE}}$ Chip enable	12 D4 Data input
4 $\overline{\mathrm{WR}}$ Write	11 D3 Data input
5 $\overline{\mathrm{BL1}}$ Brightness	10 D2 Data input
6 $\overline{\mathrm{BL0}}$ Brightness	9 D1 Data input
7 GND	8 D0 Data input LSB



64 CHAR. SUB SET			D0	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
			D1	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H
			D2	L	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H
			D3	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H
D6	D5	D4	HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
L	H	L	2		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
L	H	H	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
H	L	L	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
H	L	H	5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_



Enclosure Sizes (Inches)	
Char. Ht.	A×B×C
0.7	13.8×4.5×4.7
2.0	36×6×6
4.0	72×8×8
Mat'l: Steel Finish: Grey Enamel	

16 CHARACTER, 0.7″, LED UNIT W/SERIAL ASCII OR PARALLEL DATA BUSS INPUT, #84040C-16 The unit employs the DLX-713X display with our 820C Series serial receiver (See 820C data sheet for detailed specs) and accepts RS232, RS422 or current loop at 110 to 4800 baud. The serial type character repertoire includes 64 character subset from Hex 20 to Hex 5F. The parallel type will display the full 96 character repertoire from Hex 20 to Hex 7F. Input power options: 110V, 60Hz(Std), 220V, 50-60Hz at 40Watts or 5VDC at 3Amps. Hardware may be supplied ready for mounting and hook-up into your enclosure panel, or with enclosure (NEMA12 is std optn). Power and data connections are thru terminal blocks. A typical serial update message would be: SOH/ADD$_{10}$/ADD$_{1}$/CHAR$_{MS}$/CHAR/CHAR/…/CHAR$_{LS}$/CR. For parallel inputs with binary address, the address sequence from CHAR$_{LS}$ (Least significant character) to CHAR$_{MS}$ (Most significant character is: Binary Ø, 1, 2, 3… N (N = 16Max.).

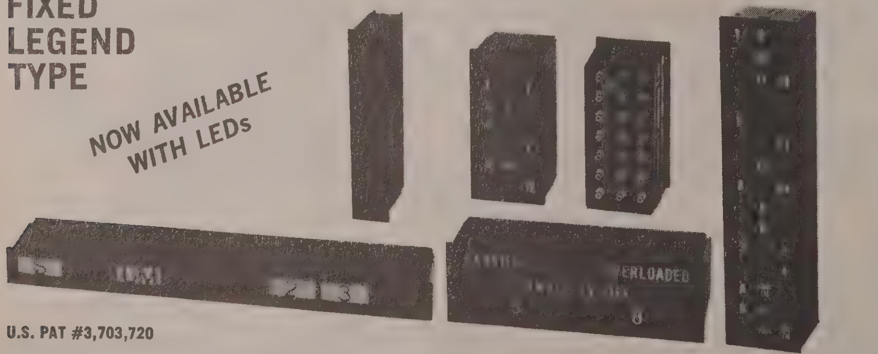
2.0″, 18 CHARACTER, RED LED, #84042C-18 AND 4.0″, 18 CHARACTER, RED LED, #84044C-18 WITH SERIAL OR PARALLEL ASCII INPUT Units accept RS232 or current loop at 300-4800 baud. Or data input may be parallel ASCII from our std. keyboard or a computer buss. Power: 110VAC (220VAC optl) at 70 watts for 2″; 250 watts for 4″. Other features: Fixed or Scrolled Messages • Flashing • Double Width Chars • Reverse Chars (Black chars on red background) • 6K Memory • 17 Stored, Addressable Message Memories • 96 Char Repertoire • Rechargeable Back-Up Battery • Real Time Calendar-Clock • Supplied Ready For User Mounting or in NEMA12 or Designer Oak Enclosure • IBM PC Software Available • Graphics Capability • Viewing Distance; 60 feet for 2″, 120 feet for 4″ • Typical Fixed Message: ESC/CTRL A/CTRL A/ESC/CHAR$_{MS}$/CHAR/CHAR/… CHAR$_{LS}$.

Dio-Rey products carry a 1 year warranty for parts and labor.

If applications engineering assistance is required, please contact us.

BACK LIGHTED INDICATORS PANELS • ANNUNCIATORS • STATUS DISPLAYS • DEAD FRONT PANELS

FIXED LEGEND TYPE



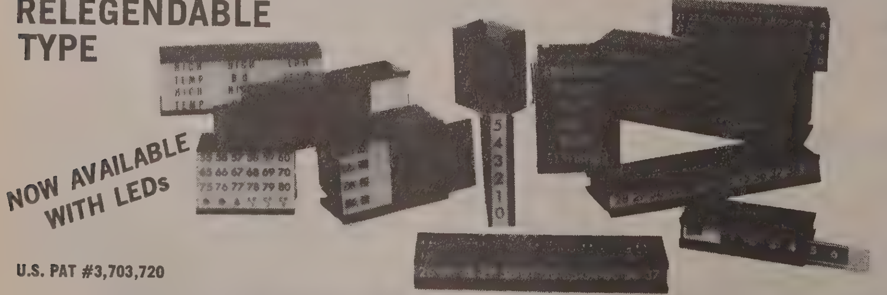
U.S. PAT #3,703,720

Series	Indicator Module Size	Series	Indicator Module Size
68811	3/8″ x 3/8″	68822	3/4″ x 3/4″
68812	3/8″ x 3/4″	68823	3/4″ x 1 1/8″
68813	3/8″ x 1 1/8″	68824	3/4″ x 1 1/2″
68814	3/8″ x 1 1/2″	Special	Any size on 3/8″ Grid

Any group of messages/symbols can be displayed in any combination of colors

- Construction is modular
- Front panel graphics are back lighted using LEDS — STD MFB T1¾ lamps also available
- Units are supplied in an attractive package with bezel and "Black-Out" front panel, ready to snap into rectangular panel cutout
- Lamp common reduces installation time
- Serviced from the front
- Lamp drivers and special logic available

RELEGENDABLE TYPE



U.S. PAT #3,703,720

Series	68911	68912	68914
Indicator Module Size	3/8″ x 3/8″	3/8″ x 3/4″	3/8″ x 1 1/2″

For applications where the legend or graphics must be able to be changed

- Same features as the FIXED LEGEND TYPE
- Can be supplied with photographic film legend
- Relegendable from front
- Six standard color filters
- Twenty-three standard units with from 2 to 48 indicator modules
- Special assemblies available

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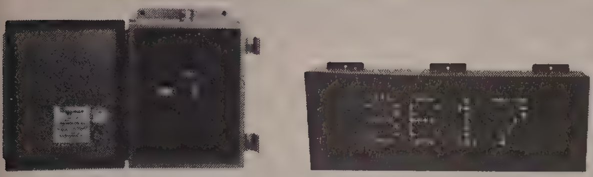
SUPER LARGE INDUSTRIAL READOUTS



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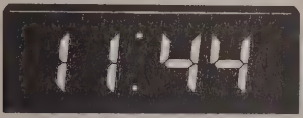
FULL 5 x 7 DOT MATRIX IN HEIGHTS OF 4", 5", 6", 8", 12". UP TO 8 CHARACTER LENGTH. INDOOR & OUTDOOR MODELS. PC/PLC/ADC COMPATIBLE. NEMA 1, 4, 12 CABINETS.



ELAPSED TIMERS

CHARACTER HEIGHTS: .6", 2.25", 4.0", 5", 6", 8", 12". HI-EFFICIENCY LED 7-SEGMENT DIGITS. UP TO 8 DIGIT LENGTH. FRACTIONS OF SECONDS TO HOURS. 12/24 HOUR FORMAT. UP/DOWN, PULSE INPUT, RESET, PRESET. REMOTE CONTROL OPTIONAL. NEMA 1, 4, 12 CABINETS.

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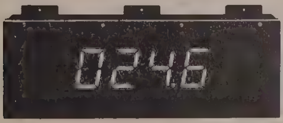
SYNCHRONIZE SATELLITE DISPLAYS WITHOUT A SEPARATE MASTER. DISPLAY HEIGHTS: 1", 2.25", 4", IN HH:MM OR HH:MM:SS FORMAT. BATTERY BACKUP. COMPUTER INTERFACE CAPABILITY. UPDATES EVERY SECOND. DRIVE UP TO 30 SECONDARY DISPLAYS. EASY TWO WIRE, NO POLARITY HOOKUP. SECONDARY DISPLAY HEIGHTS RANGE FROM 1.0" TO 12" TALL.



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THE ED225/ED400 COUNTERS FEATURE HI-EFFICIENCY 7-SEGMENT LED BLOCKS IN CHARACTER HEIGHTS OF 2.25" OR 4.0" WITH LENGTHS UP TO 8 DIGITS. UP/DOWN PULSE INPUT. RESET AND PRESET AVAILABLE. NEMA 1, 4, 12 CABINETS.

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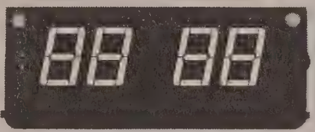
OFFERING ALPHA - NUMERIC, MULTI LINE
DISPLAYS FROM 0.7" TO 8.0" TALL CHARACTERS
INDOOR/OUTDOOR APPLICATIONS

MESSAGE CENTERS - SINGLE LINE

PC/PLC/ADC COMPATIBLE. DISPLAY HEIGHTS: .7", 2", 4" 5.25", 8.0". STANDARD CHARACTER LENGTHS: 12 (.7" ONLY), 16, 20, 24 CHARACTERS. STATIC OR MOVING (SCROLLING) DISPLAYS. ADDRESSABLE. 128 ASCII CHARACTERS. HI-EFFICIENCY OR HI-INTENSITY LEDS. LOW POWER CONSUMPTION. INDOOR & OUTDOOR MODELS. NEMA 1, 4, 12 EXTRUDED ALUMINUM OR STEEL CABINETS. PC SOFTWARE INCLUDED.

MESSAGE CENTERS - MULTI-LINE

PC/PLC/ADC COMPATIBLE. DISPLAY HEIGHTS: 1.16", 2", 4". CHARACTER LENGTHS: 1.16"- UP TO 80 CHARACTERS, 2"- UP TO 40 CHARACTERS, 4"- UP TO 24 CHARACTERS. STATIC PROTOCOL. ADDRESSABLE. 128 ASCII CHARACTERS. OPTIONAL FLASH. DATA TYPES RECEIVED: RS232/RS422/CURRENT LOOP. NEMA 1, 4, 12 EXTRUDED ALUMINUM OR STEEL CABINETS.

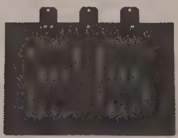


0.6" PANEL METER

EXPANDED OR COMPRESSED 4 DIGIT, 7 SEGMENT LED DISPLAY. DATA TYPES RECEIVED: RS232, RS422, CURRENT LOOP. AVAILABLE AS PANEL MOUNT OR WITH CABINET. STD VOLTAGE REQUIREMENT IS 12 VDC OR 12 VAC.

TIME & NUMERIC MASTER CONTROLLER

MASTER CONTROLLER FOR TIME/DATE OR NUMERIC SECONDARY DISPLAYS UPDATES SECONDARIES EVERY SECOND. TABLETOP OR WALL MOUNT. CONTROLS UP TO 30 DISPLAYS AT 1000'. KEYBOARD INPUT WITH LOCAL DISPLAY. INCLUDES DAYLIGHT SAVINGS TIME CORRECTION. 12/24 HOUR FORMAT & MORE!



12" 5 x 7 DOT MATRIX DISPLAY - INDOOR/OUTDOOR

BIG AND BOLD 12" TALL 5 x 7 DOT MATRIX DIGITS CAN BE SEEN UP TO 500' AWAY. THE ED1200AN HAS 420 HI-EFFICIENCY/HI-INTENSITY LEDS AND IS AVAILABLE IN LENGTHS OF 2 TO 8 DIGITS FOR INDOOR & OUTDOOR APPLICATIONS. NEMA 1, 4, 12 CABINETS. PC/PLC/ADC COMPATIBLE. TYPICAL USES: ELAPSED TIMER, COUNTER, TIME DISPLAY, SERIAL DISPLAY FOR LARGE AREAS. ADC COMPATIBLE.

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The U.S. Power Supply Source for Information Displays

E1056 (SHARP 10" TFT COLOR LCD INVERTER)

The ERG E1056 dc to ac inverter is specifically designed to power the Sharp LQ10D011 10 inch TFT color LCD display module to a nominal brightness level from a +12 volt dc source.

The E1056 offers:

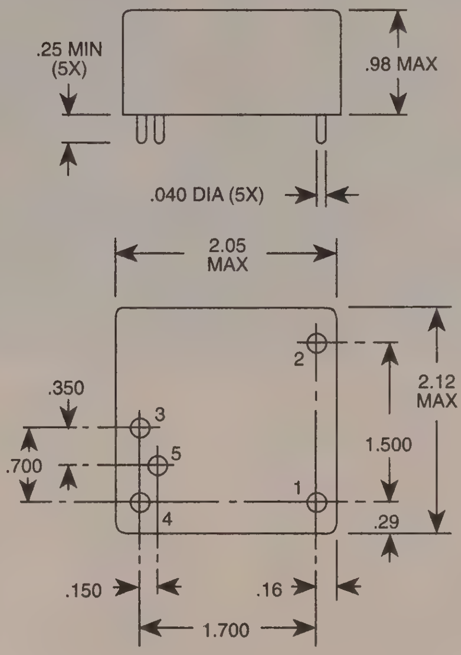
- Small size (only one inverter for both tubes)
- Encapsulated package
- Low cost
- High efficiency (typically 88%)

The E1056 is the ideal power source for applications where small size, high efficiency and reliability are critical.

The E1056 inverter powers the internal hot cathode flourescent tubes in a cold-cathode mode. The very high initial minimum output voltage of the E1056 inverter will insure reliable performance over the useful life of this display module.

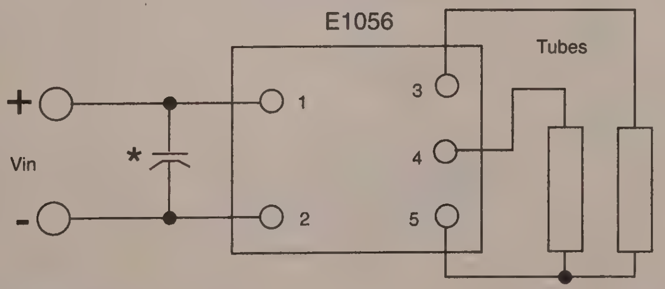
Reference: Sharp Technical Reference LD-2456 6/4/90.

E1056 Package Configurations



1. Vin (+)
2. Vin (-)
3. Vout (AC) tube 1
4. Vout (AC) tube 2
5. Vout (common)

Connection Diagram



* Input bypass capacitor may be required (100uf - 220uf)

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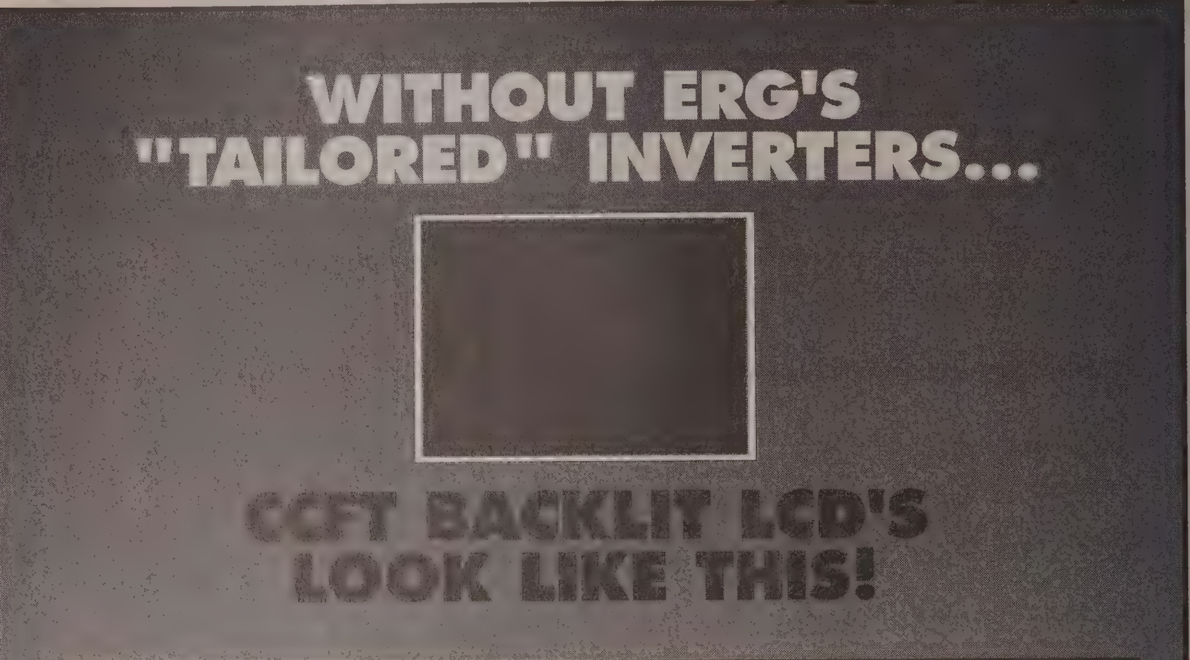
The U.S. Power Supply Source for Information Displays

The U.S. Power Supply Source for Information Displays


WITHOUT ERG'S "TAILORED" INVERTERS...
CCFT BACKLIT LCD'S LOOK LIKE THIS!

The ERG E200II dc to ac inverters are a unique series of dc to ac power supplies designed and processed to power the cold-cathode flourescent tube(s) contained in different LCD display assemblies. Each E200II part number is tailored to the specifications of the individual LCD display assembly. This insures complete system compatibility, maximum LCD display life and reliability.

Every ERG E200II part number is designed and validated by testing with the actual LCD display assembly. Data Sheets are produced for each unit outlining performance characteristics at various operating points providing performance specifications which make system interfacing with the ERG E200II Series simple.

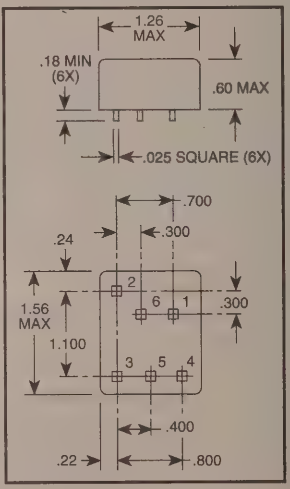
Each E200II inverter is offered in a "C" configuration (brightness adjustment with, or without disabling) or "E" configuration (permits inverter disabling). These configurations provide "extra pin" control, allowing the inverter to be disabled and/or dimmed without adding series input components.

ERG's E200II Series Offers:

- High Efficiencies (80% to 85%)
- Small printed circuit mountable package
- Designed and manufactured in the USA with local support
- Optional dimming and disable control

Contact the factory for tailored designs to meet special requirements including new low profile package configurations.

E200II Package Configurations



1. Vin (+)
2. Vin (-)
3. Vout (common)
4. Vout (AC) tube 1
5. Vout (AC) tube 2
   (on two tube inverters)
6. **Optional** Disable/Control
   ("C" and "E" type)

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Phone 607 754-9187 • FAX 607 754-9255
The U.S. Power Supply Source for Information Displays

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DON'T BE LEFT IN THE DARK

The following is a preliminary cross reference list of current ERG Inverters for various manufacturer's LCD modules.

MANUFACTURER	LCD DISPLAY PART NUMBER	ERG PART NUMBER 5 Volt Input	12 Volt Input	24 Volt Input
Epson	EG2405B-LS	E1050	E1051	
Epson	EG7500B-LS*	E1026	E1042	E1288
Epson	EG7501B-LS	E1113	E1041	E1162
Epson	EG8003N-NS*	E1058		
Epson	EG9005G-NS*	E1074		
Epson	EG9006D-NS*	E1076	E1098	
Epson	EG9007F-NS	E1015		
Epson	EG9012	E1361		
Epson	EG9013	E1353	E1354	
Hitachi	LM721XBNP	E1233	E1234	
Hitachi	LMG5040XUFC	E1022		
Hitachi	LMG5042XUFC	E1057	E1164	
Hitachi	LMG5120XUFC	E1235	E1236	
Hitachi	LMG5160XUFC		E1312	
Hitachi	LMG5268XUFC	E1329		
Hitachi	LMG6121XUFC*	E1067	E1163	
Kyocera	KL11278BSTC*	E1347	E1306	
Kyocera	KL3225ASTC-FW		E1326	
Kyocera	KL6440ASHT-FW	E1127		
Kyocera	KL6448ASTT-FW		E1019	
Optrex	DMF5010NBU-FW	E1166	E1097	
Optrex	DMF6104NB-FW	E1084	E1082	E1083
Optrex	DMF651AN-FW	E1190	E1013	
Optrex	DMF666NB-FW*	E1120		
Sanyo	LCM5327*		E1271	
Seiko	G242CX		E1402	
Seiko	G2446X		E1401	
Seiko	G643GX5S100		E1049	
Seiko	G643GY5H1AK	E1300	E1299	
Seiko	G645F	E1206	E1207	
Sharp	LM10P10*		E1119	
Sharp	LM24010Z	E1099	E1081	E1232
Sharp	LM32004T	E1126		E1114
Sharp	LM64014C*			E1017
Sharp	LM64C031*	E1262	E1263	E1264
Sharp	LM64P10	E1295	E1296	
Sharp	LM64P60*	E1043	E1024	
Sharp	LM64P62*	E1066	E1065	
Sharp	LM64P64*	E1039	E1040	
Sharp	LM64P70	E1001	E1181	E1182
Sharp	LM64P722	E1131	E1132	
Sharp	LM64P80	E1191	E1192	
Sharp	LM64P831	E1373	E1374	
Sharp	LQ10D011*		E1056	
Sharp	LQ10D021*		E1340	
Sharp	LQ4RANC	E1284	E1002	
Sharp	LQ6NC01*		E1018	E1188
Sharp	LQ6NC02*		E1018	E1188
Sharp	LQ9D011*	E1291	E1290	
Toshiba	TLX-1341-C3B	E1075		
Toshiba	TLX-1501-C3M*	E1135	E1136	
Toshiba	TLX-1551-C3M*	E1103	E1230	E1201
Toshiba	TLX-1702S-C3M	E1137	E1138	
Toshiba	TLX-1721-A3	E1133	E1134	
Toshiba	TLX-1741-C3M	E1118		
Toshiba	TLX-1781-C3M	E1241	E1242	
Toshiba	TLX-1832S-C3M1	E1268	E1269	
Toshiba	TLX-1841-C3M*	E1276	E1277	
Toshiba	TLX-5152S-C3M	E1274	E1275	

Contact the Factory For Up To Date LCD Cross Reference List.

Note: *Indicates 2 tube displays
Other Input Voltages Available - Contact the Factory
"C" & "E" Option Available for All Inverters (Except E1056)

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SMART FORCE™ INVERTERS

For Electroluminescent Lamps

ERG Smart Force™ DC-AC Inverters compensate for the aging characteristics (brightness loss over time) of electroluminescent (EL) phosphors to improve EL lamp useful life. Smart Force™ Inverters automatically adjust operating voltage and frequency as the impedance of the EL lamp changes. Thus, providing an almost constant brightness throughout the life of the lamp. (See Typical Relative Brightness VS Time Performance Curve below.)

Dedicated Series:

Because all EL lamps are not electrically the same, ERG offers a Dedicated and Tailored Inverter Series for different EL lamp brands.

Each DEDICATED inverter series is designed specifically to the required voltages, frequency and load characteristics of the specific area of selected manufacturers EL lamp. Each Series offers four different output voltage configurations (providing different brightness levels), 3 different package sizes with a wide range of input voltages available providing maximum flexibility! ERG can offer the best matched inverter for ANY MANUFACTURERS EL LAMP!

Dedicated Series Include:

JLA Series ... Imported EL Backlit Displays

LPS Series ... Loctite Luminescent Systems, EL Products

JLA Series inverters are ideal for powering EL backlit modules from Desitron, Hitachi, Epson, NEC, Optrex, Seiko, Sharp, Toshiba and others.

General Specifications:

Input:
3, 5, 6, 9, 12, 15, 18, 24, 28 vdc (your choice)

Output:
60-130 V RMS @ 400-700 Hz. nom. (P/N dependent)

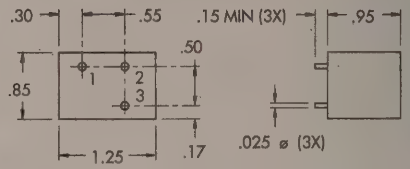
Package:
Nylon, epoxy filled

Mounting:
PCB Mount standard
Leads optional

Temperature Range:
Operating: -25°C to +85°C

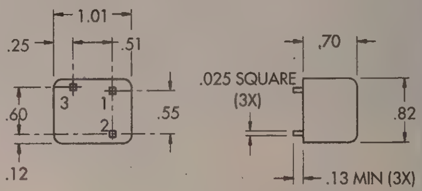
- **No matter whose EL Lamp...ERG has the right inverter!!!**
- **No other company in the world offers a wider range of DC-AC invertersfor EL Lamp applications!**
- **And no other company offers the Smart Force™ Feature!**
- **Contact ERG to tailor an inverter to meet specific requirements.**

Standard Package



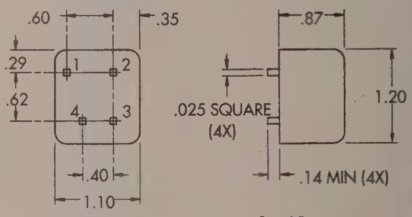
1. +Vin
2. COM
3. Vout

P Package

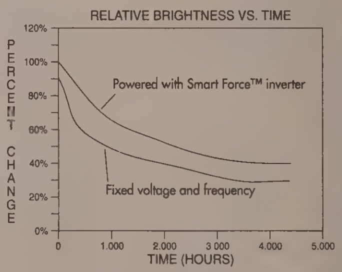


1. +Vin
2. COM
3. Vout

H Package



1. +Vin
2. - Vin
3. Vout
4. Vout



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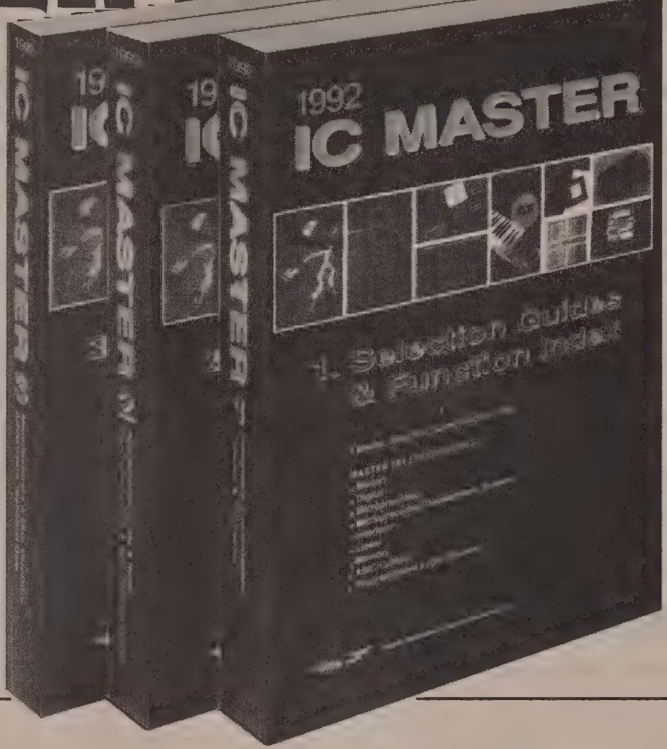
SUPER TIME SAVER!



Do you work with ICs? Do you have trouble finding the IC you need? Are you sick and tired of sifting through dozens of manufacturers' data books? Do you have trouble comparing one set of specs to another? Are you sick and tired of wasting time?

Do we have good news for you! Get your hands on the latest annual copy of the IC Master. The Master will save you both time and money. Here's how.

The Master lists every single IC you can buy. Better yet, the Master lists ICs by function. You know what you want to do. The Master tells you who makes what for what you want to do.

There's more! The Master lists every known alternate source to every integrated circuit. If somebody makes a substitute for an IC, the Master tells you. And fast!

Want to find a custom or semicustom IC? The Master tells you who the manufacturers are, what their capabilities are, and what design tools you need.

Looking for a distributor or a local sales office? The Master tells you where they are. Got a technical problem? The Master tells you who to call. Can't figure out a part number? The Master tells you how the part number systems work.

There's more! The Master has a section on microprocessor development tools with complete performance parameters. There's another section on programmable logic devices giving you everything from output configuration to PLD development systems.

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If you prefer, write to Marie, Hearst Business Communications, 645 Stewart Ave., Garden City, NY 11530. She'll mail you the IC Master subscription form right away.

And, if you tell her you saw it in the 1992/93 EEM, she'll take $10 off the subscription price!

IC MASTER
Published annually in February,

EG2405B-LS

EG Series

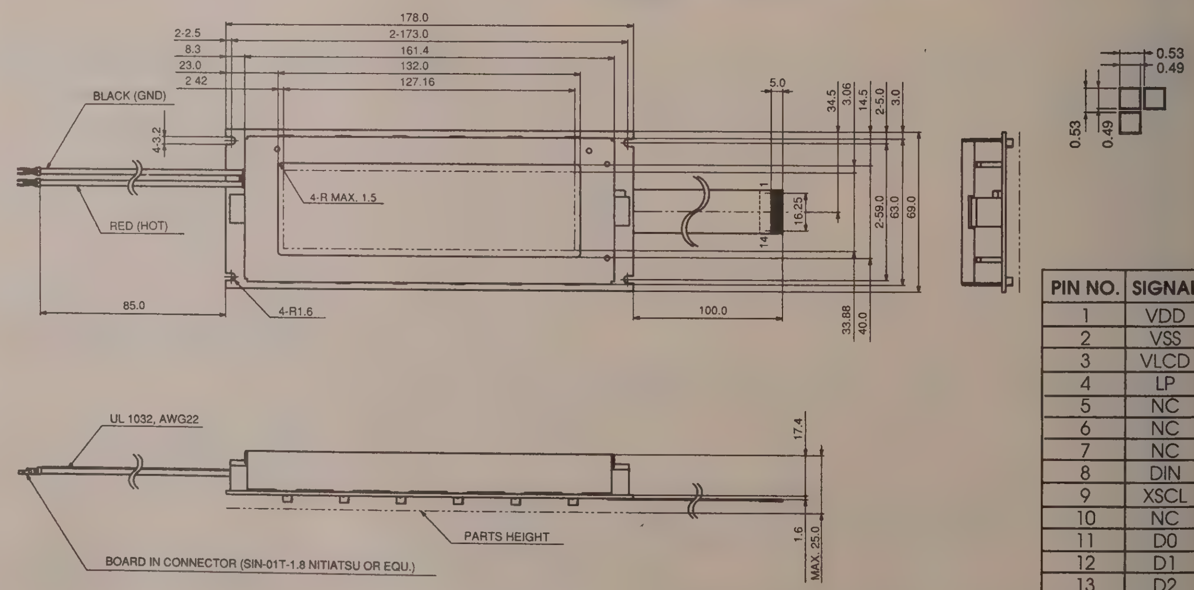
FEATURES

- **Dot Matrix** : 240 x 64 Dots
- **Dot Ratio** : 1 : 1
- **Duty** : 1/64
- **LCD Mode** : STN, Transmissive Negative Type
- **Backlight** : CCFT Backlight (One Tube)
- **Dot Color** : White (Display) Blue (Background)
- **Mating I/O Connector** : 5597-14APB/ 5597-14CPB (Molex)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	178.0 x 69.0 x 25.0
Viewing Area	132.0 x 40.0
Active Area	127.16 x 33.88
Dot Pitch	0.53 x 0.53
Dot Size	0.49 x 0.49
Weight	250 (g)

OUTLINE DIMENSIONS


178.0
2-173.0
161.4
132.0
127.16
2-2.5
8.3
23.0
2 42
BLACK (GND)
4-3.2
4-R MAX. 1.5
RED (HOT)
85.0
4-R1.6
100.0
5.0
34.5
3.06
14.5
2-5.0
3.0
16.25
14
2-59.0
63.0
69.0
33.88
40.0
0.53
0.49
0.53
0.49
UL 1032, AWG22
17.4
1.6
MAX. 25.0
PARTS HEIGHT
BOARD IN CONNECTOR (SIN-01T-1.8 NITIATSU OR EQU.)

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VLCD
4	LP
5	NC
6	NC
7	NC
8	DIN
9	XSCL
10	NC
11	D0
12	D1
13	D2
14	D3

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EG2405F-LS

EG Series

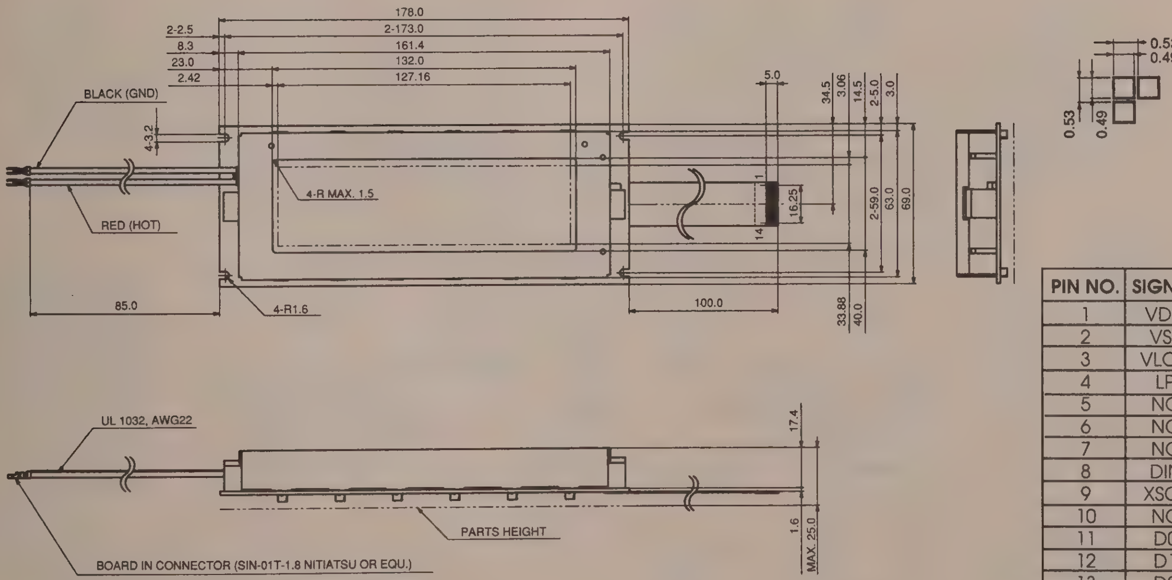
FEATURES

- **Dot Matrix** : 240 x 64 Dots
- **Dot Ratio** : 1 : 1
- **Duty** : 1/64
- **LCD Mode** : FTN, Transmissive Negative Type
- **Backlight** : CCFT Backlight (One Tube)
- **Dot Color** : White (Display) Black (Background)
- **Mating I/O Connector** : 5597-14APB/ 5597-14CPB (MOLEX)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	178.0 x 69.0 x 25.0
Viewing Area	132.0 x 40.0
Active Area	127.16 x 33.88
Dot Pitch	0.53 x 0.53
Dot Size	0.49 x 0.49
Weight	250 (g)

OUTLINE DIMENSIONS


178.0
2-173.0
161.4
132.0
127.16
2-2.5
8.3
23.0
2.42
BLACK (GND)
4-3.2
4-R MAX. 1.5
RED (HOT)
85.0
4-R1.6
100.0
5.0
11
16.25
14
34.5
3.06
14.5
2-5.0
3.0
2-59.0
63.0
69.0
33.88
40.0
0.53
0.49
0.53
0.49
UL 1032, AWG22
17.4
PARTS HEIGHT
1.6
MAX. 25.0
BOARD IN CONNECTOR (SIN-01T-1.8 NITIATSU OR EQU.)

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VLCD
4	LP
5	NC
6	NC
7	NC
8	DIN
9	XSCL
10	NC
11	D0
12	D1
13	D2
14	D3

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EG7500B-LS

EG Series

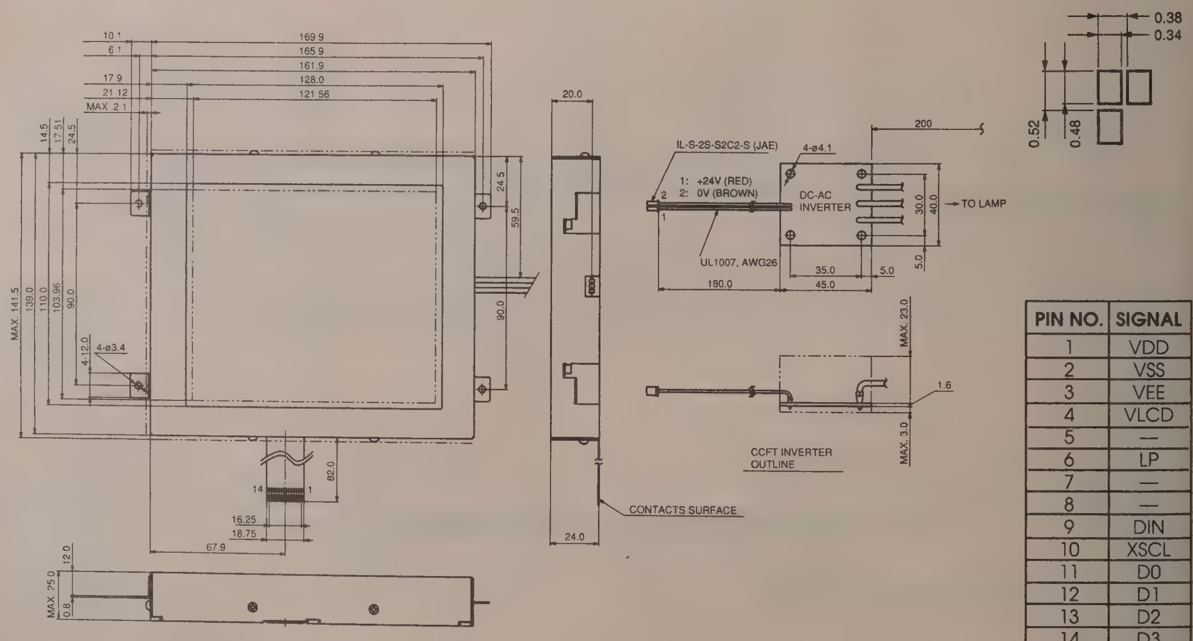
FEATURES

- **Dot Matrix** : 320 x 200 Dots
- **Dot Ratio** : 1 : 1.36
- **Duty** : 1/200
- **LCD Mode** : STN, Transmissive Negative Type
- **Backlight** : CCFT Backlight (Two Tubes)
- **Dot Color** : White (Display) Blue (Background)
- **Mating I/O Connector** : 5597-14APB/ 5597-14CPB (Molex)
- **CCFT Inverter** : Standard (Vin=24V)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	161.9 x 139.0 x 25.0
Viewing Area	128.0 x 110.0
Active Area	121.56 x 103.96
Dot Pitch	0.38 x 0.52
Dot Size	0.34 x 0.48
Weight	460 (g)

OUTLINE DIMENSIONS


10.1
6.1
17.9
21.12
MAX 2.1
169.9
165.9
161.9
128.0
121.56
14.5
17.51
24.5
MAX. 141.5
139.0
110.0
103.96
90.0
4-12.0
4-ø3.4
24.5
59.5
90.0
82.0
14
1
16.25
18.75
67.9
12.0
MAX 25.0
0.8
20.0
24.0
CONTACTS SURFACE
IL-S-2S-S2C2-S (JAE)
4-ø4.1
1: +24V (RED)
2: 0V (BROWN)
DC-AC INVERTER
UL1007, AWG26
180.0
35.0
45.0
5.0
200
30.0
40.0
TO LAMP
MAX. 23.0
MAX. 3.0
1.6
CCFT INVERTER OUTLINE
0.38
0.34
0.52
0.48

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VEE
4	VLCD
5	—
6	LP
7	—
8	—
9	DIN
10	XSCL
11	D0
12	D1
13	D2
14	D3

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EG7500D-LS

EG Series

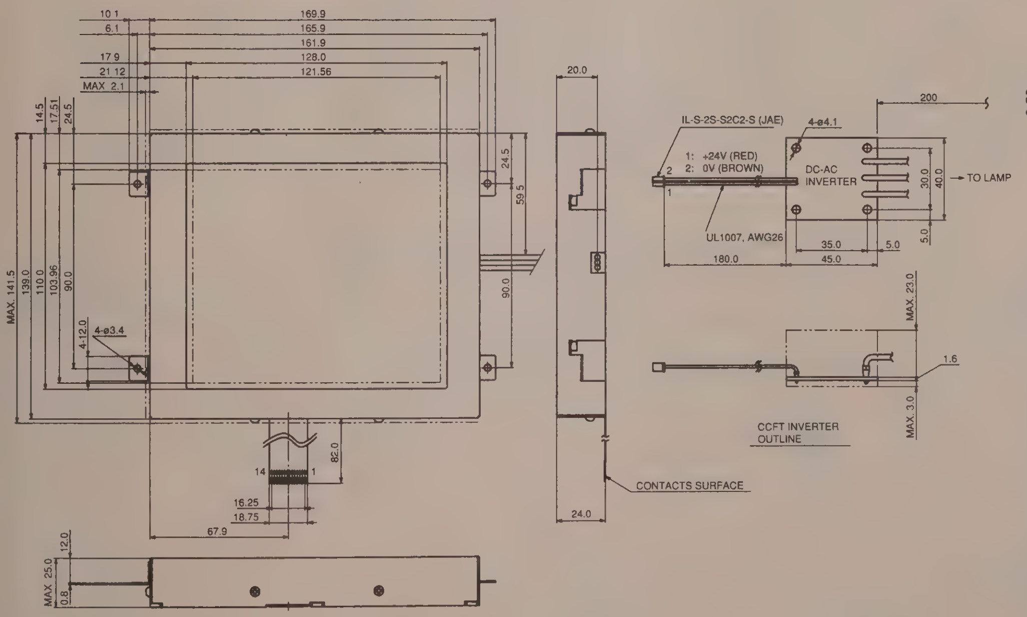
FEATURES

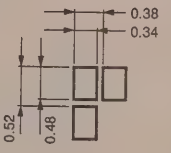
- **Dot Matrix** : 320 x 200 Dots
- **Dot Ratio** : 1 : 1.36
- **Duty** : 1/200
- **LCD Mode** : FTN, Transmissive Negative Type
- **Backlight** : CCFT Backlight (Two Tubes)
- **Dot Color** : White (Display) Black (Background)
- **Mating I/O Connector** : 5597-14APB/ 5597-14CPB (Molex)
- **CCFT Inverter** : Standard (Vin=24V)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	161.9 x 139.0 x 25.0
Viewing Area	128.0 x 110.0
Active Area	121.56 x 103.96
Dot Pitch	0.38 x 0.52
Dot Size	0.34 x 0.48
Weight	460 (g)

OUTLINE DIMENSIONS


10 1
6.1
17 9
21 12
MAX 2.1
169.9
165.9
161.9
128.0
121.56
14.5
17.51
24.5
MAX. 141.5
139.0
110.0
103.96
90.0
4-12.0
4-ø3.4
24.5
59 5
90.0
82.0
14
1
16.25
18.75
67.9
12.0
MAX 25.0
0.8
20.0
24.0
CONTACTS SURFACE
IL-S-2S-S2C2-S (JAE)
4-ø4.1
1: +24V (RED)
2: 0V (BROWN)
2
1
DC-AC INVERTER
200
30.0
40.0
TO LAMP
UL1007, AWG26
35.0
5.0
5.0
180.0
45.0
MAX. 23.0
1.6
MAX. 3.0
CCFT INVERTER OUTLINE


0.38
0.34
0.52
0.48

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VEE
4	VLCD
5	—
6	LP
7	—
8	—
9	DIN
10	XSCL
11	D0
12	D1
13	D2
14	D3

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EG7501B-LS

EG Series

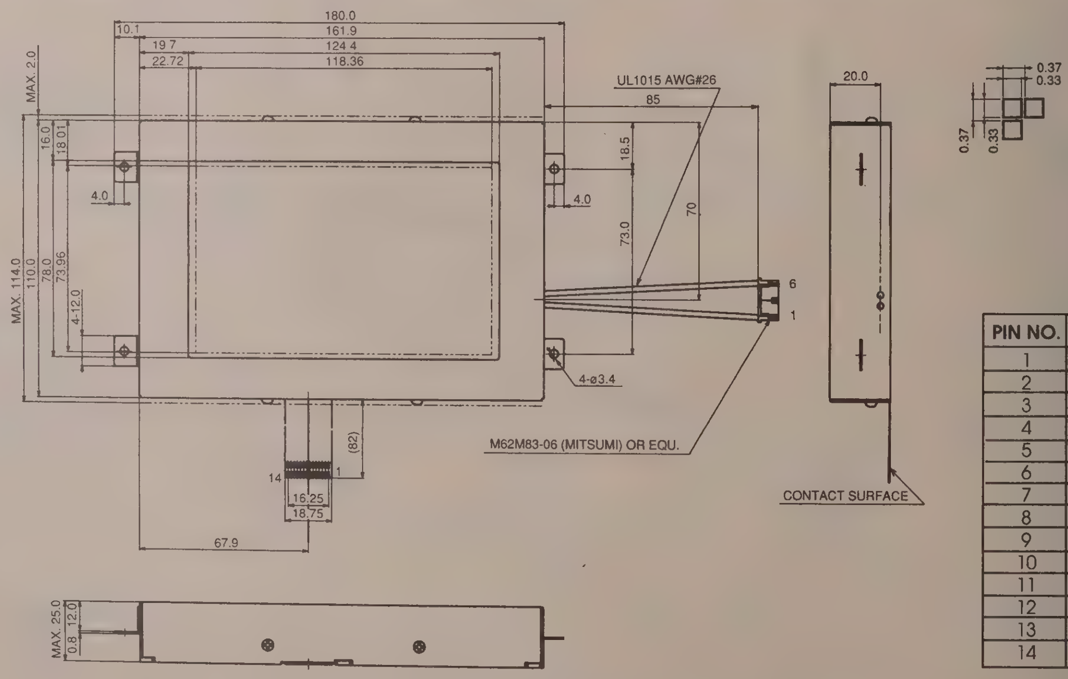
FEATURES

- **Dot Matrix** : 320 x 200 Dots
- **Dot Ratio** : 1 : 1
- **Duty** : 1/200
- **LCD Mode** : STN, Transmissive Negative Type
- **Backlight** : CCFT Backlight (One Tube)
- **Dot Color** : White (Display) Blue (Background)
- **Mating I/O Connector** : 5597-14APB/ 5597-14CPB (Molex)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	161.9 x 110.0 x 25.0
Viewing Area	124.4 x 78.0
Active Area	118.36 x 73.96
Dot Pitch	0.37 x 0.37
Dot Size	0.33 x 0.33
Weight	360 (g)

OUTLINE DIMENSIONS


180.0
161.9
124.4
118.36
10.1
19.7
22.72
MAX. 2.0
16.0
18.01
4.0
UL1015 AWG#26
85
18.5
70
73.0
4.0
MAX. 114.0
110.0
78.0
73.96
4-12.0
6
1
4-ø3.4
M62M83-06 (MITSUMI) OR EQU.
(82)
14
1
16.25
18.75
67.9
20.0
CONTACT SURFACE
0.37
0.33
0.37
0.33
MAX. 25.0
12.0
0.8

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VEE
4	VLCD
5	—
6	LP
7	—
8	—
9	DIN
10	XSCL
11	D0
12	D1
13	D2
14	D3

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EG7501D-LS

EG Series

FEATURES

- **Dot Matrix** : 320 x 200 Dots
- **Dot Ratio** : 1 : 1
- **Duty** : 1/200
- **LCD Mode** : FTN, Transmissive Negative Type
- **Backlight** : CCFT Backlight (One Tube)
- **Dot Color** : White (Display) Black (Background)
- **Mating I/O Connector** : 5597-14APB/ 5597-14CPB (Molex)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	161.9 x 110.0 x 25.0
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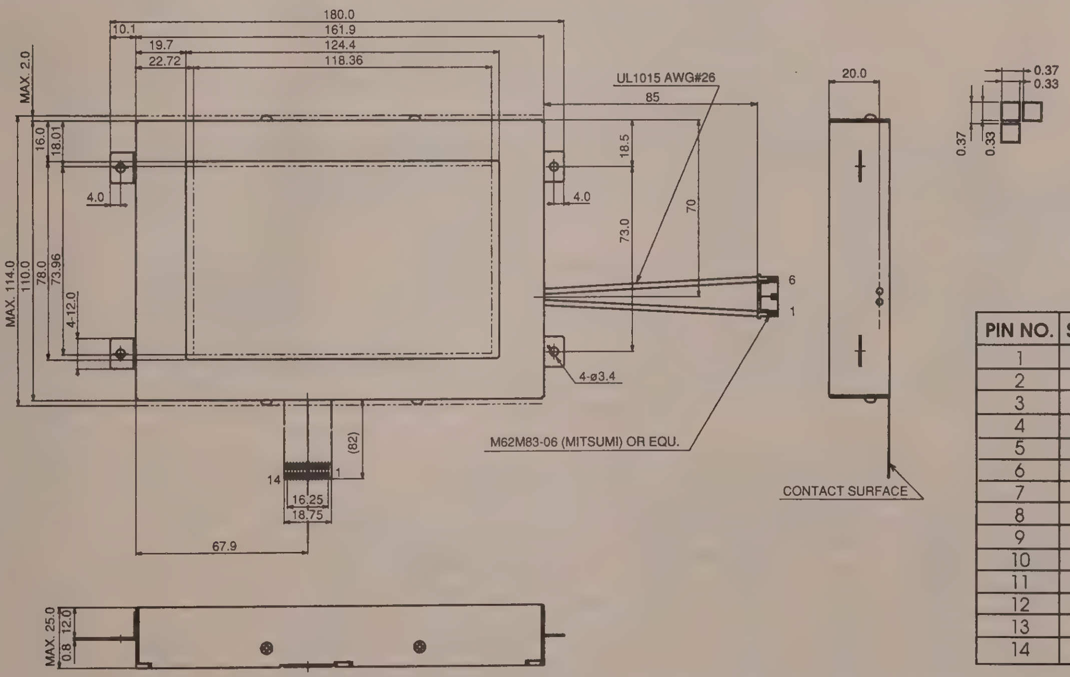
OUTLINE DIMENSIONS


180.0
161.9
124.4
118.36
10.1
19.7
22.72
MAX. 2.0
UL1015 AWG#26
85
20.0
0.37
0.33
0.37
0.33
16.0
18.01
4.0
4.0
18.5
70
73.0
MAX. 114.0
110.0
78.0
73.96
4-12.0
6
1
4-ø3.4
M62M83-06 (MITSUMI) OR EQU.
(82)
14
1
16.25
18.75
67.9
CONTACT SURFACE
MAX. 25.0
12.0
0.8

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VEE
4	VLCD
5	—
6	LP
7	—
8	—
9	DIN
10	XSCL
11	D0
12	D1
13	D2
14	D3

EPSON

Epson America, Inc. (OEM)
20770 MADRONA AVE., TORRANCE, CA 90509-2842 • Phone: (310) 787-6300 • FAX: (310) 782-5350

EG8501B-LZ

EG Series

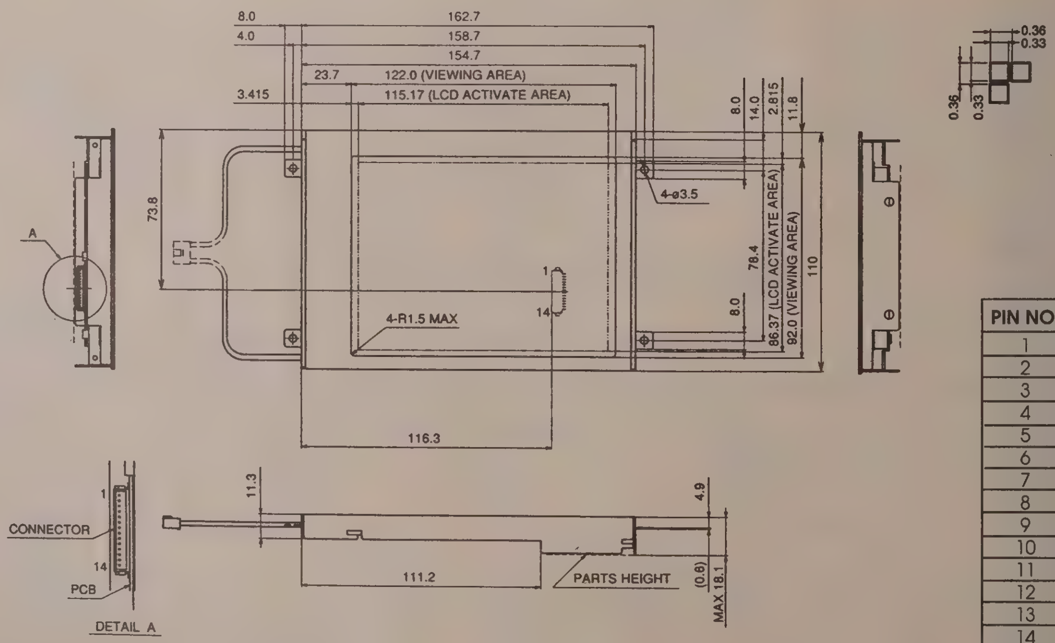
FEATURES

Dot Matrix	:	320 x 240 Dots
Dot Ratio	:	1 : 1
Duty	:	1/240
LCD Mode	:	STN, Transmissive Negative Type
Backlight	:	CCFT Sidelight (One Tube)
Dot Color	:	White (Display) Blue (Background)
Mating I/O Connector	:	DF13-14S-1.25C (Hirose)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	154.7 x 110.0 x 18.1
Viewing Area	122.0 x 92.0
Active Area	115.17 x 86.37
Dot Pitch	0.36 x 0.36
Dot Size	0.33 x 0.33
Weight	250 (g)

OUTLINE DIMENSIONS


8.0
4.0
162.7
158.7
154.7
23.7
122.0 (VIEWING AREA)
3.415
115.17 (LCD ACTIVATE AREA)
8.0
14.0
2.815
11.8
73.8
A
4-ø3.5
1
14
4-R1.5 MAX
78.4
86.37 (LCD ACTIVATE AREA)
92.0 (VIEWING AREA)
110
8.0
116.3
0.36
0.33
0.36
0.33
CONNECTOR
PCB
DETAIL A
11.3
111.2
PARTS HEIGHT
4.9
(0.6)
MAX 18.1

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VLCD
4	LP
5	NC
6	NC
7	NC
8	DIN
9	XSCL
10	NC
11	D0
12	D1
13	D2
14	D3

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EG9005D-NS

EG Series

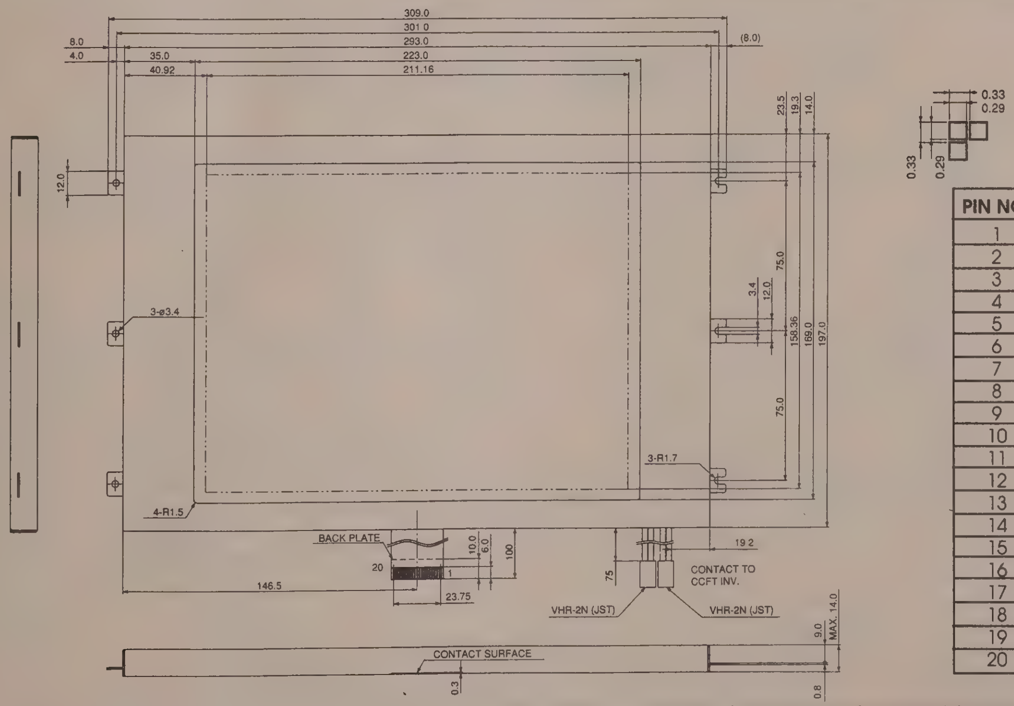
FEATURES

- **Dot Matrix** : 640 x 480 Dots
- **Dot Ratio** : 1 : 1
- **Duty** : 1/242
- **LCD Mode** : FTN, Transmissive Negative Type
- **Backlight** : CCFT Sidelight (Two Tubes)
- **Dot Color** : White (Display) Black (Background)
- **Mating I/O Connector** : 5597-20APB/ 5597-20CPB (Molex)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	293.0 x 197.0 x 14.0
Viewing Area	223.0 x 169.0
Active Area	211.16 x 158.36
Dot Pitch	0.33 x 0.33
Dot Size	0.29 x 0.29
Weight	960 (g)

OUTLINE DIMENSIONS


309.0
301.0
293.0
223.0
211.16
8.0
4.0
35.0
40.92
(8.0)
23.5
19.3
14.0
12.0
3-ø3.4
75.0
3.4
12.0
158.36
169.0
197.0
75.0
3-R1.7
4-R1.5
BACK PLATE
10.0
6.0
100
20
1
146.5
23.75
19.2
75
CONTACT TO CCFT INV.
VHR-2N (JST)
VHR-2N (JST)
9.0
MAX. 14.0
CONTACT SURFACE
0.3
0.8
0.33
0.29
0.33
0.29

PIN NO.	SIGNAL
1	VDD
2	VSS
3	VLCD
4	LP
5	FR
6	NC
7	YSCL
8	DIN
9	XSCL
10	NC
11	UD0
12	UD1
13	UD2
14	UD3
15	LD0
16	LD1
17	LD2
18	LD3
19	E1
20	E0

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EG9011B-NZ

EG Series

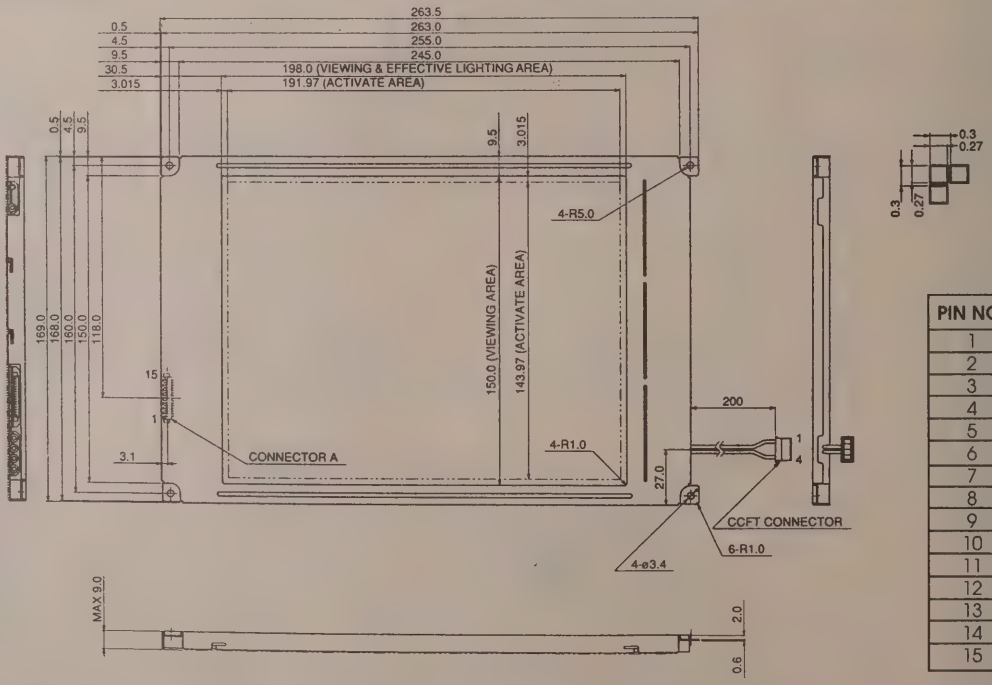
FEATURES

- **Dot Matrix** : 640 x 480 Dots
- **Dot Ratio** : 1 : 1
- **Duty** : 1/240
- **LCD Mode** : FTN, Transmissive Negative Type
- **Backlight** : CCFT Sidelight (One Tube)
- **Dot Color** : White (Display) Black (Background)
- **Mating I/O Connector** : 51021-1500 (Molex)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	259.5 x 169.0 x 9.0
Viewing Area	198.0 x 150.0
Active Area	191.97 x 143.97
Dot Pitch	0.30 x 0.30
Dot Size	0.27 x 0.27
Weight	480 (g)

OUTLINE DIMENSIONS


263.5
263.0
255.0
245.0
0.5
4.5
9.5
30.5
3.015
198.0 (VIEWING & EFFECTIVE LIGHTING AREA)
191.97 (ACTIVATE AREA)
0.5
4.5
9.5
9.5
3.015
4-R5.0
169.0
168.0
160.0
150.0
118.0
150.0 (VIEWING AREA)
143.97 (ACTIVATE AREA)
15
1
3.1
CONNECTOR A
4-R1.0
200
1
4
27.0
CCFT CONNECTOR
6-R1.0
4-ø3.4
0.3
0.27
0.3
0.27
MAX 9.0
2.0
0.6

PIN NO.	SIGNAL
1	S
2	CP1
3	CP2
4	VDD
5	VSS
6	VEE
7	VSS
8	DU0
9	DU1
10	DU2
11	DU3
12	DL0
13	DL1
14	DL2
15	DL3

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EG9012F-NX

EG Series

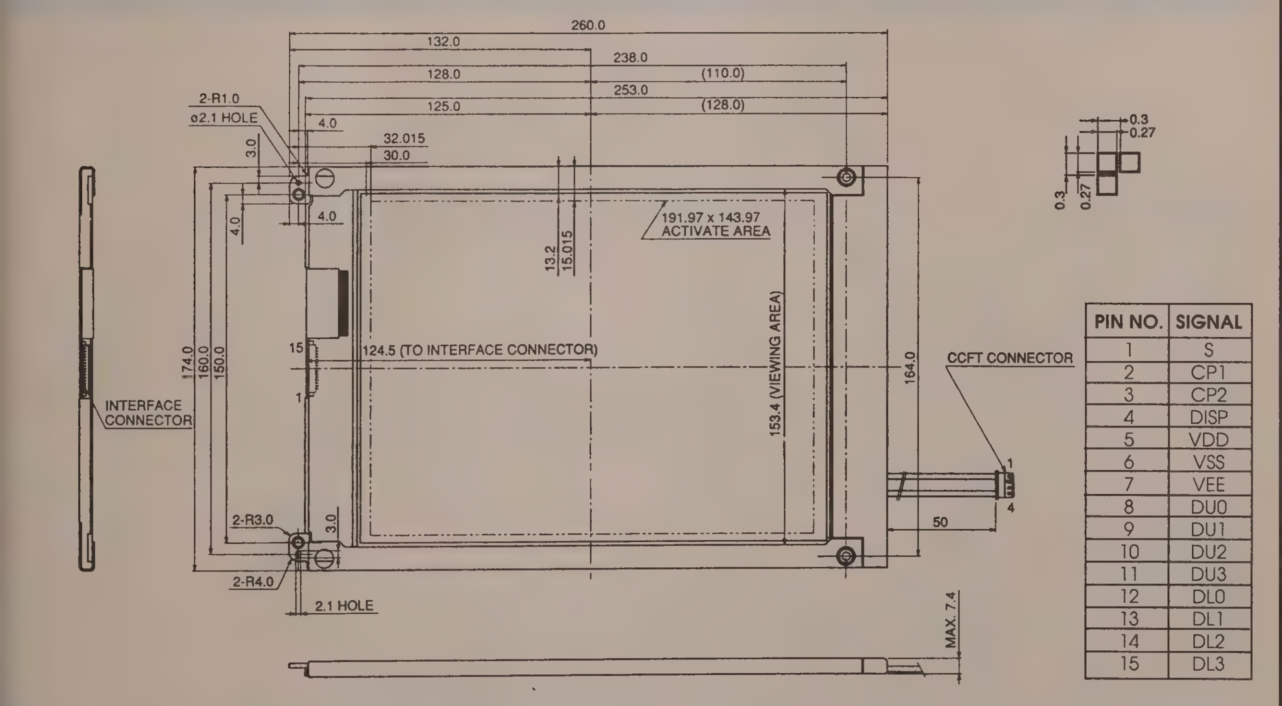
FEATURES

- **Dot Matrix** : 640 x 480 Dots
- **Dot Ratio** : 1 : 1
- **Duty** : 1/240
- **LCD Mode** : FTN, Transmissive Negative Type
- **Backlight** : CCFT Sidelight (One Tube)
- **Dot Color** : White (Display) Black (Background)
- **Mating I/O Connector** : 51021-1500 (Molex)

MECHANICAL SPECIFICATIONS

Parameter	Dimensions (mm)
Overall Size	253.0 x 174.0 x 7.4
Viewing Area	201.4 x 153.4
Active Area	191.97 x 143.97
Dot Pitch	0.30 x 0.30
Dot Size	0.27 x 0.27
Weight	390 (g)

OUTLINE DIMENSIONS


260.0
132.0
238.0
128.0
(110.0)
253.0
125.0
(128.0)
2-R1.0
ø2.1 HOLE
4.0
3.0
32.015
30.0
4.0
4.0
13.2
15.015
191.97 x 143.97
ACTIVATE AREA
15
124.5 (TO INTERFACE CONNECTOR)
1
174.0
160.0
150.0
153.4 (VIEWING AREA)
164.0
CCFT CONNECTOR
INTERFACE CONNECTOR
1
4
50
2-R3.0
3.0
2-R4.0
2.1 HOLE
MAX. 7.4
0.3
0.27
0.3
0.27

PIN NO.	SIGNAL
1	S
2	CP1
3	CP2
4	DISP
5	VDD
6	VSS
7	VEE
8	DU0
9	DU1
10	DU2
11	DU3
12	DL0
13	DL1
14	DL2
15	DL3

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EG8502F-LZ

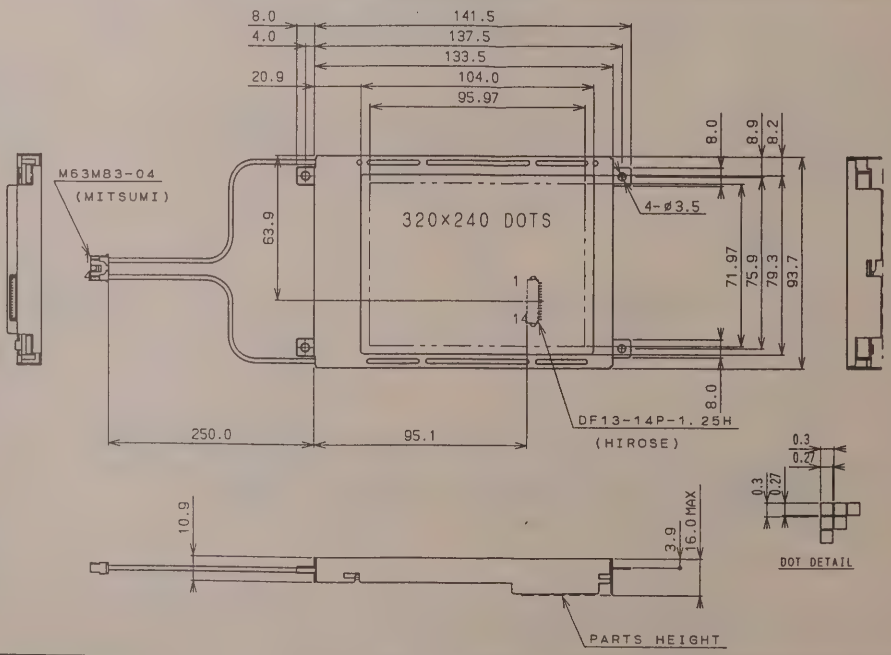
EG Series — Passive Matrix LCD Module

SPECIFICATIONS

LCD Mode	**FTN**	
Dot Format (W x H)	320 x 240	dots
Dot Pitch (W x H)	0.30 x 0.30	mm
Viewing Area	104.0 x 79.3	mm
Overall Dimension (W x H x D)	133.5 x 93.7 x 16.5 (MAX)	mm
Driving Duty	1/240	duty
Panel Surface Brightness	40	nit
Contrast	1 : 7	
Response Time (tr + tf)	450	msec
Weight	180	g
Backlight	CCFT Sidelight (1 tube)	

Specifications are subject to change without notice. Please confirm the latest specification before designing your product.

OUTER DIMENSIONS


8.0
4.0
20.9
141.5
137.5
133.5
104.0
95.97
8.0
8.9
8.2
M63M83-04
(MITSUMI)
320×240 DOTS
63.9
4-ø3.5
71.97
75.9
79.3
93.7
1
14
8.0
DF13-14P-1.25H
(HIROSE)
250.0
95.1
0.3
0.27
0.3
0.27
DOT DETAIL
10.9
3.9
16.0MAX
PARTS HEIGHT

EPSON

EPSON AMERICA, INC. (OEM)

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EG9013F-NZ

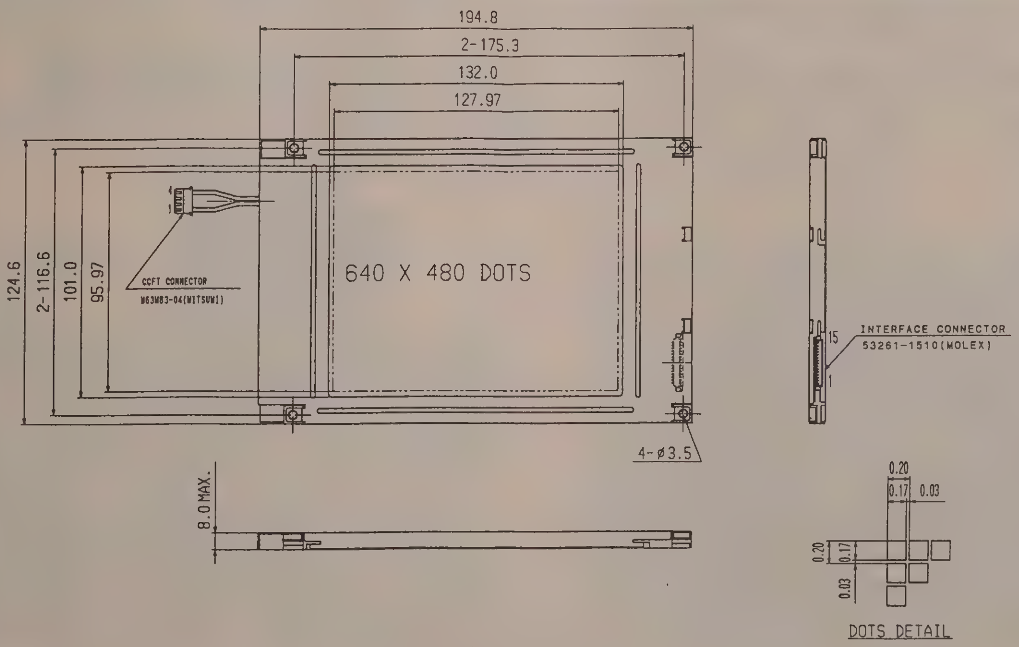
EG Series — Passive Matrix LCD Module

SPECIFICATIONS

LCD Mode	**FTN**	
Dot Format (W x H)	640 x 480	dots
Dot Pitch (W x H)	0.20 x 0.20	mm
Viewing Area (W x H)	132.0 x 101.0	mm
Overall Dimension (WxHxD)	194.8 x 124.6 x 8.2 (MAX)	mm
Driving Duty	1/480	duty
Panel Surface Brightness	50	nit
Contrast	1 : 6.4	
Response Time (tr + tf)	450	msec
Weight	280	g
Backlight	CCFT Sidelight (1 tube)	

Specifications are subject to change without notice. Please confirm the latest specification before designing your product.

OUTLINE DIMENSIONS


194.8
2-175.3
132.0
127.97
124.6
2-116.6
101.0
95.97
CCFT CONNECTOR
M63M83-04(MITSUMI)
640 X 480 DOTS
4-ø3.5
8.0MAX.
15
1
INTERFACE CONNECTOR
53261-1510(MOLEX)
0.20
0.17
0.03
0.20
0.17
0.03
DOTS DETAIL

INTERFACE CONNECTOR	
1	DIN
2	LP
3	XSCL
4	VDD
5	VSS
6	VDDH
7	VSS
8	D0
9	D1
10	D2
11	D3
12	D4
13	D5
14	D6
15	D7
INTERFACE CONNECTOR	
1	CCFT Cold
2	N C
3	N C
4	CCFT Hot

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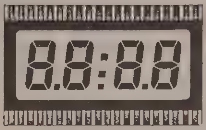
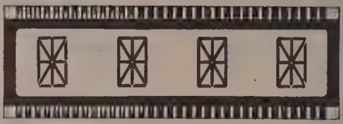
EXCEL EXCELIX® LCD Technology International Corp.





Excelix L.C.D. Model #	Digit Height (inches)	Display Format	Connector	Glass Size (inches)
3150	0.181	3½ digits, duplex	S.I.L. Elastomer	0.808 x 0.520
3252	0.200	3½ digits, duplex	S.I.L. Elastomer	0.808 x 0.520
6200	0.200	6 digits, duplex	D.I.L. Pins	1.500 x 0.600
3251	0.220	3½ digits, direct	D.I.L. Pins	1.200 x 0.600
8200	0.236	8 digits, M/E, triplex	S.I.L. Elastomer	2.090 x 0.690
3250	0.255	3½ digits, direct	D.I.L. Elastomer	0.808 x 0.590
8200E	0.284	8 digits, triplex	S.I.L. Elastomer	1.575 x 0.567
3313	0.300	3 digits, ▲ 5, triplex	D.I.L. Pins	1.200 x 1.000
8300	0.300	8 digits, triplex	D.I.L. Pins	2.750 x 1.100
4300	0.315	4 digits, S, bell direct	D.I.L. Pins	1.457 x 0.709
3350	0.350	3 digits, direct	D.I.L. Pins	1.300 x 0.950
4320	0.350	4 digits, direct	D.I.L. Pins	2.000 x 0.900
1400	0.400	1 digit, direct	D.I.L. Pins	
3401	0.400	3½ digits, direct	S.I.L. Pins	2.500 x 1.100
3450	0.400	3½ digits, duplex	S.I.L. Elastomer	1.960 x 0.950
4400	0.400	4 digits, AM, PM, S, bell	D.I.L. Pins	1.960 x 0.950
4451	0.400	4½ digits, ← direct	D.I.L. Pins	2.005 x 1.200
4455	0.400	4½ digits, Lobat, direct	D.I.L. Pins	2.000 x 1.200
5400	0.400	5 digits, direct	D.I.L. Pins	2.000 x 1.200
3451	0.433	3½ digits, direct	D.I.L. Pins	1.960 x 0.950
3501	0.500	3½ digits, direct	S.I.L. Pins	2.000 x 1.200
3551	0.500	3½ digits, ← direct	D.I.L. Pins	2.000 x 1.200
3555	0.500	3½ digits, Lobat, direct	D.I.L. Pins	2.000 x 1.200

Excelix L.C.D. Model #	Digit Height (inches)	Display Format	Connector	Glass Size (inches)
3557	0.500	3½ digits, AM, PM, bell	D.I.L. Pins	2.000 x 1.200
4500	0.500	4 digits, direct	D.I.L. Pins	2.000 x 1.200
4500 (M3)	0.500	4 digits, triplex	D.I.L. Pins	2.000 x 1.200
6500	0.500	6 digits, direct	D.I.L. Pins	2.750 x 1.200
8500	0.500	8 digits, direct	D.I.L. Pins	3.695 x 1.200
3452	0.531	3½ digits, AM, PM, AL, bell, direct	D.I.L. Pins	1.960 x 1.079
3751	0.700	3½ digits, ← direct	D.I.L. Pins	2.750 x 1.500
4700	0.700	4 digits, direct	D.I.L. Pins	2.750 x 1.500
4707	0.700	4 digits, PM, direct	S.I.L. Elastomer	3.250 x 1.250
5700	0.700	5 digits, direct	D.I.L. Pins	3.200 x 1.500
5701	0.700	5 digits, 1 D.P., direct	D.I.L. Pins	3.200 x 1.500
6700	0.700	6 digits, direct	D.I.L. Pins	3.695 x 1.500
4851A	0.750	4½ digits, ← direct	D.I.L. Pins	3.000 x 1.550
31030	1.000	3 digits, direct	D.I.L. Pins	3.695 x 1.800
31051	1.000	3½ digits, ← direct	D.I.L. Pins	3.695 x 1.800
41000	1.000	4 digits, direct	D.I.L. Pins	3.695 x 1.800
41051	1.000	4½ digits, ← direct	D.I.L. Pins	4.000 x 1.800
4540	0.500	4 characters, direct	D.I.L	3.500 x 1.150
8540	0.500	8 charcters, triplex	D.I.L	3.700 x 1.200
12540	0.500	12 characters, triplex	D.I.L	5.750 x 1.200
16540	0.500	16 characters, triplex	D.I.L	7.250 x 1.200
11040	1.000	1 character, direct	S.I.L. Elastomer	1.000 x 1.750

PIONEERS IN LCD TECHNOLOGY

Twisted Nematic
Supertwist

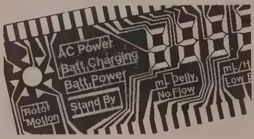
- Numeric
- Alphanumeric
- Bar Graphs
- Light Valves

Guest-host
Backlighting

- Dot Matrix
- Graphic
- LCD Modules

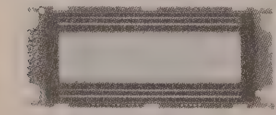
CUSTOM DISPLAYS FROM EXCEL

Make your display unique by using unusual messages, symbols and artwork.



With the expertise of Excel's Design and Layout department, it's easy to have a display custom-made to meet your particular requirements. Whether you need us to duplicate a display from an existing design, or help you bring your own ideas to life, we can help you move from start to finish smoothly and cost-effectively.

EXCELIX® LCD MODULES



Features

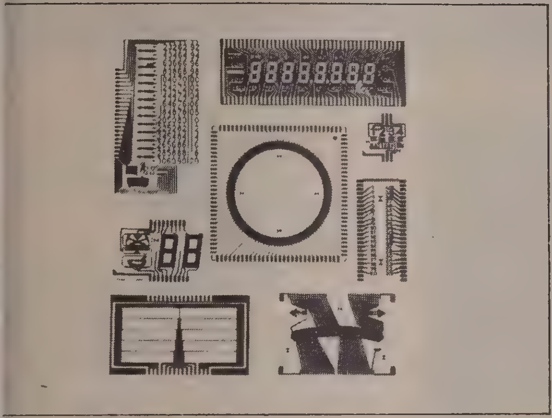
- Slim, light-weight design.
- High-contrast, wide viewing angle.
- Built-in control IC for easy interfacing.
- Low power consumption.

EXCELIX® LCD MODULE MECHANICAL SPECIFICATIONS

Excelix® No.	Character Format Line x Character	Character Font	Module Size (W x H x T, mm)	Viewing Area (W x H, mm)	Character Size (W x H, mm)	Dot Size (W x H, mm)	Backlight Type	
							EL	LED
LCM1610	1 x 16	5 x 7 dots + cursor	80 x 36 x 10	64.5 x 13.8	3.07 x 5.73	0.55 x 0.75	avail	avail
LCM1610 B	1 x 16	5 x 7 dots + cursor	122 x 33 x 10	99. x 13.	4.84 x 8.06	1.10 x 0.92	avail	avail
LCM1620-30	2 x 16	5 x 7 dots + cursor	85 x 30 x 10	62.2 x 17.2	2.78 x 4.27	0.50 x 0.55	avail	avail
LCM1620-44	2 x 16	5 x 7 dots + cursor	84 x 44x 10	62.2 x 17.8	2.96 x 4.86	0.56 x 0.66	avail	avail
LCM1640	4 x 16	5 x 7 dots + cursor	87 x 60 x 10	61.5 x 25.2	2.95 x 4.15	0.55 x 0.55	avail	not avail
LCM2020	2 x 20	5 x 7 dots + cursor	115 x 36 x 10	83.0 x 18.8	3.20 x 4.85	0.60 x 0.65	avail	avail
LCM2420	2 x 24	5 x 7 dots + cursor	118 x 36 x 10	94.5 x 18.0	3.20 x 4.85	0.60 x 0.65	avail	avail
LCM4020	2 x 40	5 x 7 dots + cursor	182 x 35.5 x 10	154. x 16.	3.20 x 4.85	0.60 x 0.65	avail	not avail

5–4, Stryker Lane • Hillsborough Industrial Park • Belle Mead, NJ 08502 • **Tel. (908) 874-4747 • FAX (908) 874-3278**

FEMA *The Display Specialist*



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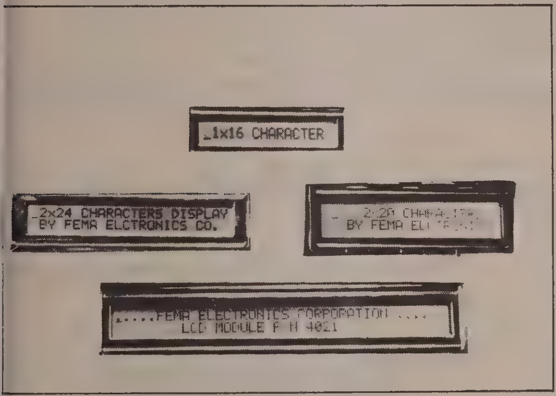
COMPLETE LINE OF LCD'S AND LED'S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2x24 CHARACTERS DISPLAY BY FEMA ELCTRONICS CO.
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LCD MODULE F M 4021

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- Standard and Custom Dot Matrix Modules
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- Twist Neumatic & Super Twist Versions
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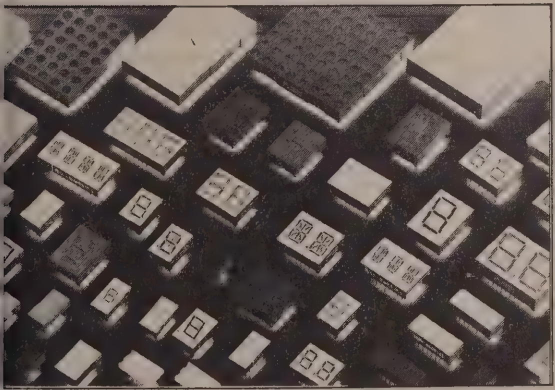
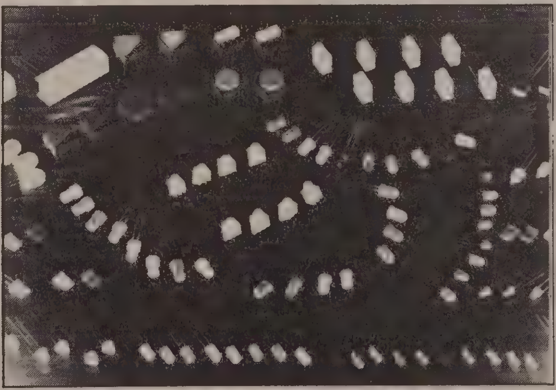
- LED Displays
- Light Bars
- Graphic Arrays
- LED Lamps





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(800) 292-3362 (FEMA)

eem

MINIGLOSSARY
TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer

(Delay-On-Operate/Interval Timer)

The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)

The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time

(Delay-On-Operate or Interval Timer)

The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)

The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.

Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

Trip Point
The predetermined point at which a sensing device is set to change the output state.

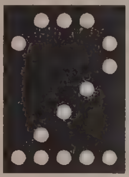
Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

FOX

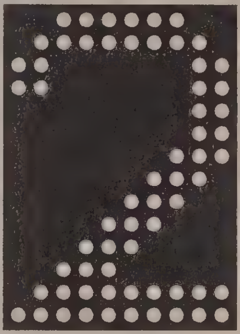
FD 200, FD 400 and FD 600 SERIES LARGE DISPLAYS

SUPERIOR DISPLAY VIEWABILITY IN HARSH ENVIRONMENTS

2.1" TALL X 1.5" WIDE



4.2" TALL X 3.0" WIDE



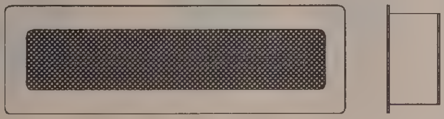
6.3" TALL X 4.5" WIDE

- STAINLESS STEEL CASE
- 8 TO 72 CHARACTERS
- NEMA 4 X STANDARD
- FULL 2 YEAR WARRANTY
- TRI-COLOR LED DISPLAY
- FULL ALPHA-NUMERIC DISPLAY CAPABILITY
- DATA HIGHWAY AND MODBUS COMPATABILITY
- REAL-TIME DATA DISPLAY OR MESSAGES
- EASY PC INTERFACE FOR PROGRAMMING

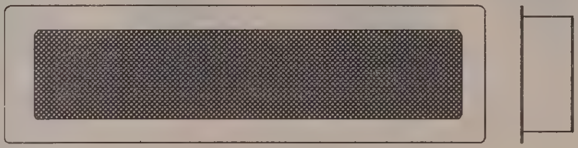
PHYSICAL SIZE (NOTE: UNITS INCLUDE HARDWARE FOR PANEL MOUNT OR STAND ALONE)

CASE "A"
16.5" WIDE X 6.5" HIGH X 4.0" DEEP

CASE "C"
40.5" WIDE X 9.0" HIGH X 4.0" DEEP



CASE "B"
28.5" WIDE X 9.0" HIGH X 4.0" DEEP



CASE "D"
40.5" WIDE X 11.5" HIGH X 4.0" DEEP

ORDERING INFORMATION

To build a model number, make selections from tables A, B and C and combine as shown in the box at right. Total prices.

A B - C

TABLE "A" - LARGE DISPLAY SELECTION

CODE	DESCRIPTION / SPECIFICATION	CASE	PRICE
FD21	2" TALL - 1 LINE WITH 8 CHARACTERS	A	$ 895
FD22	2" TALL - 1 LINE WITH 16 CHARACTERS	B	$ 1435
FD23	2" TALL - 1 LINE WITH 24 CHARACTERS	C	$ 1975
FD24	2" TALL - 2 LINE WITH 16 CHARACTERS	B	$ 2180
FD26	2" TALL - 2 LINE WITH 24 CHARACTERS	C	$ 2955
FD29	2" TALL - 3 LINE WITH 24 CHARACTERS	D	$ 4125
FD41	4" TALL - 1 LINE WITH 8 CHARACTERS	B	$ 2180
FD42	4" TALL - 1 LINE WITH 12 CHARACTERS	C	$ 2955
FD61	6" TALL - 1 LINE WITH 8 CHARACTERS	D	$ 4125

TABLE "B" - POWER SELECTIONS

CODE	DESCRIPTION / SPECIFICATION	PRICE
1	120 VAC, 50/60 Hz	$ 0
3	240 VAC, 50/60 Hz	$ 15

TABLE "C" - DATA INPUT SELECTIONS

CODE	DESCRIPTION / SPECIFICATION	PRICE
651	RS232C SERIAL DATA I/O	$ 0
652	RS422 / RS485 SERIAL DATA I/O	$ 0
655	CURRENT LOOP SERIAL DATA I/O	$ 45
687	ALLEN BRADLEY "DATA HIGHWAY"	$ 105
688	MODICON "MODBUS"	$ 105
693	PARALLEL DATA INPUT SINKING	$ 75
695	PARALLEL DATA INPUT SOURCING	$ 75

CONTACT FACTORY for TECHNICAL ASSISTANCE @ 815-758-7000

FOX METER INC. ALSO MANUFACTURES A FULL LINE OF DIGITAL PANEL METERS, SEE VOL. D, SECT. 2950 AND CONTROLLERS VOL. D, SECT. 2200

333 Dietz Avenue, Unit B, DeKalb, IL 60115-2672 - Phone 815-758-7000 - *Fax 815-758-1640*

F-P ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

DISPLAY COMPONENTS

Ferranti-Packard light reflecting electro-magnetic display components offer the user numerous benefits such as...

1. Excellent Visibility Utilizing a range of fluorescent colors in addition to white, the contrast ratio of an F-P display actually improves as the ambient light increases, ensuring excellent visibility both in low ambient light and direct sunlight.

2. High Reliability Virtually maintenance free operation is achieved since there are no lamps to burn out, and no mechanical linkages or bearings to wear.

3. Lower Power Consumption Because of our unique patented technology, no power is required to maintain the display, and only minimal energy is required to change the status of display.

4. Ruggedness Modules and indicators are highly resistant to shock and vibration and are ideally suited to mobile applications or displays in a high vibration environment.

COLORS The displays are available in a range of fluorescent colors including green, yellow, red and orange, in addition to white. For a complete listing of standard and non-standard colors refer to the individual product data sheet.

CHARACTER SIZE The general rule for selecting the optimum character size is to allow approximately 26mm (1 in.) of character height for every 15m (50 feet) of viewing distance. This will vary slightly depending on the color selected and the ambient light conditions.

STATUS INDICATORS Disk sizes are 7.6mm (0.3 in.) 8.9mm (0.35 in.) and 13mm (0.53 in.) diameter. A 13mm (0.5 in.) square flag is used in the series 50. These devices are current operated and can be driven from source voltages ranging from 3.3 Vdc to 25 Vdc, depending upon the model selected. Indicators are available for panel mounting or direct PCB mounting. Consult the individual data sheets to determine the indicator best suited for your requirements. Typical applications include: Transient Recorders, Industrial Process Displays, Fault Indicators, Portable Field Equipment, Continuous Matrix Display

PRE-ENCODED MODULES These modules are designed for applications where a limited number of character symbols are required. Standard modules provide the numerals 0 to 9 plus blank. Non-standard modules can be supplied with up to 12 alphanumeric or special characters including blank. Three character heights are available, 70mm (2.7 in.), 104mm-(4.1 in.) and 215mm (8.4 in.). Each character is encoded into the winding of the module coils and no external character generation is required. A single current pulse of 1 millisecond duration applied to the selected control wire erases the existing character and displays the desired character. The pulse can be driven from a single capacitor discharge circuit.

Typical applications include: Weigh-Scale Readouts, Industrial Instrumentation Displays, Cash Register Readouts for parking lots and toll booths, Scoreboards, Time/Temperature Displays, Vehicle Destination Signs.

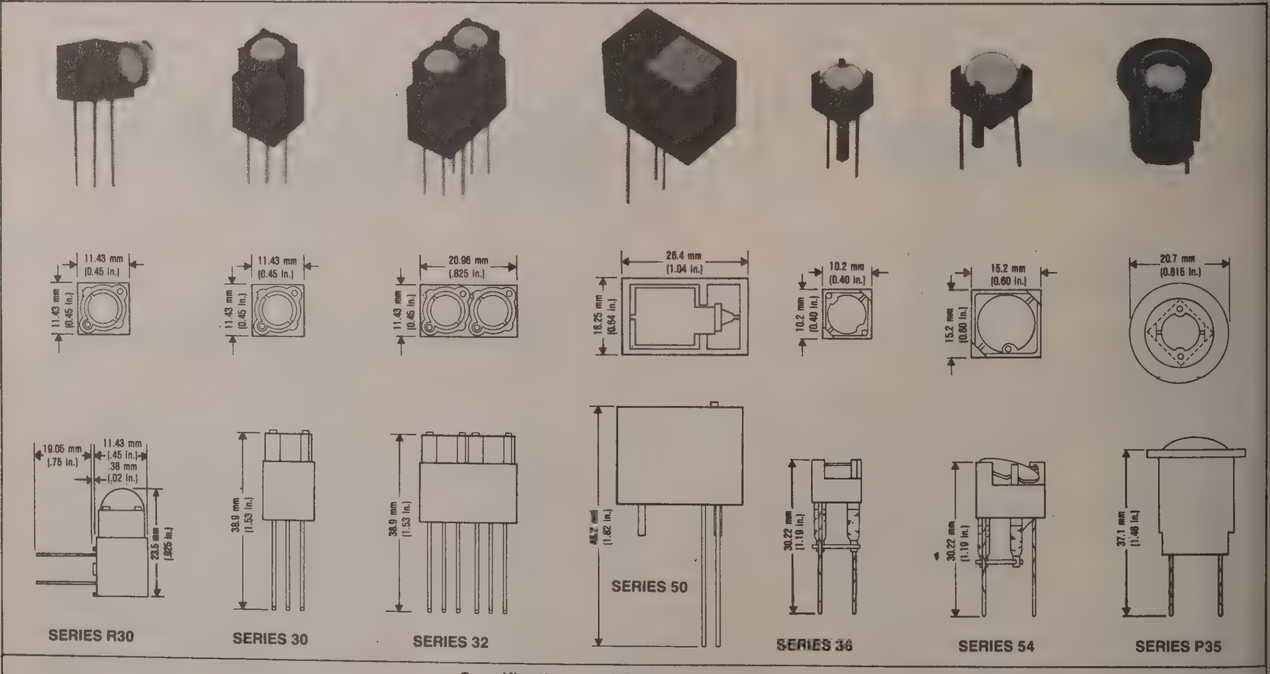
ALPHANUMERIC MODULES These modules offer the user a complete alphanumeric or special character capability. Each module contains 35 light reflecting disks or elements arranged in a 5 × 7 matrix. Five character heights are available — 70mm (2.7 in.), 104mm (4.1 in.), 215mm (8.4 in.), 328mm (12.9 in.) and 452mm (17.8 in.).

Typical applications include: Scoreboard Displays, Advertising Displays, Message Signs, Traffic Control Signs, Industrial Displays, Passenger Information Displays and Vehicle Destination Signs.

7 SEGMENT MODULES The 7 segment module is basically a numeric readout, but it can display a limited number of alpha characters within its 7 segment format. Five character heights are available — 26mm (1.0 in.), 135mm (5.3 in.), 230mm (9.0 in.), 305mm (12.0 in.) and 457mm (18.0 in.).

Typical applications include: Gasoline Pump Displays, Weigh Scale Readouts, Cash Register Readouts, Time/Temperature Displays, Gas Pricing Signs, Speed Limit Signs, Scoreboards, Industrial Displays.

STATUS INDICATORS



Specifications and Operating Parameters

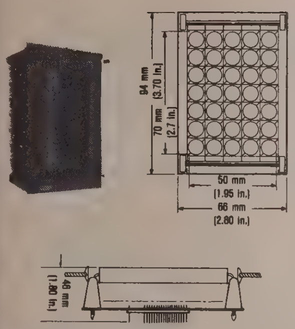
Series	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°C) (Ω)	Minimum Pulse Duration	Minimum Pulse (V) at 20°C	Data Sheet Reference	Disk Dia	Flag Size	Weight
R30 + 30	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.16 oz., 4.5 g
32	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.28 oz., 8.0 g
50	– 40 to 75°C	up to 95%	53mA	430 ± 10%	1.5 ms	25V	372	—	12.7 mm, 0.50 × 0.50 in.	0.50 oz., 14.2 g
36	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	8.9 mm, .350 in.	—	0.07 oz., 2.0 g
54	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	13.46 mm, .53 in.	—	0.11 oz., 3.2 g
P35	– 40 to 75°C	up to 95%	250mA	27 ± 10%	1 ms	10V	372	8.9 mm, .350 in.	—	0.14 oz., 3.9 g

* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

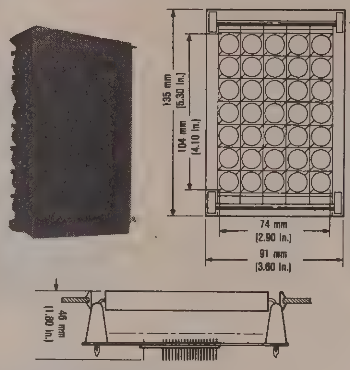
F-P ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

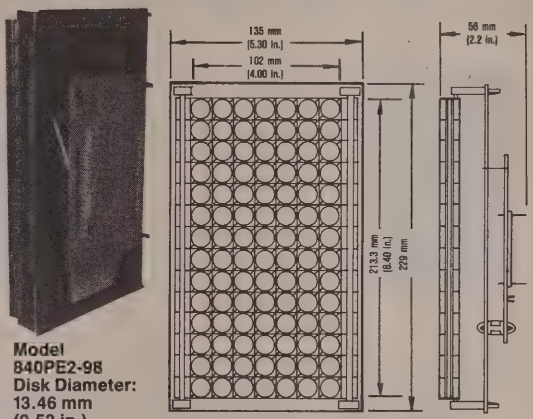
PRE-ENCODED MODULES



Model 270PE2-35
Disk Diameter: 8.9 mm (0.35 in.)
Weight: 142g



Model 410PE2-35
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 227g

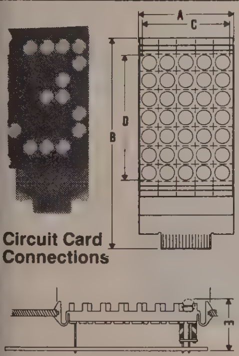


Model 840PE2-98
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 570g

Specifications and Operating Parameters

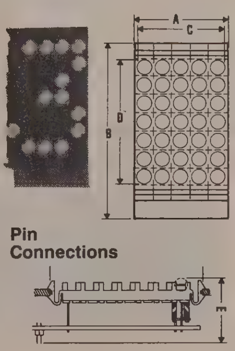
Model Number	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°V) (Ω)	Minimum Pulse Duration	Minimum Pulse Voltage at	Data Sheet Reference
270PE2-35	– 40 to 75°C	up to 95%	10A	4.3 ± 10%	1 ms	48 V	778
410PE2-35	– 40 to 75°C	up to 95%	12A	5.5 ± 10%	1 ms	72 V	751
840PE2-98	– 40 to 75°C	up to 95%	16A	5.9 ± 10%	1 ms	96 V	759

ALPHANUMERIC MODULES



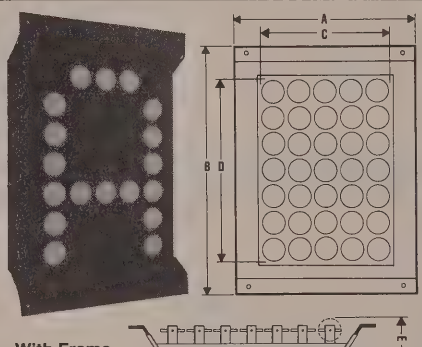
Circuit Card Connections

Model 270XY5-35SC
Model 410XY5-35SC



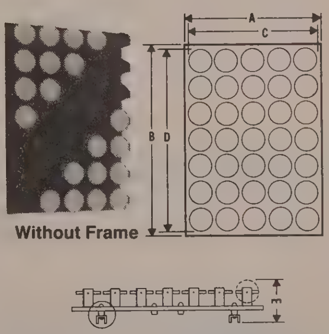
Pin Connections

Model 271XY5-35SC
Model 411XY5-35SC



With Frame

Model 842XY2-35SC
Model 1202XY2-35SC
Model 1802XY2-35SC



Without Frame

Model 840XY2-35SC
Model 1200XY2-35SC
Model 1800XY2-35SC

Specifications and Operating Parameters

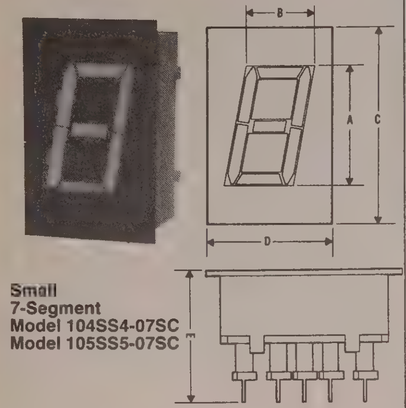
Model Number	Temp. Range	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance (at 20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°	A × B	C × D	E	Disk Diameter	Weight (g)	Data Sheet Ref
270XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 × 116 in. 2.03 × 4.57	50 × 70 1.95 × 2.70	28.9 1.14	8.9 0.35	98g	797
410XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 × 167 mm 3.03 × 6.60	74 × 104 2.93 × 4.10	32 1.26	13.46 0.53	139g	797
271XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 × 116 in. 2.03 × 4.57	50 × 70 1.95 × 2.70	39.8 1.57	8.9 0.35	98g	797
411XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 × 167 in. 3.03 × 6.60	74 × 104 2.93 × 4.10	42 1.69	13.46 0.53	139g	797
842XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 215 × 312 in. 8.45 × 12.5	150 × 213 5.9 × 8.4	74 2.9	24 0.95	992g	586
1202XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 317 × 457 in. 12.5 × 18.0	231 × 328 9.1 × 12.9	81 3.2	38 1.5	1786g	586
1802XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 457 × 660 in. 18.0 × 26.0	320 × 452 12.6 × 17.8	91 3.6	56 2.2	3317g	586
840XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 163 × 221 in. 6.4 × 8.7	150 × 213 5.9 × 8.4	84 3.29	24 0.95	425g	586
1200XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 244 × 335 in. 9.6 × 13.2	231 × 328 9.1 × 12.9	87 3.42	38 1.5	595g	586
1800XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 333 × 457 in. 13.1 × 18.0	320 × 452 12.6 × 17.8	95 3.75	56 2.2	822g	586

*All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

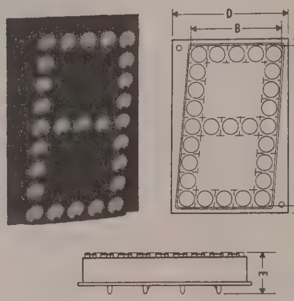
F-P ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

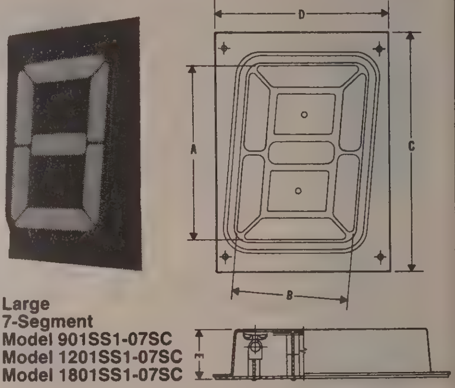
7-SEGMENT MODULES



Small 7-Segment Model 104SS4-07SC Model 105SS5-07SC



Disk Matrix 7-Segment Model 531SS2-07SC



Large 7-Segment Model 901SS1-07SC Model 1201SS1-07SC Model 1801SS1-07SC

Specifications and Operating Parameters

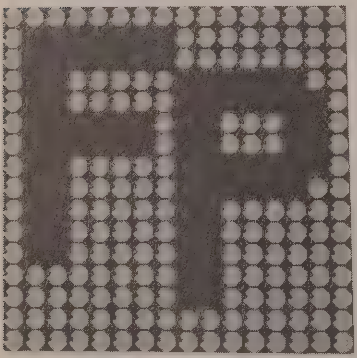
Model Number	Temp. Range °C	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance at (20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°C	A × B	C × D	E	Weight (g)	Data Sheet Reference
104SS4-07SC	– 40 to 75	up to 95%	1A	6.8 ± 10%	650μs	12	mm 25.4 × 14 in. 1.00 × 0.55	42.9 × 27.3 1.69 × 1.075	29 1.123	12.3	777
105SS5-07SC	– 40 to 75	up to 95%	335 mA	45 ± 10%	1ms	19	mm 25.4 × 14 in. 1.00 × 0.55	42.9 × 27.3 1.69 × 1.075	29 1.123	13.8	777
531SS2-07SC	– 40 to 75	up to 95%	1.8A	A, D, G, -6Ohms B, E -4-5Ohms C, F -3-6Ohms	1 ms	See Data Sheet 531	mm 135 × 76.2 in. 5.3 × 3.0	155.7 × 105.4 6.13 × 4.15	33 1.3	150	531
901SS1-07SC	– 40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 230 × 152 in. 9.0 × 6.0	312 × 230 12.3 × 9.0	76 3.0	936	200
1201SS1-07SC	– 40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 305 × 203 in. 12.0 × 8.0	457 × 318 18.0 × 12.5	76 3.0	1360	200
1801SS1-07SC	– 40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 457 × 305 in. 18.0 × 12.0	660 × 457 26.0 × 18.0	79 3.1	2495	200

(1) All erase coils connected in series.
(2) Individual erase coils. If connected in series the erase voltage must be 26V minimum.

* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

DISK MATRIX MODULES

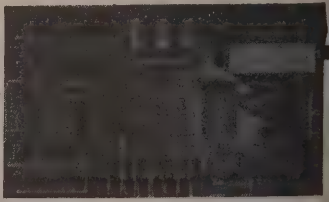
16 BY 16 CONTINUOUS ARRAYS



The elements are arranged in a 16 by 16 matrix capable of producing a full range of graphic characters. Each element can be individually addressed on a row and column basis. Each row of elements has a set and reset line, which is connected to the positive end of each coil in the row, through blocking diodes. The negative end of each coil in a column is connected to a common column return. By pulsing a row set line and closing the column return circuit, the element at the intersection will be set. All circuits are completed on a printed circuit board to connectors on the rear of the module.

SERIES 300 DRIVER/DECODER BOARD

The Series 300 driver/decoder boards provide a simple, economical method of driving small display systems comprising either (70mm) 2.7 inch, (104mm) 4.1 inch or (215mm) 8.4 inch type DCP pre-encoded modules. (Data Sheet 265.)



MODEL 700DD DRIVER/ DECODER BOARD

MODEL 701DD DRIVER/ DECODER BOARD

The Model 700DD 7 bar module driver/decoder board provides a simple, economical method of driving small display systems utilizing (230mm) 9 inch, (305mm) 12 inch, (457mm) 18 inch large 7 bar modules. (Data Sheet 700.)

The Model 701DD 7 bar module driver/decoder board drives small display systems utilizing 135mm (5.3 in.) disk matrix segment modules. (Data Sheet 701.)

PRINCIPLES OF OPERATION

Alphanumeric Modules/Status Indicators

The basic display element is a magnetic disk. Short pulses of current in the coil assembly set the magnetic field in the stator pins in either one direction or the other. Each disk rotates to line up with the stator field and shows either its black side, or colored side.

Small 7-Segment Modules

The basic display element is a magnetic segment which pivots on its axis. Short pulses of current in the coil under each segment set the magnetic field in the stator pins in either one direction or the other. Attraction or repulsion by a segment's bar magnet, retracts or shows a segment.

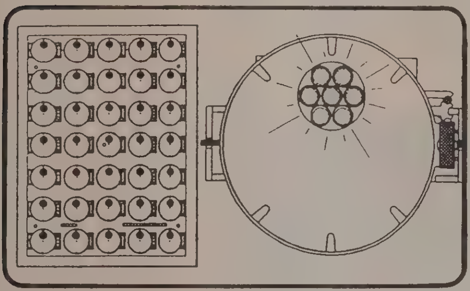
F-P ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

NEW PRODUCTS

XY2L Hybrid
18" Character Module

a new LED / DISK Hybrid Display Technology



The XY2L module combines the benefits of high intensity LED clusters with the high performance and reliability of existing F-P Electronics XY2 technology. XY2L modules are fully compatible with existing XY2 type drivers and controllers made by F-P Electronics. Mounting requirements are the same as those for the existing series of 18" XY2 modules. XY2L modules feature the addition of LED cluster technology for outstanding visibility in ambient darkness, without the need for external illumination. In darkness, selected characters are made highly visible by the LED clusters. In direct sunlight, the reflective properties of the flip disk displays the message. Light from each LED cluster is projected through an aperture in the selected flip disk therefore daylight visibility is enhanced during overcast, foggy or inclement weather conditions. The LED clusters are mounted within tubular shrouds to minimize reflections from the incident rays of sunlight on bright days.

HYBRID MODULE

OPTICAL FIBRE AND REFLECTIVE DISK

Our new optical fibre and reflective disk display module combines the benefits of high intensity optical fibre light transmission techniques with the high performance of our existing reflective disk display modules.

This new technology provides outstanding visibility at night time without the need for external illumination. These hybrid modules are particularly suited for use in variable message signs for highway motorist information applications, and may also be used in any outdoor application where viewer position can be controlled to remain within the specified cone of visibility.

Modules consist of three discrete 5 x 7 character assemblies mounted in a single framework for the display of alphanumeric text. Each disk in the module is provided with a glass optical fibre bundle terminating in a lens, the output of which is shuttered by its associated disk, allowing it to transmit light through an aperture in the disk in the activated state. In the dark state the disk rotates 180 degrees to cover the lens.

FP2000 SERIES
Display Components

The FP2000 is a small electronic sign system for alphanumeric and graphics display on a continuous disk matrix panel array. It is excellent for advertising, promotion and general information and has an attractive assortment of eye-catching writing modes. Disk diameters of 0.35" (0.89cm) or 0.50" (1.27cm) are available in arrays up to 6, 272 disks. Panels are made in basic modules 28 disks wide by 7 or 14 disks high. Signs may be 7 or 14 disks high with a maximum width of 448 disks, or they may be 21 or 28 disks high with a maximum width of 224 disks.

The signs are sold in systems consisting of Display Panels. Sign Controller, Power Supply, Distribution & Interface Board and Cable Set.

Data entry is done by user's terminal or computer.

FP2500 SERIES
Display Components

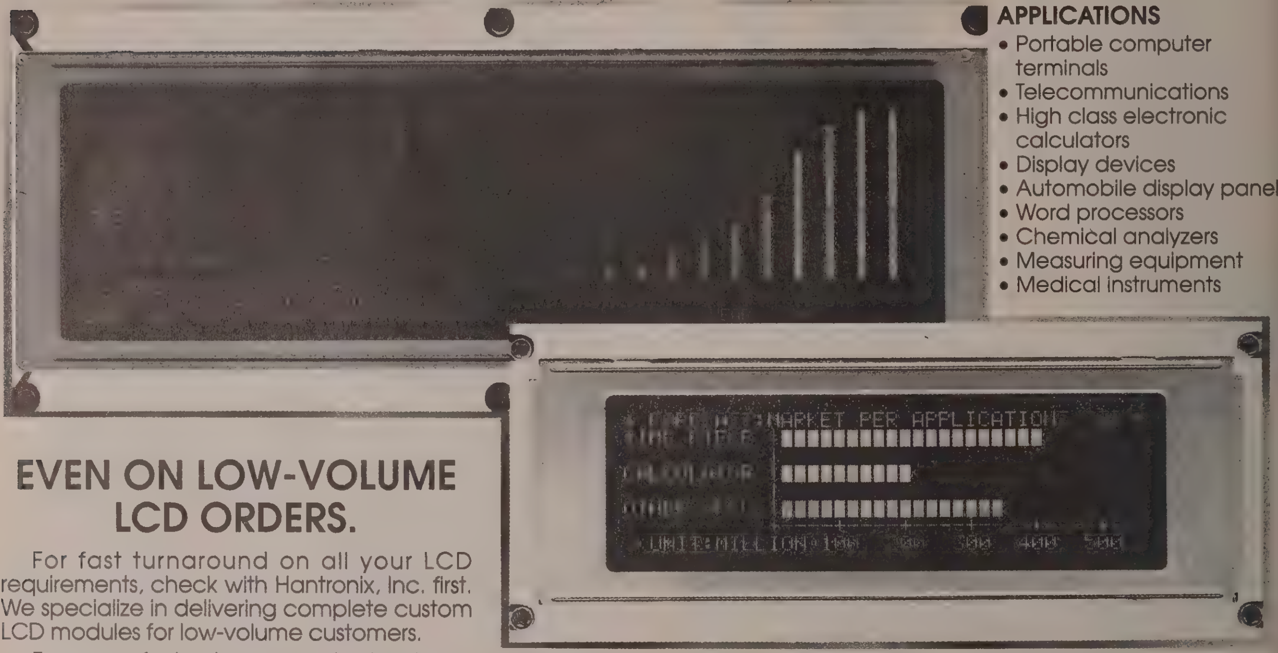
The FP2500 is a small-character alphanumeric display system, equally adaptable and economical for large and small arrays. It employs our discrete 35-disk modules of 7 rows of 5, available in heights of 2.7" (6.8cm) and 4.1" (10.4cm). There is one Control Module for each 80 character (or less) block of a sign. These are networked together on a common bus and write their blocks simultaneously, thus taking less than 2 seconds to write a complete sign whatever its size.

Our standard wall-mounting framing and trim panel system is available for FP2500 components.

Data entry is done using customer's terminal or computer.

HANTRONIX DOT MATRIX LCD MODULES

LCD VISIBLY SUPERIOR HANTRONIX



APPLICATIONS
- Portable computer terminals
- Telecommunications
- High class electronic calculators
- Display devices
- Automobile display panels
- Word processors
- Chemical analyzers
- Measuring equipment
- Medical instruments

EVEN ON LOW-VOLUME LCD ORDERS.

For fast turnaround on all your LCD requirements, check with Hantronix, Inc. first. We specialize in delivering complete custom LCD modules for low-volume customers.

For even faster turnaround, check out our standard line of dot-matrix LCDs. Modules consume very little power, yet display crystal--clear characters and graphic images with sharp contrast over a wide viewing angle. All modules are designed to make interfacing exceptionally easy.

High- quality Hantronix, Inc. LCDs are competitively priced, with discounts on larger-volume orders. They're warranted for one year, and backed by Hantronix, Inc.'s high reliability standards and prompt service. For full details, contact Hantronix, Inc. today.

FEATURES
- By the combination of dots it can be displayed many kinds of characters and symbols.
- Using FEM-TN liquid crystal developed newly, it has wide viewing angle.
- Due to low drive voltage and low current consumption, it can be operated with battery.
- For its small size, lightweight, compact display equipments can be constructed.
- Character generator included.
- Many kinds of types are available according to users' requirements.

OPTIONS

Tn (Twisted Nematic) or STN (Super Twisted Nematic) Type
- STN type offers high contrast and wider viewing angle.
- Viewing angle (TN:±20°, STN:±40°)

Standard Temperature Type
- Operating temperature range: 0°C~+50°C
- Storage temperature range: -20°C~+70°C

Extended Temperature Type
- Operating temperature range: -20°C~+70°C
- Storage temperature range: -40°C~+80°C

E/L Backlight Type
- Electro Luminescence for backlight
- Standard emitted color is "blue-green"
- Inverter is required

LED Backlight Type
- Brighter and even backlighting
- Long lifetime of LED

Single Voltage Type
- 5V for logic circuit and LCD driving

Dual Voltage Type
- 5V for logic circuit
- -1V -5V for LCD driving

Display Type
- Positive
- Negative

HANTRONIX 250 Santa Ana Court, Sunnyvale, CA 94086 Tel: (408) 736-3191 • Fax: (408) 749-0477

HANTRONIX

DOT MATRIX LCD MODULES

CHARACTER TYPE (BUILT-IN CONTROLLER)

ITEM / MODEL	EXTERNAL DIMENSION (WxHxDmm)	CHARACTER x LINE	VIEWING AREA (WxHmm)	DRIVING METHOD (DUTY)	CHARACTER FONT (WxH,DOT)	CHARACTER SIZE (WxHmm)	DOT SIZE (WxHmm)
HDM-08111H—1	54.0x37.0x10.0	8x1	32.0x16.0	1/11	5x10, CUR	2.9x6.9	0.5x0.6
HDM-08216H—1	54.0x37.0x10.5	8x2	32.0x16.0	1/16	5x7, CUR	2.95x4.5	0.55x0.6
HDM-16108H—4	80.0x36.0x10.0	16x1	65.6x13.8	1/8	5x7, CUR	3.15x5.5	0.55x0.7
HDM-16108H—7	122.0x33.0x10.0	16x1	99.0x13.0	1/8	5x7, CUR	4.84x8.06	0.92x1.1
HDM-16116H—2	80.0x36.0x10.0	16x1	65.6x13.8	1/16	5x7, CUR	3.15x5.5	0.55x0.7
HDM-16111H—4	80.0x36.0x10.0	16x1	65.6x13.8	1/11	5x10, CUR	3.15x7.9	0.55x0.7
HDM-16216H—2	85.0x36.0x10.0	16x2	63.5x15.8	1/16	5x7, CUR	3.15x4.45	0.55x0.55
HDM-16216H—4	122.0x44.0x10.0	16x2	99.0x24.0	1/16	5x7, CUR	4.84x8.06	0.92x1.1
HDM-16216H—5	80.0x36.0x10.0	16x2	65.6x13.8	1/16	5x7, CUR	2.95x3.8	0.55x0.55
HDM-16216H—B	84.0x44.0x10.0	16x2	61x15.8	1/16	5x7 CUR	2.85x4.85	0.55x0.65
HDM16216H—D	85.0x30.0x10.1	16x2	62.0x16.0	1/16	5x7, CUR	3.20x4.85	0.60x0.65
HDM-16416H	87.0x60.0x10.0	16x4	61.8x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-20108H	120.0x36x10.0	20x1	88.2x20.0	1/8	5x7, CUR	3.4x5.15	0.6x0.65
HDM-20108H—1	182.0x33.5x10.0	20x1	154.5x15.8	1/8	5x7, CUR	6.7x9.4	1.3x1.3
HDM-20111H	120.0x36.0x10.0	20x1	88.2x20.0	1/11	5x10, CUR	3.4x7.9	0.6x0.7
HDM-20216H	120.0x36.0x10.0	20x2	88.2x20.0	1/16	5x7, CUR	3.4x5.15	0.6x0.65
HDM-20416H	98.60.0x10.0	20x4	76x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-20416H—1	146.0x62.5x10.0	20x4	123.0x42.5	1/16	5x7, CUR	4.85x8.07	0.93x1.11
HDM-24108H	118.0x36.0x10.0	24x1	93.5x15.8	1/8	5x7, CUR	3.15x5.5	0.55x0.7
HDM-24111H	118.0x36.0x10.0	24x1	93.5x15.8	1/11	5x10, CUR	3.15x7.9	0.55x0.7
HDM-24216H	118.0x36.0x10.0	24x2	93.5x15.8	1/16	5x7, CUR	3.15x4.45	0.55x0.55
HDM-24216H—2	118.0x36.0x10.0	24x2	93.5x15.8	1/16	5x7, CUR	3.20x4.85	0.60x0.65
HDM-24416C	130.0x62.0x11.0	24x4	82.0x41.0	1/16	5x7, CUR	2.80x4.1	0.52x0.70
HDM-32108H—1	174.5x31.0x10.0	32x1	141.2x17.0	1/8	5x7, CUR	3.42x5.52	0.62x0.72
HDM-32111H—1	174.5x31.0x10.0	32x1	141.2x17.0	1/11	5x10, CUR	3.42x7.9	0.62x0.7
HDM-32216H—1	174.5x31.0x10.0	32x2	141.2x17.0	1/16	5x7, CUR	3.42x4.82	0.62x0.62
HDM-40108H—2	182.0x33.5x10.0	40x1	154.5x15.8	1/8	5x7, CUR	3.15x5.5	0.55x0.7
HDM-40111H—1	182.0x33.5x10.0	40x1	154.5x15.8	1/11	5x10, CUR	3.15x7.9	0.55x0.7
HDM-40108H—3	285.0x40.0x10.5	40x1	245.0x20.0	1/8	5x7, CUR	5.2x14.5	1.0x1.77
HDM-40216H—2	182.0x33.5x10.0	40x2	154.5x15.8	1/16	5x7, CUR	3.15x4.45	0.55x0.55
HDM-40216H—4	182.0x33.5x10.0	40x2	154.5x15.8	1/16	5x7, CUR	3.2x4.85	0.6x0.65
HDM-40216H—5	285.0x56.0x10.5	40x2	245.0x38.0	1/16	5x7, CUR	5.2x2.69	1.0x1.77
HDM-40416H	215.0x60.0x10.0	40x4	160.0x34.0	1/6	5x7, CUR	3.2x4.85	0.6x0.65
HDM-40416H—4	190.0x54.0x10.5	40x4	147.0x29.5	1/16	5x7, CUR	2.8x4.29	0.52x0.57

CHARACTER TYPE (LED Backlight)

ITEM / MODEL	EXTERNAL DIMENSION (WxHxDmm)	CHARACTER x LINE	VIEWING AREA (WxHmm)	DRIVING METHOD (DUTY)	CHARACTER FONT (WxH,DOT)	CHARACTER SIZE (WxHmm)	DOT SIZE (WxHmm)
HDM-16108L	80.0x36.0x13.0	16x1	65.6x13.8	1/8	5x7, CUR	3.2x5.55	0.6x0.75
HDM-16108L—7	122.0x33.0x15.0	16x1	99.0x13.0	1/8	5x7, CUR	4.84x8.06	0.92x1.10
HDM-16116L—1	80.0x36.0x11.0	16x1	61x15.8	1/16	5x7, CUR	3.2x5.2	0.6x0.7
HDM-16216L	84.0x45.0x13.0	16x2	61.0x16.0	1/16	5x7, CUR	2.95x4.85	0.55x0.65
HDM-16216L—2	80.0x36.0x11.0	16x2	61.0x15.8	1/16	5x7, CUR	2.95x5.55	0.55x0.65
HDM-16216L—4	80.0x35.0x11.0	16x2	61.0x15.8	1/16	5x7, CUR	2.95x5.55	0.55x0.65
HDM-16216L—5	80.0x36.0x11.0	16x2	65.6x13.8	1/16	5x7, CUR	2.95x3.8	0.55x0.5
HDM-16216L—6	80.0x36.0x11.0	16x2	61.0x15.8	1/16	5x7, CUR	2.95x5.55	0.55x0.65
HDM-16216L—7	122.0x44.0x12.5	16x2	99.0x24.0	1/16	5x7, CUR	4.84x8.06	0.92x1.1
HDM-16416L	87.0x60.0x12.5	16x4	61.8x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-20216L	116.0x37.0x13.0	20x2	83.0x18.6	1/16	5x7, CUR	3.2x4.85	0.6x0.65
HDM-20216L—1	116.0x36.0x15.0	20x2	83.0x18.6	1/16	5x7, CUR	3.2x4.85	0.6x0.65
HDM-20416L	98.0x60.0x12.5	20x4	76.0x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-20416L—1	98.0x60.0x15.0	20x4	76.0x25.2	1/16	5x7, CUR	2.95x4.15	0.55x0.55
HDM-40216L	182.0x33.5x13.0	40x2	154.5x15.8	1/16	5x7, CUR	3.2x4.85	0.6x0.65
HDM-40416L—4	190.0x54.0x14.5	40x4	147.0x29.5	1/16	5x7, CUR	2.80x4.29	0.52x0.57

GRAPHIC TYPE

ITEM / MODEL	EXTERNAL DIMENSION (WxHxDmm)	DOT NUMBER (WxH, DOT)	VIEWING AREA (WxHmm)	DRIVING METHOD (DUTY)	DOT SIZE (WxHmm)	DOT PITCH (WxHmm)
HDM-32GS12Y	152.0x56.0x15.0	120x32	90.0x32.0	1/32	0.65x0.75	0.7x0.8
HDM-64GS12	93.0x70.0x8.5	128x64	70.7x38.8	1/64	0.48x0.48	0.52x0.52
HDM-64GD24—3	180.0x75.0x11.0	240x64	132.0x41.0	1/32	0.47x0.47	0.52x0.52
HDM-64GS24—Y	180.0x75.0x11.0	240x64	132.0x41.0	1/64	0.47x0.47	0.52x0.52
HDM-64GS48	270.0x82.0x10.0	480x64	240.0x38.0	1/64	0.44x0.44	0.49x0.49
HDM-128GS12—Y	85.0x100.0x14.0	128x128	62.0x62.0	1/128	0.40x0.40	0.43x0.43
HDM-128GD25-1	200.0x110.0x10.0	256x128	128.0x66.5	1/64	0.43x0.43	0.48x0.48
HDM-128GD48-1	270.0x110.0x10.0	480x128	242.0x69.0	1/64	0.43x0.43	0.48x0.48
HDM-3220	161.9x110.0x25.0	320x200	124.4x78.0	1/200	0.33x0.33	0.37x0.37
HDM-3224	143.0x96.8x12.0	320x240	104.0x79.3	1/240	0.27x0.27	0.30x0.30
HDM-6448	260.0x174.0x7.0	648x480	196.0x148.0	1/24	0.27x0.27	0.30x0.30

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HITACHI®

Hitachi America, Ltd. Liquid Crystal Displays

Leadership in Technology

Hitachi has been a pioneer in LCD research and development ever since the infancy of commercial LCD technology. Hitachi involvement in LCD technology began in 1968, with basic research on the electro-optical properties of liquid crystal materials.

Since then, Hitachi expertise has led to a number of important firsts in the LCD industry:

- The first production TN-FE mode numerical LCDs for wristwatch applications.
- The first LSIs for driving matrix LCDs.
- The first LCDs for television applications.
- The first production Super Twist LCD.
- The first LCDs for use in an automotive instrument panel.
- The first production of large-size full color active matrix LCDs.
- The first production of notebook size LCDs utilizing micro-tab technology.

LCDs Provide a Number of Key Benefits For Your Design

LCDs have a unique combination of features and benefits unmatched by other display technologies.

Low power requirements

Unlike CRT and gas plasma displays, LCDs are inherently low power devices. Typically, they exhibit power consumption of less than 10uw/cm², and operate with power supply voltages of 8VDC or less.

As a result, LCDs are ideal for portable or battery-powered applications where power consumption must be as low as possible. For those applications powered from the AC line, a liquid crystal display can mean a smaller, less expensive power supply.

High readability

Clearly, one of the most important qualities of any display is that it be easy to read. In this regard, LCDs excel.

Their flickerless display means improved readability with less eye strain and fatigue. And, because of their optically passive nature, bright ambient light makes them even easier to read.

Compact packaging

LCDs are thin, compact, and lightweight. While obviously ideal for portable applications, these qualities can help make possible the new generation of "small footprint" electronics.

Easy integration into your design

Because of their simple interfacing and power supply requirements, LCDs get your design to market faster, with less design cost.

Highly rugged construction

LCDs don't rely on fragile glass envelopes or complicated structures as do other display technologies. This gives them better durability, making your design more reliable.

Cost-effective design

Hitachi's LCDs are cost-effective design solutions because Hitachi's highly automated manufacturing process results in lower prices per unit. Standard interfaces and low power requirements also contribute to more cost-effective designs, and help reduce your overall system costs.

16-level gray scale, 640 x 480 resolution

HITACHI®

Color Displays

ACTIVE MATRIX DISPLAYS

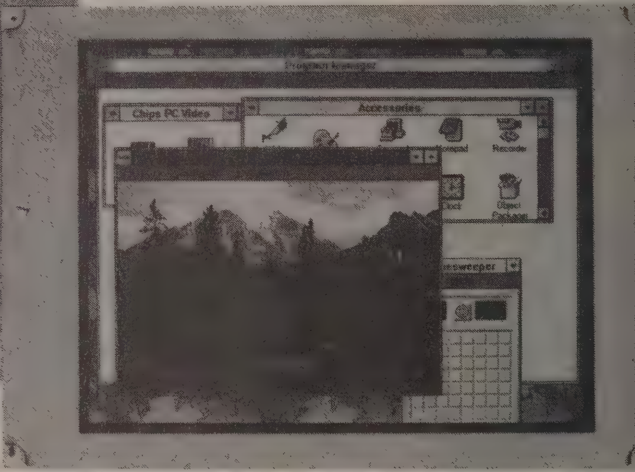
10.4" TFT TX26D51VC1CAA

Resolution	VGA 640 x (3) x 480
Active Display Area	211 (H) x 158.4 (V)mm
Effective Viewing Area	219.2 (H) x 166.4 (V) mm
Contrast	100:1
Viewing Direction	6:00 O'clock
Response Time	50ms (Tr + Tf)
Module Width	285mm
Module Height	217mm
Thickness	28mm
Typical Brightness	80 Cd/m2

9.4" TFT TX24D55VC1CAA

Resolution	VGA 640 x 480
Active Display Area	192 (H) x 144 (V)mm
Effective Viewing Area	196 (H) x 147.7 (V) mm
Contrast	100:1
Viewing Direction	12:00 O'clock (top)
Response Time	50ms (Tr + Tf)
Module Width	255mm
Module Height	180mm
Thickness	10mm
Typical Brightness	65 Cd/m2

10.4" TX26D51VC1CAA



9.4" TX24D55VC1CAA

PASSIVE MATRIX DISPLAYS

9.4" Color VGA LMG9720XUFC

Resolution	640 x 3 (RGB) x 480
Active Display Area	192 (H) x 144 (V)mm
Effective Viewing Area	196 (H) x 149 (V)mm
Contrast	20:1
Viewing Direction	6:00 O'clock
Response Time	300ms
Module Width	255mm
Module Height	183mm
Thickness	10mm
Typical Brightness	60 Cd/m2

HITACHI

Hitachi America, Ltd., Electron Tube Division, 3850 Holcomb Bridge Rd., Suite 300, Norcross, GA 30092
Phone (404) 409-3000 Fax (404) 409-3028

HITACHI®

Graphic Displays

Graphic Displays

Hitachi's newest monochrome VGA and XGA LCDs feature advanced micro-tab construction technology, for a thin profile, lightweight display with improved brightness, higher contrast and faster response times. In addition, micro-tab technology shrinks the border size significantly, for a larger viewing area and better readability.

The new models range in thickness from 5.5mm to 10mm and from 9.4" to 10.4" in size.
Models of both VGA and XGA are available now for use in a wide range of portable applications, including laptop and notebook computers, portable monitors, overhead projection systems, hand-held instruments, and pen-based computers.

Monochrome VGA Displays

XGA Displays

Model / Part #	LMG5278-C	LMG5364	LMG5160	LMG5042	LMG5310XUFC	LMG9060
Resolution	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480	1024 x 768
Contrast Ratio	18 : 1	18 : 1	10 : 1	10 : 1	18 : 1	6 : 1
Pixel Pitch	.30 x .30mm	.30 x .30mm	.30 x .30mm	.28 x .28mm	.23 x .23mm	.22 x .22mm
Response Time	270ms	270ms	270ms	400ms	270ms	700ms
Backlight Technology	1 CCFL Edgelight	1 CCFL Edgelight	1 CCFL Edgelight	1 CCFL Edgelight	1 CCFL Edgelight	2 CCFL Edgelight
Duty Ratio	1/242	1/240	1/240	1/240	1/240	1/387
Weight	350g	350g	350g	360g	290g	1200g
Outline Dimensions	257.5 x 174mm	258 x 174mm	255 x 172mm	256.5 x 160mm	205 x 143mm	300 x 234mm
Active Area Dimensions	196 x 148mm	192 x 144mm	192 x 143mm	179 x 134mm	151.2 x 114.4mm	231 x 175mm
Thickness includes Backlight	7.0mm	5.5mm	8.5mm	10.0mm	5.5mm	17.0mm
Brightness	60 Cd / m2	60 Cd / m2	40 Cd / m2	40 Cd / m2	60 Cd / m2	100 Cd / m2

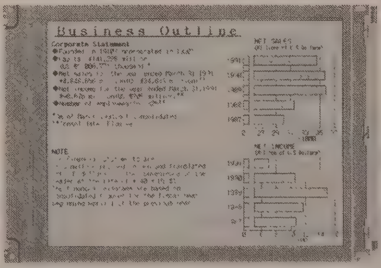
Hitachi's line of medium sized monochrome graphic displays, known for outstanding image quality and high reliability, are now available in black and white and new gray color modes. The displays, available from 256 x 64 to 640 x 200 also feature built-in drivers.

Midsized Graphic Displays

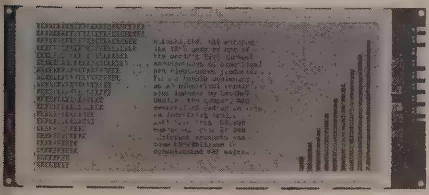
Model/ Part # Without Controller	No. of pixels W x H	Display Color	Dot Pitch W x H	Driving Method (Duty)
LMG6390	256 x 64	New Gray	.47 x .47mm	1/64
LMG6392	256 x 64	Black & White	.47 x .47mm	1/64
LMG6410	240 x 128	New Gray	.50 x .50mm	1/128
LMG6412	240 x 128	Black & White	.50 x .50mm	1/128
LMG6910	320 x 240	New Gray	.36 x .36mm	1/240
LMG6911	320 x 240	Blue Mode	.36 x .36mm	1/240
LMG6912	320 x 240	Black & White	.36 x .36mm	1/240
LMG6250	480 x 128	New Gray	.48 x .48mm	1/128
LMG6252	640 x 200	Black & White	.48 x .48mm	1/200
LMG6270	640 x 200	New Gray	.33 x .33mm	1/200
LMG6272	640 x 200	Black & White	.33 x .33mm	1/200
LMG6273	640 x 200	Black & White anti-glare	.33 x .33mm	1/200
LMG6280	640 x 200	New Gray	.33 x .45mm	1/200
LMG6282	640 x 200	Black & White	.33 x .45mm	1/200
LMG6283	640 x 200	Black & White anti-glare	.33 x .45mm	1/200

EL Backlit Versions

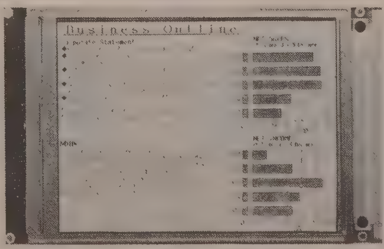
Model/ Part # Without Controller	No. of dots	Display Color	Dot Pitch	Driving Method (Duty)
LMG6391	256 x 64	New Gray	.47 x .47mm	1/64
LMG6411	240 x 128	New Gray	.50 x .50mm	1/128
LMG6251	480 x 128	New Gray	.48 x .48mm	1/128
LMG6271	640 x 200	New Gray	.33 x .33mm	1/200



LMG5268XUFC



LMG6281XNGE



LMG5040XUFC

HITACHI LIQUID CRYSTAL
DISPLAY DEVICE
LMG5160XUFC
Number of dots : 640 × 480
Hi response time of LCD

LMG5160XUFC

HITACHI
Hitachi America, Ltd., Electron Tube Division, 3850 Holcomb Bridge Rd., Suite 300, Norcross, GA 30092
Phone (404) 409-3000 Fax (404) 409-3028

Liquid Crystal Displays

Character LCD Modules

Hitachi Character LCD modules are ideal for general purpose character display applications where numbers, letters, and symbols are presented. These products display 160 types of 5 x 7 dot character fonts, 32 types of 5 x 10 fonts, and 8 software programmable fonts.

Hitachi's broad line includes character LCD modules ranging from 1 to 4 lines. 40 characters. A choice of EL or LED backlight versions provides clear, highly legible displays. All models include built-in drivers and controllers.

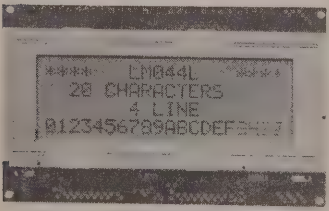
Character LCD Modules (without backlight)

Part #	No. of Char (Char x line)	Display color	External Dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Character Dimensions W x H (mm)	Driving method (Duty)	Recommended power supply Vdd - Vss (V)
LMO54	8 x 1	Gray	84 x 44 x 12 max	61 x 15.8	6.45 x 9.4	1/8	+5
LMO15	16 x 1	Gray	80 x 36 x 12 max	64.6 x 13.8	3.15 x 5.5	1/8	+5
H2570	16 x 1	Gray	80 x 36 x 12 max	64.6 x 13.8	3.15 x 7.9	1/11	+5
LMO20L	16 x 1	Gray	80 x 36 x 12 max	64.6 x 13.8	3.07 x 5.73	1/16	+5
LMO20XMBL	16 x 1	New gray	80 x 36 x 12 max	64.6 x 13.8	3.07 x 5.73	1/16	+5
LMO70L	20 x 1	Gray	105 x 39 x 11 max	84 x 13	3.2 x 5.2	1/8	+5
LMO38	20 x 1	Gray	182 x 35.5 x 13 max	154 x 15.3	6.7 x 9.4	1/8	+5
LMO27	24 x 1	Gray	126 x 36 x 12 max	100 x 13.8	3.15 x 7.9	1/11	+5
H2571	32 x 1	Gray	174.5 x 33 x 13 max	132.5 x 14	3.15 x 7.9	1/11	+5
H2572	40 x 1	Gray	182 x 35.5 x 13 max	154 x 15.3	3.15 x 7.9	1/11	+5
LMO58	40 x 1	Gray	290 x 60 x 13 max	245 x 19	4.82 x 8.18	1/8	+5
LMO52L	16 x 2	Gray	80 x 36 x 11 max	64.5 x 13.8	2.95 x 3.8	1/16	+5
LMO16L	16 x 2	Gray	84 x 44 x 12 max	61 x 15.8	2.96 x 4.86	1/16	+5
LMO16XMBL	16 x 2	New gray	84 x 44 x 12 max	61 x 15.8	2.96 x 4.86	1/16	+5
LMO32L	20 x 2	Gray	116 x 39 x 13 max	83 x 18.6	3.2 x 4.85	1/16	+5
LM,O32XMBL	20 x 2	New gray	116 x 37 x 10.5 max	83 x 18.6	3.2 x 4.85	1/16	+5
LMO60L	24 x 2	Gray	116 x 39 x 13	83 x 18.6	2.7 x 4.85	1/16	+5
LMO17L	32 x 2	Gray	174.5 x 33 x 13.4 max	141 x 19 x 16.75	3.45 x 4.85	1/16	+5
LMO18L	40 x 2	Gray	182 x 35.5 x 13 max	154 x 15.3	3.2 x 4.85	1/16	+5
LMO18XMBL	40 x 2	New gray	182 x 35.5 x 13	154 x 15.3	3.2 x 4.85	1/16	+5
LMO41L	16 x 4	Gray	87 x 60 x 12	61.8 x 25.2	2.95 x 4.15	1/16	+5
LMO44L	20 x 4	Gray	98 x 60 x 12	76 x 25.2	2.95 x 4.15	1/16	+5

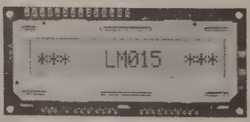
New Gray = (STN)

LED Backlight Versions

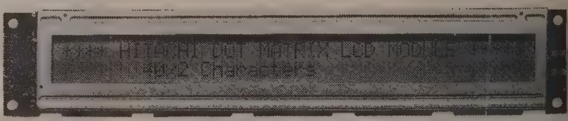
Part #	No. of Char (Char x line)	Display color	External Dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Character Dimensions W x H (mm)	Driving method (Duty)	Recommended power supply Vdd - Vss (V)
LMO87ALN	16 x 1	Gray	90 x 36 x 14 max	64.5 x 13.8	3.07 x 6.56	1/16	+5, (+5)
LMO86ALN	16 x 2	Gray	90 x 36 x 14 max	64.5 x 13.8	2.95 x 3.8	1/16	+5, (+5)
LMO93XMLN	16 x 2	New gray	90 x 44 x 13.8 max	61 x 15.3	2.96 x 4.86	1/16	+5, (+5)
LMO91XMLN	20 x 2	New gray	126 x 39 x 14 max	83 x 18.6	3.2 x 4.85	1/16	+5, (+5)
LMO92XMLN	40 x 2	New gray	192 x 35.5 x 14 max	154 x 15.3	3.2 x 4.85	1/16	+5, (+5)



LMO44L



LMO15



LMO18L, LMO18XMBL

HOMALITE DISPLAY FILTERS AND SPECIFICATIONS

LOW REFLECTANCE CONTRAST ENHANCEMENT FILTERS

Product Description

In designing instruments with LED, LCD, CRT, gas discharge, plasma or vacuum fluorescent displays, an important design consideration is the human engineering factor.

For optimum contrast and readability, Homalite™ display filters are available in colors designed to meet requirements of a wide variety of displays. Glare is reduced with a low reflectance surface cast into the material—it can't chip or peel. By increasing contrast and reducing glare, the display can be read easily and accurately under varied lighting conditions.

Because Homalite materials are thermosetting plastics, the display filters are more rigid and resistant to impact, heat, abrasion and chemical attack than other plastic filters.

All our filters can be cleaned with soap and water, acetone, chlorinated and other commercial solvents or common glass cleaning preparations.

Homalite representatives can provide technical assistance to meet your design requirements. Sample chips in various colors are available upon request.

Grades of Material

All grades shown below are available with LR (low-reflectance) surface.

	Description	Properties	UL Flammability Classification
H-100	Thermosetting polyester. Available in all colors.	General purpose applications. Excellent resistance to chemical attack. Scratch-resistant.	UL94HB
H-101	Thermosetting polyester. Available in all colors.	For high temperature applications. This self-extinguishing, fire retardant grade offers good heat distortion resistance.	UL94V-0 (thicknesses ⅛″ and over) UL94HB (thicknesses up to ⅛″)
H-911	Allyl diglycol carbonate. Available in clear.	Highest optical qualities. Abrasion resistant—30 to 40 times more scratch-resistant than acrylics.	UL94HB

Low Reflectance Surface

Homalite filters reduce specular reflection associated with conventional face plates and filters. Unlike other filters, the low glare surface of Homalite filters is cast into the material. This surface is **not** a lamination or coating, so it cannot separate, chip, peel or rub off.

The Homalite low-reflectance surface, referred to as "LR", minimizes glare and improves readability.

Two low-reflectance surfaces are available.

LR-72—The most light diffusing surface. For mounting as close as possible to the light source, up to ½″ distance.

LR-92—For mounting from ½″ to 2″ from the light source.

INSTRUMENT DISPLAY FILTERS

Sizes and Forms

Homalite can fabricate display filters to meet your requirements. This includes cutting to size, drilling holes, milling slots, steps and beveled edges, etc. Parts can be silkscreened, mirrored or coated for RFI/EMI shielding. See standard CRT filter sizes.

Homalite materials are available in standard thicknesses of 1/16″, 3/32″, and ⅛″. Other thicknesses from 1/32″ to over 2″ are available upon request.

A protective, removable masking is available on one or both sides of fabricated parts. If masking is required, please specify when ordering.

If you choose to fabricate your own display filters, you can order Homalite materials in sheet form in two sizes: 21″ x 31″ and 33″ x 45″. Sheets will be supplied with masking on both sides. Instructions for fabrication are available upon request.

Filter Colors

Homalite filters are available in a wide range of standard colors which are designed for use with commonly available displays. Homalite can also color match and prepare filter material for specific application requirements or to duplicate the color of existing filters. Choosing the proper color will give sharp, clear characters with enhanced contrast between the information displayed and the background.

Light Emitting Displays and CRT'S

An important consideration in choosing the filter shade is the environment where the instrument will be used. For instance, if the display will be viewed in bright sunlight, you would select a darker shade than if the display were used in a room with fluorescent lighting.

Standard colors and spectral curves are as displayed. However, we would be pleased to match a specific color or work with you on a shade that meets your special application requirements.

Liquid Crystal Displays

Although LCD's do not emit light, reduction of glare from ambient light greatly improves readability. Homalite materials with the LR finish in clear or light gray (1295) are recommended for this type of display.

Spectral Transmission Data

Color	Shade	% of Transmission	Wavelength Nanometers
Gray	1245	45	N/A
	1250	22	N/A
	1265	30	N/A
	1295	60	N/A
Green	1425	25	565
	1436	36	500
	1440	40	565
	1452	50	505
Red	1600	44	655
	1670	71	655
Amber	1709	24	575
	1720	34	565
	1726	46	565
	1795	25	565
Blue	1500	55	450
	1558	80	440

CRT FILTERS

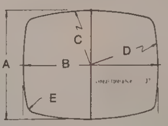
Typical filter configurations for CRT sizes 5″ to 19″ are shown below in contoured and rectangular shapes. For 5″ to 15″ filters, the standard thickness is 1/16″. For 19″ filters, we recommend 3/32″ thickness material. Other thicknesses available upon request.

When ordering filters, the letter C or R after the (Diagonal) Filter Size denotes contoured or rectangular shape. The spherical radius shown for each size applies to both contoured and rectangular shapes.

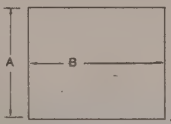
Homalite will fabricate filters to the exact size and shape requirement of specific monitors. For best results, please include measurements (width, length and spherical radius) to ensure proper fit. A mechanical assembly drawing of the monitor showing dimensions and mounting arrangements can be useful in establishing the proper configuration for your filter.

Filters can be supplied with or without adhesive tape for mounting.

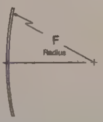
Contoured



Rectangular



Curvature



Standard Dimensions*	Filter Size (Diagonal) 5″	9″	12″	15″	19″
A	3.62	5.87	7.88	9.50	12.87
B	4.62	7.97	10.32	11.83	15.97
C	14.19	22.00	39.00	60.00	15.00
D	13.38	22.00	18.00	49.00	32.60
E	0.44	0.68	0.75	0.81	1.50
F	14	27	25 or 24	25 or 24	47/21**

* All linear tolerances ±.030″
Curvature radius tolerance (F) ±1″

** Compound Radius

HOMALITE™ DIV. WHITCO INC.

11 BROOKSIDE DRIVE
WILMINGTON, DELAWARE 19804, U.S.A.
(302) 652-3686 800-346-7802
FAX (302) 652-4578

Send For Engineering Bulletin 126-128 for Spectral Transmission Curves and Engineering Bulletin 135 for Material Properties Chart

How to Order

When placing an order for Homalite filters, please include the following information:	Example
1. Material grade	H 100
2. Type of LR surface	LR 72
3. Color number (or clear)	1265
4. Masking required (one side or both sides)	2 Sides
5. Size: For fabricated filters, indicate width x length, thickness and tolerances. Please include drawing if available (Preferred)	10″ x 8″ ±.030″ x .062″ ±.015″
For sheet material, indicate either 21″ x 31″ or 33″ x 45″ and thickness	21″ x 31″
For standard CRT applications, include diagonal size and whether filter shape is contoured (C) or rectangular (R)	12″ R

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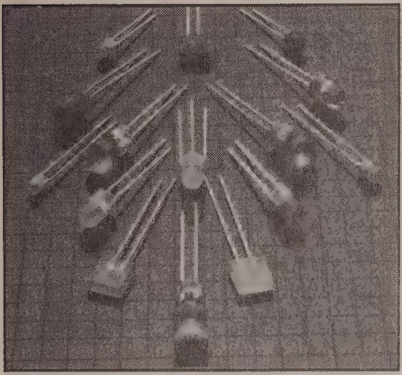
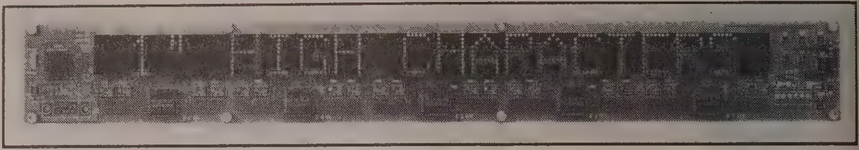
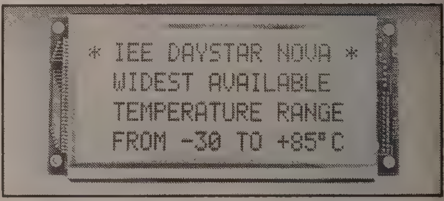
IEE offers a broad range of man-machine interface products including LED and incandescent lamps/indicators, vacuum fluorescent dot matrix and segmented display modules, LED, electroluminescent and point-of-sale displays,


LED and Incandescent Lamps


VISTA™ LED Modules

LEDPRO™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WIDEST AVAILABLE
TEMPERATURE RANGE
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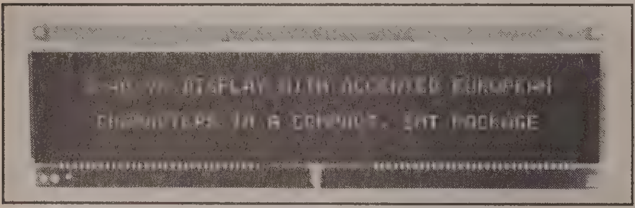
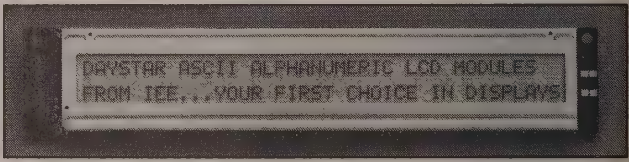
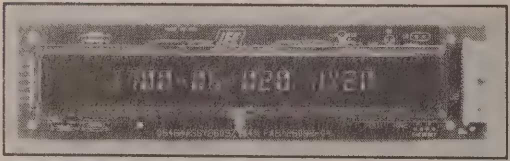
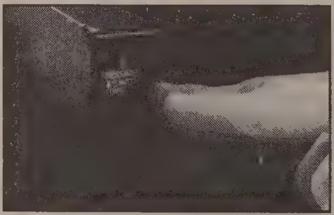
DAYSTAR NOVA™ LCD Modules

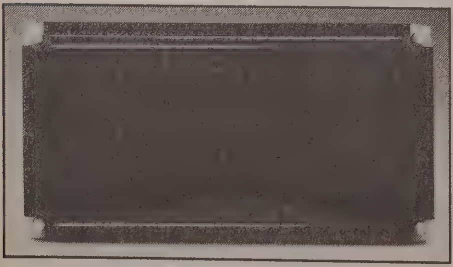

FLIP™ VF Dot Matrix Modules

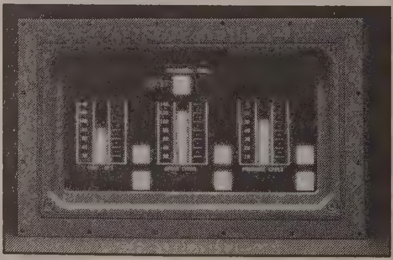

DAYSTAR ASCII ALPHANUMERIC LCD MODULES
FROM IEE...YOUR FIRST CHOICE IN DISPLAYS
DAYSTAR™ ASCII LCD Modules

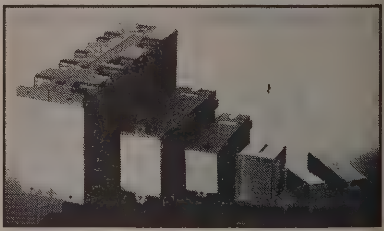

FLIP™ VF Segmented Modules


Illuminated PROSWITCHes™

Industrial Interface Cards


ARGUS™ DC Plasma


EL Displays


TITAN™ Projection Readouts

Each of the products shown on these two pages represent IEE's ability to communicate.

Industrial Electronic Engineers, Inc.

The Ability to Communicate!

and liquid crystal modules/displays. IEE also offers projection readouts, an assortment of flat panel switches, a wide variety of keypads and keyboards and interactive IR displays, as well as customized design capability.

OFF/ON
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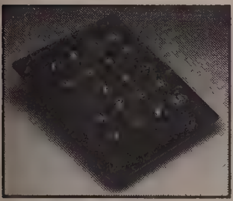
FIX
TEST/ACK
1
2
3
4
5
6
7
8
9
0
CLR
DED
DISP
ALN
TIME/TRIP
NAV/SURV
CH/SGN
ENT/HOLD
GRD
DIM

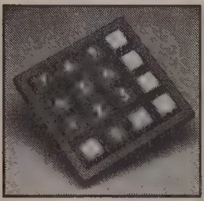
SEALEDSWITCH™

THINPANEL™

FTMKs

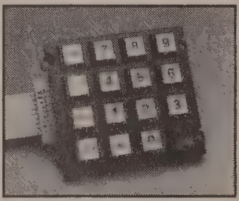


PANELSWITCH™

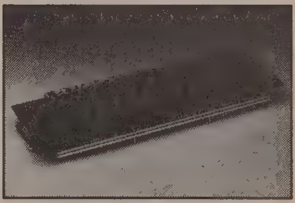


TELSWITCH™

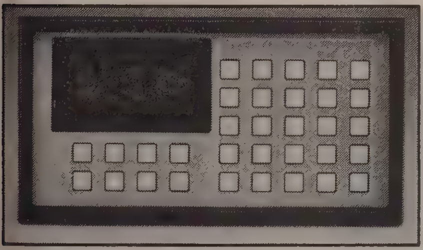
THINSWITCH™



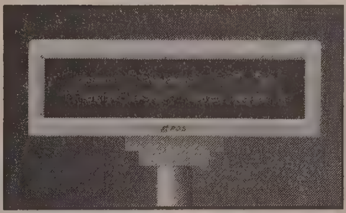
THRIFTSWITCH™



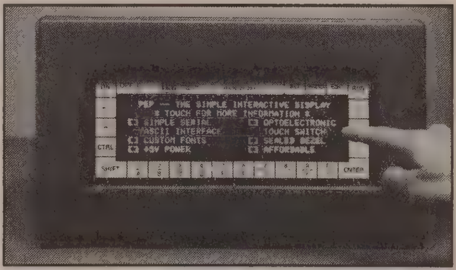
Elastomer



V.I.P.™ Interactive Displays



POS Displays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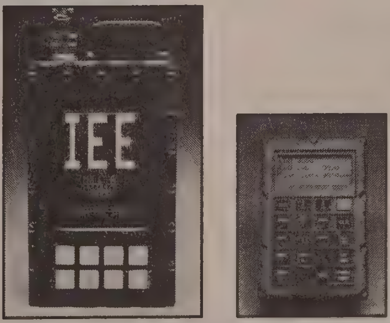
Displays



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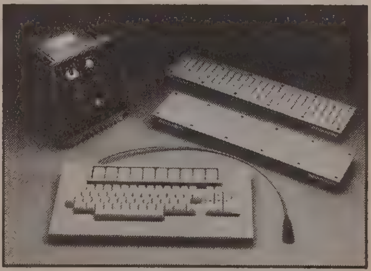

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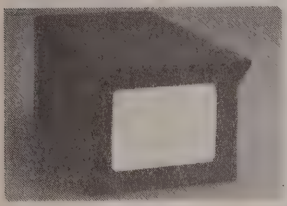
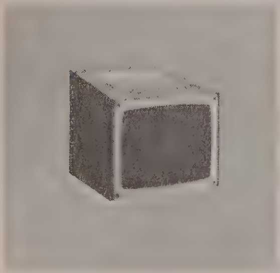


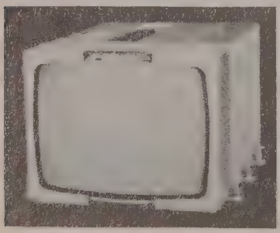
RD05-J5-149
5" diagonal raster CRT; ruggedized compact unit; 15.75KHz horizonal scan; sunlight readable; 28vdc

U.S. Air Force F-16 Training Simulator



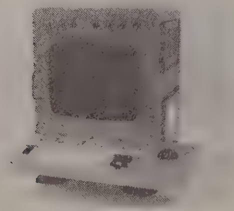
RD07-J5/8-140
7" diagonal raster CRT; 15.75KHz and 26.25KHz horizontal scan rates; internal sensing of incoming line rate and automatic switching of scan to match incoming rate; 20MHz video BW; high resolution; 28vdc

U.S. Navy Active Emission Sonar Display



RD09-M8-238
9" diagonal raster; MIL compliant; 26.25KHz horizontal scan; 25MHz video BW; 115V 30 60Hz

U.S. Navy Shipboard Computer Display



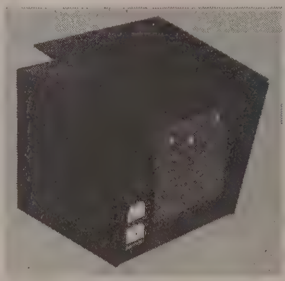
RD17-M10-214
17" diagonal raster CRT; 45MHz video BW; high resolution; MIL compliant; 50KHz horizontal scan; 115V 60Hz

ELECTROLUMINESCENT PANEL

U.S. Navy Electronic Surveillance System

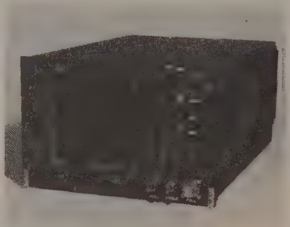
EL66M48
High brightness; 4 level gray scale, MIL-STD-1553B compatible

U.S. Army Vulcan Gun



EL66M44
High brightness; Custom interface; Used in rugged conditions: dust, rain & vibration

U.S. Navy EA6B Communication Jamming System



EL66J44A-064
High brightness; alpha numeric and graphic controller

MODEL	DISPLAY RESOLUTION	PEAK LUMINANCE*	CASE DIM. (METRIC)	ACTIVE PANEL AREA (METRIC)
EL66M44	256x256	110 FT-L	6"x6'x5" (150x150x130mm)	4"x4"(3.838x3.838) (97.5x97.5mm)
EL66M48	256x512	100 FT-L	6"x10"x3" (150x250x75mm)	4"x8"(3.838x7.676) (97.5x195mm)

*Unfiltered

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INFODEX

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intronics

C 300/400 SERIES—

MONOLITHIC WIDEBAND CRT DISTORTION CORRECTION DEVICE

FEATURES

- 16 pin ceramic dip (C300 Series)
- 24 pin ceramic dip (C400 Series)
- Minimum of external components required
- Easily adjusts for yoke errors
- Accuracy better than 0.1% Max.
- Bandwidth compatible with 10MHz systems
- Both geometry and focus available
- MIL 883 available
- Low cost

APPLICATIONS (for Vector Displays Only)

- Military Displays
  - HUDS
  - ATC
  - HDDS
  - PPI
- Simulators
  - Beam Penetration
  - Shadow mask
- Phototypsetting equipment
- Computer Output Microfilm displays
- Computer driven graphic displays
- Medical monitors
- CAD displays
- TV Cameras and projection systems

DESCRIPTION

The Intronics C300/400 Series are monolithic devices that accurately correct for geometric or focus distortion in CRT displays. The C300 (16 pin DIP) series provides wideband, accurate full face geometry or focus correction with few external components. These units connect between the horizontal and vertical inputs and their deflection amplifiers. Simple external adjustments provide for correction magnitude, horizontal/vertical keystone curvature symmetry. The C400 series (24 pin DIP) is a full Mil temp range, -55°C to +125°C device.

The principle of operation is based on circuitry which smoothly synthesizes a correction function that closely approximates the exact mathematical correction function.

SPECIFICATIONS

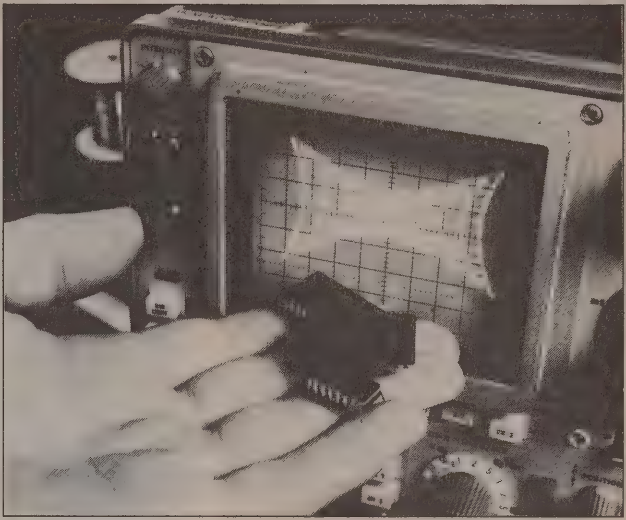
OPERATING TEMPERATURE

C310 SERIES $-25°C \leq T_A \leq +85°C$

C410 SERIES $-55°C \leq T_A \leq +125°C$

Resulting Accuracy of Corrected Function by total deflection angle.

	Uncorrected	C310	C311	C312	C410	C411	
20°	1.5	.30	.15	.08	.15	.08	%Max
30°	3.5	.68	.34	.17	.34	.17	%Max
40°	6.4	1.24	.62	.31	.62	.31	%Max
50°	10.3	2.00	1.00	.50	1.00	.50	%Max
60°	15.5	3.00	1.50	.75	1.50	.75	%Max
70°	22.0	4.28	2.14	1.07	2.14	1.07	%Max
80°	31.0	6.00	3.00	1.50	3.00	1.50	%Max



TRANSFER FUNCTION

GEOMETRY CORRECTION

$V_X = -x(x^2 + y^2)$

$V_Y = -y(x^2 + y^2)$

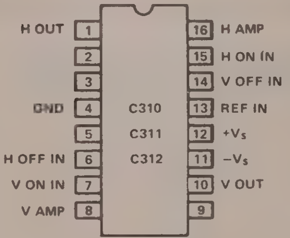
FOCUS CORRECTION

$V_F = -(x^2 + y^2)$

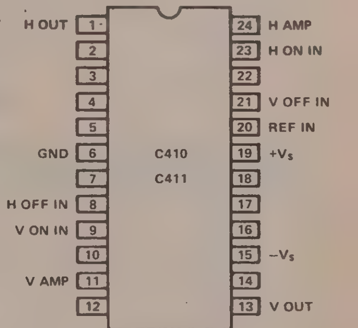
PINOUT

H = HORIZONTAL

V = VERTICAL


H OUT 1
2
3
GND 4
5
H OFF IN 6
V ON IN 7
V AMP 8
9
10 V OUT
11 −Vs
12 +Vs
13 REF IN
14 V OFF IN
15 H ON IN
16 H AMP
C310
C311
C312

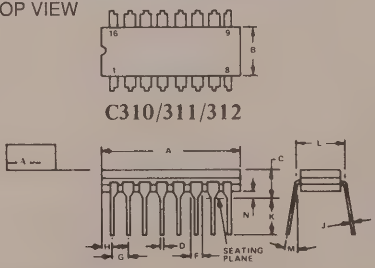
16 PIN CERAMIC


H OUT 1
2
3
4
5
GND 6
7
H OFF IN 8
V ON IN 9
10
V AMP 11
12
13 V OUT
14
15 −Vs
16
17
18
19 +Vs
20 REF IN
21 V OFF IN
22
23 H ON IN
24 H AMP
C410
C411

24 PIN CERAMIC

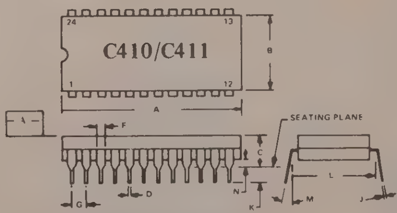
MECHANICAL DIMENSIONS

TOP VIEW


16
9
1
8
B
C310/311/312
A
L
C
N
K
J
H
G
D
F
M
SEATING PLANE

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	19.05	19.81	0.750	0.780
B	6.22	6.98	0.245	0.275
C	4.05	5.08	0.160	0.200
D	0.38	0.51	0.015	0.020
F	1.40	1.65	0.055	0.055
G	2.54 BSC		0.100 BSC	
H	0.51	1.14	0.020	0.045
J	0.20	0.30	0.003	0.012
K	3.18	4.06	0.125	0.160
L	7.37	7.87	0.029	0.310
M	—	15°	—	15°
N	0.51	1.02	0.020	0.040

TOP VIEW


24
13
C410/C411
1
12
B
A
F
SEATING PLANE
C
L
N
K
G
D
M
J

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	31.24	32.26	1.230	1.270
B	12.70	13.72	0.500	0.540
C	4.06	5.03	0.150	0.200
D	0.41	0.51	0.016	0.020
F	1.27	1.52	0.050	0.060
G	2.54 BSC		0.100 BSC	
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	15.31 BSC		0.605 BSC	
M	5°	15°	5°	15°
N	0.51	0.76	0.020	0.030

150 Dan Road, Canton, Massachusetts 02021 TEL: 617-828-4992, FAX: 617-828-5050

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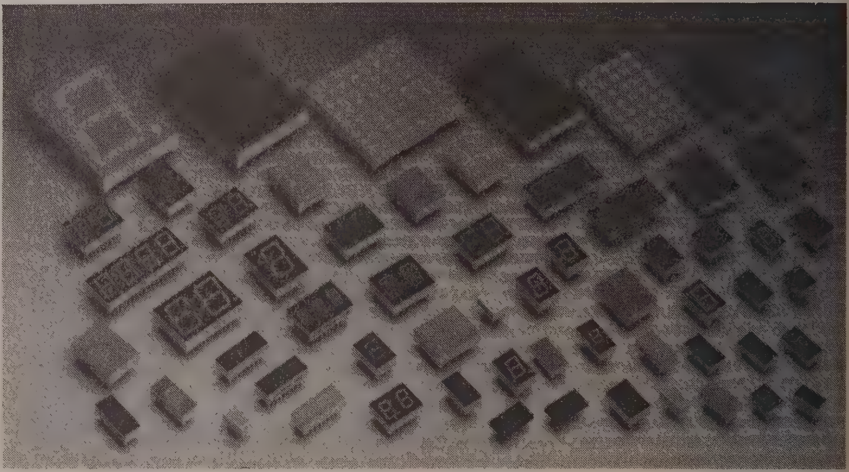
LED Products

For More Information
Call 1-800-5620 or 1-805-257-6964
Or FAX 1-805-257-6490

Ledtech offers a complete assortment of Numeric and Alphanumeric LED Displays compatible with most major manufacturers. All units are available in High-Efficiency Red, Standard Red (GaAsP or GaP), Green, Yellow and Orange. The light output of each unit is measured and bin categorized for consistent and even brightness so that each lot will not contain units with visible differences between individual displays. All units shown are completely epoxy encapsulated and offer clear bold segments for maximum light output. Call for information on pinouts or ask for a data sheet giving complete specifications on units of your choice.



Please note that individual data sheets are available upon request for each product giving specific details on brightness, operating voltages and currents, maximum ratings, package sizes, tolerances, and pinouts. For some displays, companion overflow digits are available for popular sizes. Multiple packages that appear on the same line indicates there are variations in pinouts or drive circuitry. This is especially true in the case of multi-digit models where it is common to use multiplex, duplex or direct drive schemes. Call us for specifics.

LED Display Part Number Selection Guide

Digit Ht.	Pkg. No.	Basic Part Number
0.30"	1	LX-30-X1-16
0.30"	2	LX-30-X1-12
0.30"	3	LX-30-X1-10
0.36"	6	LX-36-X1-11
0.40"	8	LX-40-X1-11
0.43"	10	LX-43-X1-11
0.50"	12	LX-50-X1-11
0.56"	16	LX-56-X1-11
0.63"	19	LX-63-X1-21
0.80"	21	LX-80-X1-11
0.80"	22	LX-80-X1-21
1.02"	26	LX-26-X1-21
2.30"	29	LX-23-X1-41
4.00"	30	LX-41-X1-82
0.30"	31	LX-30-X2-00
0.40"	32	LX-40-X2-11
0.40"	33	LD-40-X2-11
0.50"	34	LX-50-X2-11
0.50"	35	LD-50-X2-11
0.56"	38	LX-56-X2-11
0.56"	39	LX-56-X2-12
0.80"	40	LX-80-X2-11
0.56"	41	LX-56-X3-11
0.56"	42	LM-56-X3-11
0.56"	45	LX-56-X4-11
0.56"	46	LM-56-X4-11
0.39"	47	LX-39-X1-11B
0.80"	48	LX-80-X1-11B
2.30"	49	LX-23-X1-42B
0.54"	50	LX-54-X1-11
0.30"	52	LJ-35-X1-X1
0.68"	53	LJ-70-X1-X1
1.16"	55	LJ-57-X1-X1
1.20"	56	LJ-12-X1-X1
2.00"	57	LJ-20-X1-X1
2.30"	59	LJ-23-X1-X1
2.40"	60	LJ-24-X1-X1
4.00"	62	LJ-40-X1-X1
0.50"	63	LB-50-X1-11
0.75"	64	LX-75-X1-11
1.00"	65	LL-10000-X

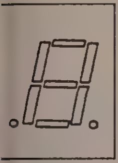
LEDTECH Electronics Corporation • 24907 Avenue Tibbetts Unit-C • Valencia, California 91355

For More Information
Call 1-800-5620 or 1-805-257-6964
Or FAX 1-805-257-6490

PACKAGE STYLES

NOT TO SCALE
SEE PRECEDING PAGE
FOR CHARACTERISTICS

Pkg 01



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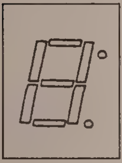

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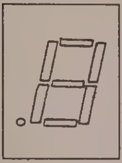

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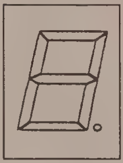

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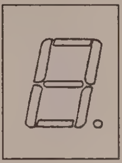

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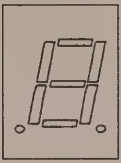

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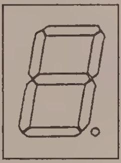

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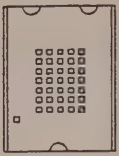

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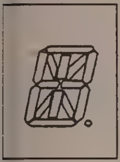

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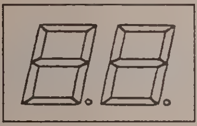

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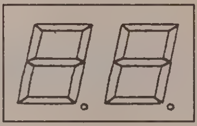

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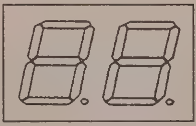

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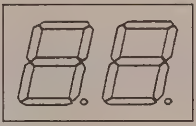

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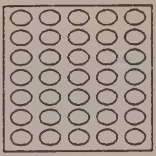

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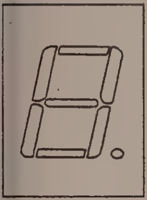

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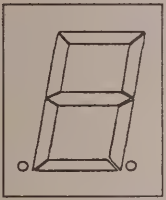

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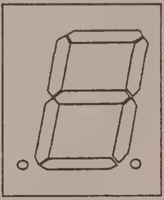

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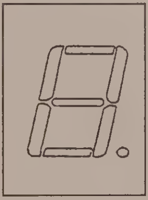

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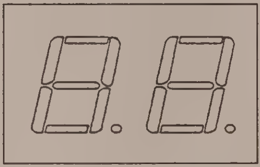

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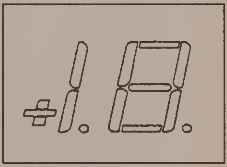

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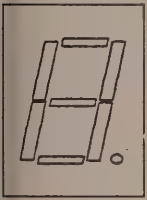

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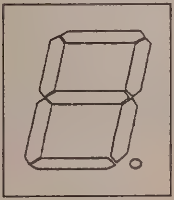

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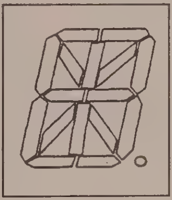

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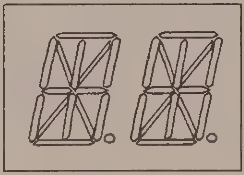

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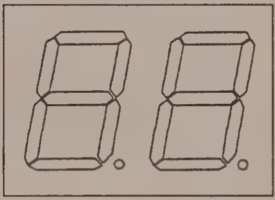

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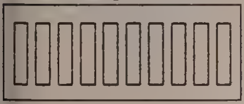
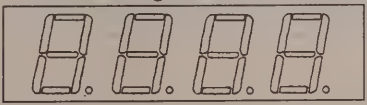


Pkg 45, 46



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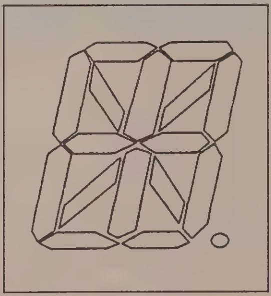

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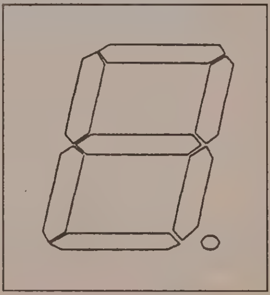
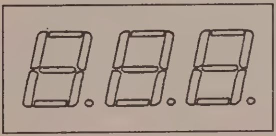


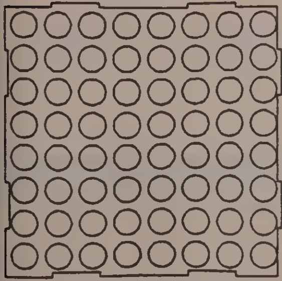
Pkg 63

Pkg 41, 42

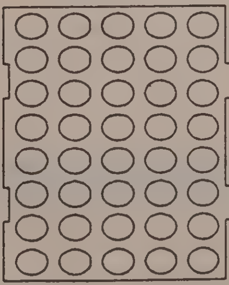


Pkg 64

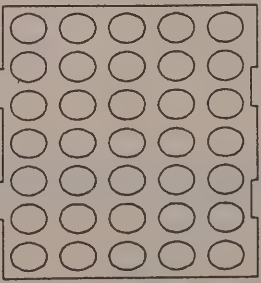
Pkg 59



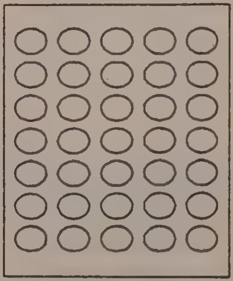
Pkg 60, 61



Pkg 57, 62



Pkg 55



Ledtech

LED Products

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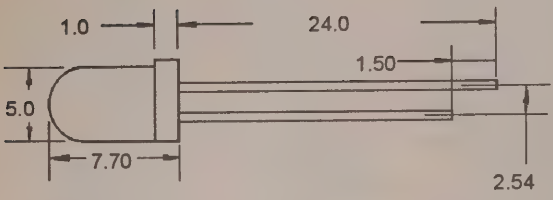
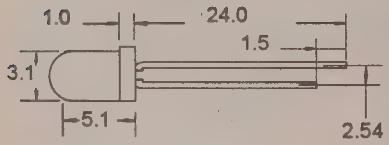
POPULAR STOCK LED LAMPS



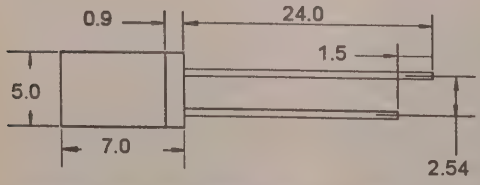
T-1 3/4 (5.0mm) DIAMETER

Part Number	Color (diffused)	Intensity (mcd)	Fwd. Voltage (dc)	Wavelength (nm)
LT1873-81	SUPER BRIGHT	476	1.7 - 2.2	660
LT1811G-81	GaP RED	1.8	2.1 - 3.0	700
LT1821-81	YELLOW GREEN	8.9	2.1 - 3.0	567
LT1831-81	YELLOW	7.3	2.1 - 3.0	585
LT1841-81	ORANGE	10.3	2.1 - 3.0	635
LT1841R-81	HI-EFF RED	10.3	2.1 - 3.0	635
LT18B1-81	BLUE	2.6	3.1 - 4.0	470



T-1 (3.0mm) DIAMETER

Part Number	Color (diffused)	Intensity (mcd)	Fwd. Voltage (dc)	Wavelength (nm)
LT0311G-41	GaP-RED	1.2	2.1-3.0	700
LT0321-41	YEL-GREEN	5.9	2.1-3.0	567
LT0331-41	YELLOW	4.9	2.1-3.0	585
LT0341-41	ORANGE	6.9	2.1-3.0	635
LT0341R-41	HI-EFF RED	6.9	2.1-3.0	635



2.0 X 5.0mm RECTANGULAR

Part Number	Color (diffused)	Intensity (mcd)	Fwd. Voltage (dc)	Wavelength (nm)
LT5311GE-41	GaP RED	1.4	2.1 - 3.0	700
LT5321E-41	YELLOW-GREEN	3.5	2.1 - 3.0	567
LT5341RE-41	HI-EFF RED	4.1	2.1 - 3.0	635

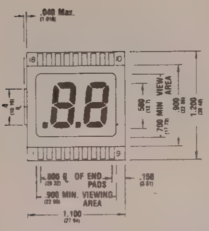
MAXIMUM CURRENT CAPACITY— CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum						
	Single-wire	Wire-bundled	Single-wire	Wire-bundled		60°C	80°C		
30	. . .	. . .	. . .	. . .	. . .	0.2	0.4	. . .	0.20
28	. . .	. . .	. . .	. . .	. . .	0.4	0.6	. . .	0.32
26	. . .	. . .	. . .	. . .	. . .	0.6	1.0	. . .	0.51
24	. . .	. . .	. . .	. . .	. . .	1.0	1.6	. . .	0.81
22	9	5	. . .	. . .	. . .	1.6	2.5	. . .	1.28
20	11	7.5	. . .	. . .	. . .	2.5	4.0	3	2.04
18	16	10	. . .	. . .	6	4.0	6.0	5	3.24
16	22	13	. . .	. . .	10	6.0	10.0	7	5.16
14	32	17	. . .	. . .	20	10.0	16.0	15	8.22
12	41	23	. . .	. . .	30	16.0	26.0	20	13.05
10	55	33	. . .	. . .	35	. . .	. . .	25	20.8
8	73	46	58	36	50	. . .	. . .	35	33.0
6	101	60	86	51	70	. . .	. . .	50	52.6
4	135	80	108	64	90	. . .	. . .	70	83.4
2	181	100	149	82	125	. . .	. . .	90	132.8
1	211	125	177	105	150	. . .	. . .	100	167.5
0	245	150	204	125	200	. . .	. . .	125	212.0
00	283	175	237	146	225	. . .	. . .	150	266.0
000	328	200	. . .	. . .	275	. . .	. . .	175	336.0
0000	380	225	. . .	. . .	325	. . .	. . .	225	424.0

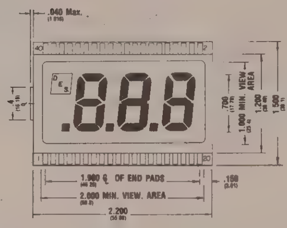
Liquid Crystal Displays

direct drive displays

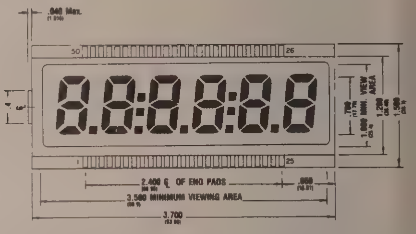
Part #29


.040 Max.
8.8
.500
.700 MIN VIEW AREA
.900
1.200
.800 ℄ OF END PADS
.150
.900 MIN. VIEWING AREA
1.100

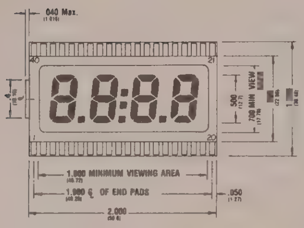
Part #58


.040 Max.
.8.8.8
.700
1.000 MIN. VIEW AREA
1.200
1.500
1.900 ℄ OF END PADS
.150
2.000 MIN. VIEW. AREA
2.200

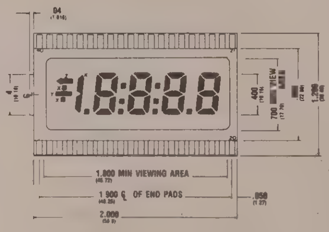
Part #70


.040 Max.
8.8:8.8:8.8
2.400 ℄ OF END PADS
.050
3.500 MINIMUM VIEWING AREA
3.700

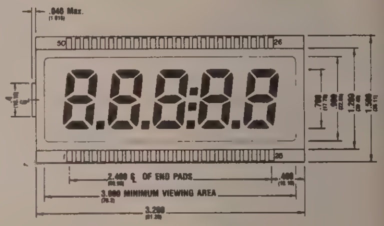
Part #44


.040 Max.
8.8:8.8
.500
.700 MIN VIEW
1.800 MINIMUM VIEWING AREA
1.900 ℄ OF END PADS
.050
2.000

Part #45

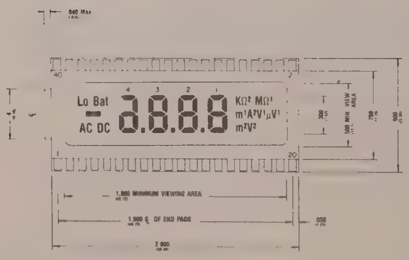

.04
±1.8:8:8.8
.400
.700
1.200
1.800 MIN VIEWING AREA
1.900 ℄ OF END PADS
.050
2.000

Part #57

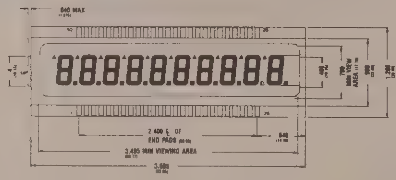

.040 Max.
8.8.8:8.8
.700
.900
1.200
1.500
2.400 ℄ OF END PADS
.400
3.000 MINIMUM VIEWING AREA
3.200

multiplexed displays

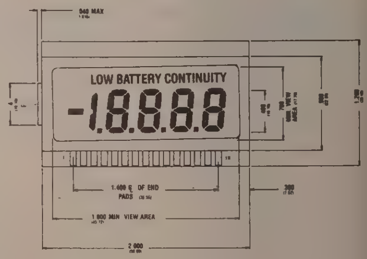
Part #38


.040 Max
Lo Bat
AC DC
8.8.8.8
KΩ² MΩ¹
m¹A²V¹μV¹
m²V²
.500 MIN VIEW AREA
.700
.900
1.800 MINIMUM VIEWING AREA
1.900 ℄ OF END PADS
.050
2.000

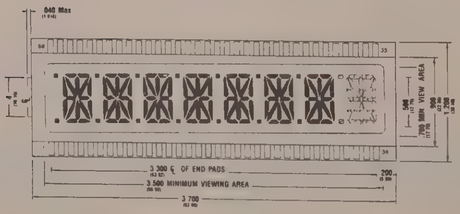
Part #66


.040 MAX
8.8.8.8.8.8.8.8.8.8.8.8.
2.400 ℄ OF END PADS
3.495 MIN VIEWING AREA
3.695

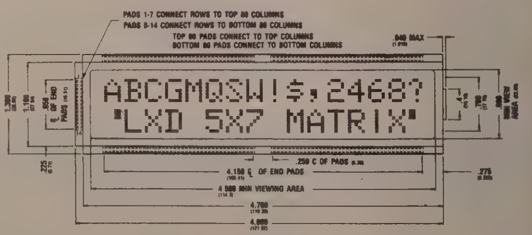
Part #353


.040 MAX
LOW BATTERY CONTINUITY
-1.8.8.8.8
1.400 ℄ OF END PADS
1.800 MIN VIEW AREA
2.000

Part #76


.040 Max
3.300 ℄ OF END PADS
.200
3.500 MINIMUM VIEWING AREA
3.700

Part #96


PADS 1-7 CONNECT ROWS TO TOP 80 COLUMNS
PADS 8-14 CONNECT ROWS TO BOTTOM 80 COLUMNS
TOP 80 PADS CONNECT TO TOP COLUMNS
BOTTOM 80 PADS CONNECT TO BOTTOM COLUMNS
.040 MAX
ABCGMQSW!$,2468?
"LXD 5X7 MATRIX"
.225
.250 C OF PADS
4.150 ℄ OF END PADS
.275
4.500 MIN VIEWING AREA
4.700
4.800

LXD, INC., 7650 First Place, Cleveland, Ohio 44146 • 216-786-8700 • FAX 216-786-8711 • Sales 216-786-8710

LXD

Liquid Crystal Displays

capability	**benefit**
Wide Temperature Operation:	-40 to 104°C
First Minima Technology:	Widest viewing, fast response
Low Power:	CMOS drive, long battery life
Custom Design:	Uniquely identifies your product
Large Area Displays:	Sign and video applications

custom design services

LXD will design and manufacture custom displays to meet your special requirements. Possibilities include large area displays up to 13.5 inches square, special characters, legends and symbols which convey the exact information that you intend for your application.

Our application staff is available for consultation on design criteria and will help guide your selections to achieve the best mix of performance and economy. LXD will prepare and submit engineering documents from our CAD design system for your approval which then become a part of the permanent record and act as a control documents on the design.

Prototype displays are produced using production tooling, equipment, methods and procedures. You can be assured that parts that you evaluate and qualify are "production quality" in every respect.

100% domestic manufacture

Every display that we sell is manufactured in our new 37,000 square foot factory near Cleveland, Ohio. A modern clean room facility and automated in-line process provide consistent quality and reliability in the finished product.

Critical and proprietary chemical formulations are maintained and produced in our on-site chemistry laboratory. These compounds make it possible for LXD displays to withstand test conditions of 121°C and 15 PSI, superheated steam, for over 100 hours without failure, (testing performed without polarizers).

Domestic manufacture also means that you face a shorter pipeline for material. Access and responsiveness are improved with phones being serviced until 6:00 PM (Eastern) for your convenience.

quality philosophy

"Quality" is more than a buzz-word, it is a state of mind that can be found throughout the LXD organization. We have implemented defined quality measures at every stage in our production process. Statistical Process Control, SPC, methods monitor activity in the factory and warn of variations in process or procedure.

Materials are qualified and with each new receipt inspected to assure continued conformance to specification. Vendor control and feedback are an integral part of LXD's quality program. Lot control throughout the factory allows traceability back to the raw materials.

100% of the product going through the factory receives inspection for electrical and mechanical characteristics. Aesthetic criteria are evaluated at several stages prior to shipment and special handling procedures and protective packaging are used to prevent damage.

standard product selector guide and index

	NUMBER OF DIGITS/ CHARACTERS	LXD BASE P/N	DESCRIPTORS (DESCRIPTION)	DRIVE	PACKAGE SIZE (INCHES)			DIGITS/ CHARACTERS HEIGHT (INCHES)
						GLASS HEIGHT		
					WIDTH	LARGER	SMALLER	
7-SEGMENT	2	29	None	Dir.	1.10	1.2	0.9	0.500
	2	28	None	Dir.	1.50	1.5	1.2	0.700
	3	48	None	Dir.	2.00	1.2	0.9	0.500
	3	58	LOBAT	Dir.	2.20	1.5	1.2	0.700
	3.5	33	<--, +, –	Dir.	2.00	0.9	0.7	0.350
	3.5	41	LOBAT, +, –	Dir.	2.00	1.2	0.9	0.500
	3.5	43	<--, +, –	Dir.	2.00	1.2	0.9	0.500
	3.5	51	LOBAT, +, –	Dir.	2.75	1.5	1.2	0.700
	3.5	53	<--, +, –	Dir.	2.75	1.5	1.2	0.700
	3.5	83	<--, +, –	Dir.	3.70	1.8	1.5	1.000
	4	34	None	Dir.	2.00	0.9	0.7	0.350
	4	44	None	Dir.	2.00	1.2	0.9	0.500
	4	54	None	Dir.	2.75	1.5	1.2	0.700
	4	84	None	Dir.	3.70	1.8	1.5	1.000
	4.5	35	<--, +, –	Dir.	2.00	0.9	0.7	0.300
	4.5	45	<--, +, –	Dir.	2.00	1.2	0.9	0.400
	4.5	49	LOBAT, +, –	Dir.	2.00	1.2	0.9	0.400
	4.5	55	<--, +, –	Dir.	2.75	1.5	1.2	0.600
	4.5	85	<--, +, –	Dir.	3.70	1.8	1.5	0.800
	5	47	None	Dir.	2.00	1.2	0.9	0.400
	5	57	None	Dir.	3.20	1.5	1.2	0.700
	5	87	None	Dir.	4.50	1.8	1.5	1.000
	6	36	None	Dir.	2.50	0.9	0.7	0.350
	6	60	None	Dir.	2.75	1.2	0.9	0.500
	6	70	None	Dir.	3.70	1.5	1.2	0.700
	8	65	None	Dir.	3.70	1.2	0.9	0.500
7-SEGMENT MULTIPLEX	4.0	38	KΩ, MΩ, mA, V, µA, mV, LOBAT, AC, DC, –	1/2	2.00	0.9	0.7	0.300
	4.5	353	Low Battery, Continuity, –	1/3	2.00	0.9	0.7	0.400
	8.0	69	None	1/4	3.70	1.2	0.9	0.500
	10.0	66	Δ	1/3	3.70	1.2	0.9	0.400
16-18 SEGMENT	4	78	None (16 Segment)	Dir	3.70	1.5	1.2	0.700
	4	77	None (18 Segment)	1/3	3.70	1.5	1.2	0.700
	8	76	None (18 Segment)	1/3	3.70	1.2	0.9	0.500
	8	350	None (18 Segment)	1/3	2.756	0.866	0.669	0.275
BAR GRAPH	40	91	(2 Rows of 20 Bars)	–	3.70	1.8	1.5	0.300
5x7 DOT MATRIX	1x8	93	(5x7 Dot Matrix)	1/7	2.60	0.9	0.7	0.300
	1x16	94	(5x7 Dot Matrix)	1/7	4.80	0.9	0.7	0.300
	2x16	96	(2-Line, 5x7 DM)	1/7	4.80	1.3	1.1	0.300
	1x20	99	(5x7 Dot Matrix)	1/7	5.90	0.9	0.7	0.300

LXD, INC., 7650 First Place, Cleveland, Ohio 44146 • 216-786-8700 • FAX 216-786-8711 • Sales 216-786-8710

NEC

NEC Electronics Inc.
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Telephone: 1-800-366-9782 FAX #: 1-800-729-9288

OPTOELECTRONIC PRODUCTS—FLUORESCENT INDICATOR PANEL DISPLAYS

Vacuum Fluorescent Indicator Panels are more effective and reliable than other display systems. An exceptionally wide variety of sizes, styles and configurations are available from NEC. The table below provides a brief glimpse at a few selected standard types. Hundreds of others are available.

The principal advantages of FIPs is their inherent brilliance and sharpness. They can be driven directly from MOS ICs and operate at voltages as low as 10V.

The normal color of an FIP is blue-green. This is filterable to red, orange or yellow with very little visual loss. The basic blue-green color is far less fatiguing to the human eye than colors in the red-orange end of the spectrum.

For complete details on NEC FIPs, ask for the FIP Selector Guide.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions				
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)	L.P. (mm)	L.L. (mm)
FIP16X1CA	16	5×7	5.05	3.3	$34.0^{+0.8}_{-0.3}$	$100.0^{+0.8}_{-0.3}$	8.5 MAX.	2.54	14.0
FIP16XM1DA/FIP16D11X	16	5×7, DP, COMMA, CURSOR (▽)	11.3	7.25	43.2 MAX.	$208.0^{+0.8}_{-0.3}$	9.9 MAX.	2.54	14.0
FIP16X2BA	32 16×2 line	5×7	5.38	3.03	$39.0^{+0.7}_{-0.5}$	$98.0^{+0.8}_{-0.5}$	$7.8^{+0.7}_{-0.5}$	2.0	10.0
FIP16XM2AA/FIP32A11X	32 16×2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	208.0±1.0	13.0 MAX.	2.54	14.0
FIP20X1DB	20	5×7	9.0	6.3	41.0±0.5	$208.0^{+1.0}_{-0.5}$	8.0±0.7	2.54	14.0
FIP20X1KA	20	5×12	15.85	6.4	42.4±1.0	208.0±1.0	9.5±0.7	2.54	14.0
FIP20X1LB	20	5×7	5.0	3.5	$20.5^{+0.7}_{-0.5}$	$115.7^{+0.8}_{-0.5}$	6.1±0.7	2.54	6.2
FIP20X2CA	40 20×2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	252.0±1.0	12.0 MAX.	2.54	16.0
FIP20X2AA/FIP40C5X	40 20×2 line	5×7, 2 line	5.05	3.55	$41.0^{+0.8}_{-0.3}$	$125.0^{+0.8}_{-0.3}$	7.8±0.7	2.54	14.0
FIP20X4AA	80 20×4 line	5×7, 4 line	11.3	7.25	90.0±1.0	240.0±1.0	13.3±0.7	2.54	10.0
FIP40X1AA/FIP40A5X	40	5×7, CURSOR	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	10.0 MAX.	2.54	7.0
FIP40X1DA/FIP40E5X	40	5×7	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	10.0 MAX.	2.54	8.76

See NECEL's other products in Sections 1500, 3700 and 4500.

These specifications are subject to change without notice.

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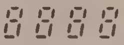
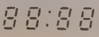
OPTOELECTRONIC PRODUCTS—FLUORESCENT INDICATOR PANEL DISPLAYS (cont.)

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions				
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)	L.P. (mm)	L.L. (mm)
FIP40X2CC	80 40×2 line	5×7, CURSOR	5.05	3.55	$49.0^{+0.8}_{-0.3}$	220.0±0.7	12.2 MAX.	2.54	14.0
FIP128GX20AA/ FIP36A10XT	—	128×20, GRAPHIC	29.7	191.7	60.0±1.0	238.0±1.0	13.0 MAX.	2.54	14.0
FIP48GX7AA/FIP48A8XT	—	48×7, GRAPHIC	7.9	57.1	34.0±1.0	93.0±1.0	9.5 MAX.	2.54	7.4
FIP16A5R FIP16A5CR	16		5.0	3.0	20.0±1.0	110.0±1.5	8.0 MAX.	2.54	10.0
FIP16B13R	16		12.5	7.0	33.0±1.0	205.0±1.0	10.0 MAX.	5.08	10.0
FIP20B6R	20		6.0	3.0	22.8±1.0	134.0±1.0	9.2 MAX.	2.54	14.0
FIP20B9AR	20		9.0	5.0	33.0±1.0	205.0±1.0	9.6 MAX.	2.54	14.0
FIP4H5	4		5.0	2.5	14.5±1.0	41.0±1.0	6.5±0.7	2.54	8.0
FIP4Q8S FIP4Q8AS	4		8.0	4.4	20.0±1.0	48.0±1.0	6.5±0.7	2.54	8.2 5.0
FIP4F8S	4		7.6	3.6	24.5±1.0	55.4±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP4C9B	4		8.5	5.0	28.5±1.0	78.2±1.0	7.5±0.7	2.54	20.0
FIP5B15	5		15.0	8.0	33.0±1.0	98.0±1.0	7.8±0.7	2.54	5.2
FIP6C13	6		12.5	6.8	33.0±1.0	98.0±1.0	7.8±0.7	4.0	10.5
FIP7B13	7		13.0	6.0	33.0±1.0	98.0±1.0	8.0±0.7	2.54	7.4

See NECEL's other products in Sections 1500, 3700 and 4500.

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OPTOELECTRONIC PRODUCTS—FLUORESCENT INDICATOR PANEL DISPLAYS (cont.)

World's first Chip-In-Glass FIP Modules give you beauty that lasts.

NEC has removed something that used to stand between you and truly reliable fluorescent displays. We took the anode and grid driver ICs out of their packages. Then mounted the bare chips directly on the display substrate. Result: a trimmed-down, cost-efficient display that solves a host of reliability problems.

Now, for the first time, the display drivers are on-board—in a vacuum-sealed glass envelope that provides the ideal protective environment. On-board ICs permit a drastic reduction in the number of lead terminals. By reducing leads, we further increase dependability. Create a more compact design. And lower costs to you.

MINI-MODULES: UP TO 50% SMALLER AND 33% LIGHTER.

We use surface-mount technology to trim our modules even more. Board height is up to 50% less than conventional modules and weight is reduced by up to 33%.

Chip-In-Glass FIPs come in four models: 20 characters × 1 line; 20 × 2; 40 × 1; or 40 × 2. All models offer a 5 × 7 dot character format. The display is brilliant and easy to read from virtually any angle.

FIPs run on a 5V power source. Interface readily with your system bus. Execute numerous commands. Fonts include: ASCII-7, ECMA-7 (General European, German, Scandinavian, Spanish) and JIS.

If you want beauty that lasts through the years, get the bare facts on NEC's Chip-In-Glass FIP modules.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FC20X1RA-AB	20	5 × 7 DOT MATRIX, CURSOR	5.05	3.55	29	194	24
FC20X1SA-AB	20	5 × 7 DOT MATRIX	9	6.3	30	259	24
FC20X2JA-AB	40	5 × 7 DOT MATRIX	5.05	3.55	34	194	24
FC40X1LA-AB	40	5 × 7 DOT MATRIX, CURSOR	5.05	3.55	29	280	24
FC40X2EA-AB	80	5 × 7 DOT MATRIX, CURSOR	5.35	3.55	40	270	28
FC16X2CA-AB	32	5 × 7 DOT MATRIX, CURSOR	5	3.3	34	142	22

Large Modules and Graphics

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FM40X6AA-FB	240	5 × 7 DOT MATRIX, CURSOR	5.0	3.5	110	264	45
FM20X4AA-AA	80	5 × 7 DOT MATRIX	11.3	7.25	110	294	49
FM256GX64AC-AA	GRAPHIC	256 × 64 DOT MATRIX	—	—	93	230	45

See NECEL's other products in Sections 1500, 3700 and 4500.

These specifications are subject to change without notice.

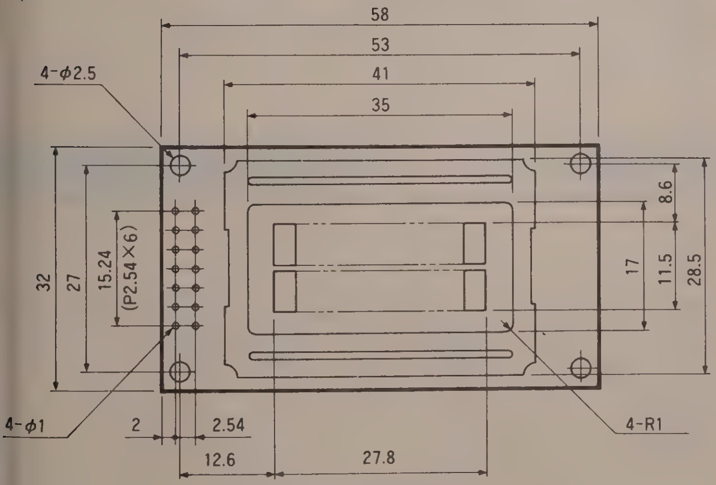
NISSEI ELECTRONICS

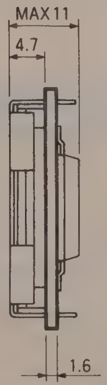
LCD MODULE

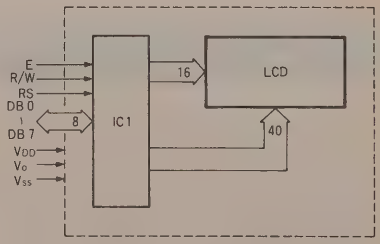
CHARACTER DOT MATRIX

Number of display characters	Dot configuration	Character size (mm)	Dot size (mm)	Outline dimension (mm)	Effect display area (mm)	Driving method
NDM082 8 characters 2 lines	5 x8 Dot	2.95 x 5.55	0.55 x 0.65	58 x 32 x 11	35 x 17	5V 1/16D, 1/4B
NDM161 16 characters 1 line	5 x 8 Dot	3.07 x 6.56	0.55 x 0.75	80 x 36 x 11	64.5 x 13.5	5V 1/16D, 1/4B
NDM162 16 characters 2 lines	5 x 8 Dot	2.95 x 4.35	0.55 x 0.5	80 x 36 x 11	64.5 x 13.5	5V 1/16D, 1/4B
NDM202 20 characters 2 lines	5 x 8 Dot	3.2 x 5.5	0.6 x 0.65	116 x 38 x 11	83 x 18.6	5V 1/16D, 1/4B
NDM204 20 characters 4 lines	5 x 8 Dot	2.95 x 4.75	0.55 x 0.55	98 x 60 x 11	76 x 25.2	5V 1/16D, 1/4B
NDM242 24 characters 2 lines	5 x 8 Dot	3.2 x 5.5	0.6 x 0.65	118 x 36 x 11	93.5 x 15.8	5V 1/16D, 1/4B
NDM402 40 characters 2 lines	5 x 8 Dot	3.2 x 5.5	0.6 x 0.65	182 x 33.5 x 11	154 x 15.3	5V 1/16D, 1/4B

8 CHARACTERS 2 LINES - NDMO82 ☐☐☐



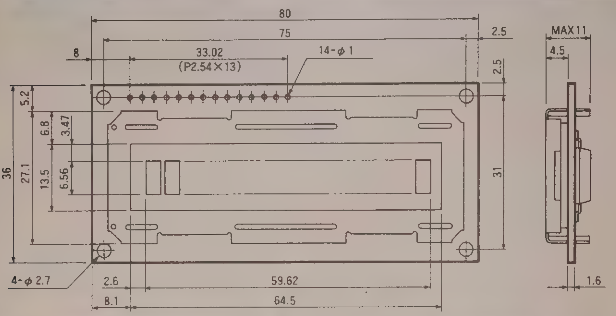


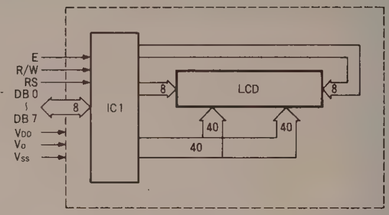


NISSEI ELECTRONICS

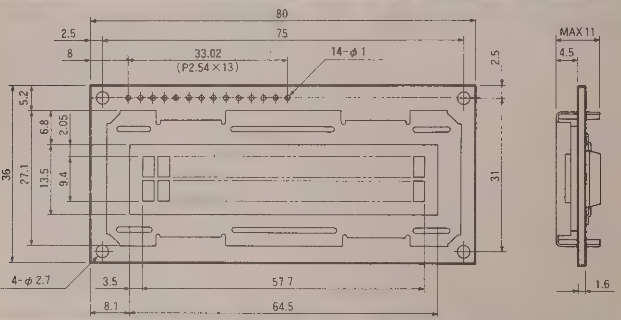
LCD MODULE

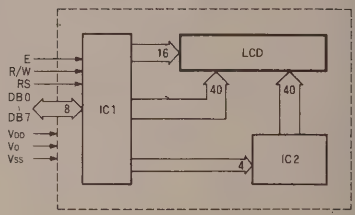
16 CHARACTERS 1 LINE - NDM161 ☐☐☐


80
75
2.5
8
33.02
(P2.54×13)
14-φ1
2.5
MAX 11
4.5
5.2
6.8
3.47
36
27.1
13.5
6.56
31
4-φ2.7
2.6
59.62
8.1
64.5
1.6

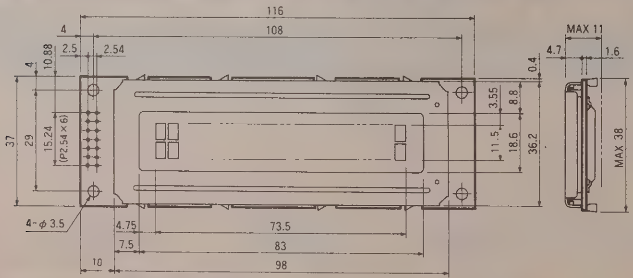

E
R/W
RS
DB 0
DB 7
VDD
Vo
Vss
8
IC1
8
LCD
8
40
40
40

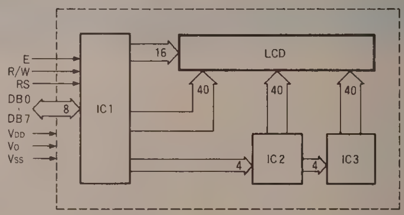
16 CHARACTERS 2 LINES - NDM162 ☐☐☐


80
2.5
75
8
33.02
(P2.54×13)
14-φ1
2.5
MAX 11
4.5
5.2
6.8
2.05
36
27.1
13.5
9.4
31
4-φ2.7
3.5
57.7
8.1
64.5
1.6

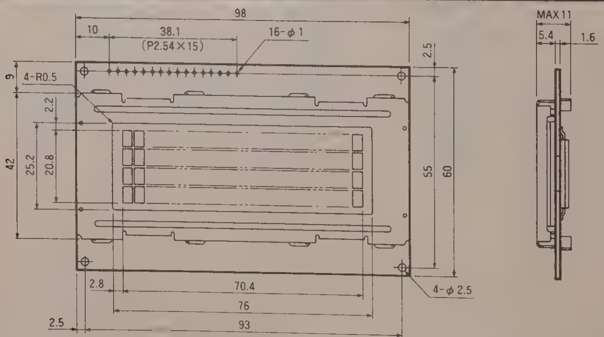

E
R/W
RS
DB0
DB7
VDD
Vo
Vss
8
IC1
16
LCD
40
40
4
IC2

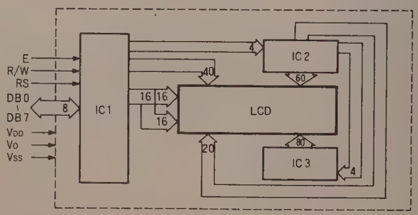
20 CHARACTERS 2 LINES - NDM202 ☐☐☐


116
4
108
10.88
2.5
2.54
4
0.4
MAX 11
4.7
1.6
3.55
8.8
37
29
15.24
(P2.54×6)
11.5
18.6
36.2
MAX 38
4-φ3.5
4.75
73.5
7.5
83
10
98


E
R/W
RS
DB0
DB7
VDD
Vo
Vss
8
IC1
16
LCD
40
40
40
4
IC2
4
IC3

20 CHARACTERS 4 LINES - NDM204 ☐☐☐


98
10
38.1
(P2.54×15)
16-φ1
MAX 11
5.4
1.6
2.5
6
4-R0.5
2.2
42
25.2
20.8
55
60
2.8
70.4
76
2.5
93
4-φ2.5


E
R/W
RS
DB0
DB7
VDD
Vo
Vss
8
IC1
4
IC2
40
60
16
16
16
LCD
80
20
IC3
4

NISSEI ELECTRONICS • 460 E. MIDDLEFIELD RD., MOUNTAIN VIEW, CA 94043 • TEL: (714) 458-1155 / (415) 969-5511
FAX: (714) 458-1166 / (415) 961-7259

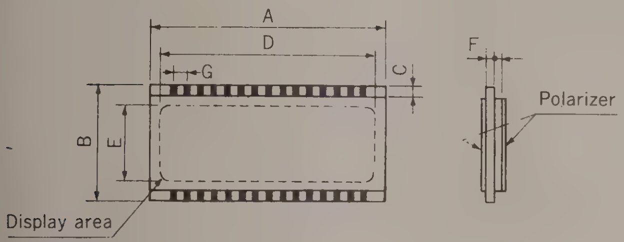
NISSEI ELECTRONICS

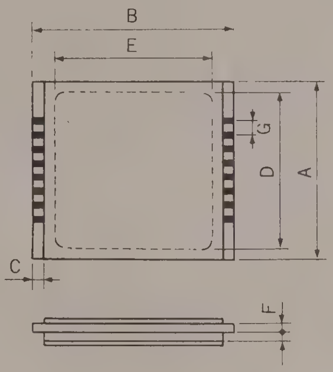
LCD MODULE

CUSTOM LCD DESIGN SPECIFICATION CHECK LIST

1. Panel Dimensions

- Vertical terminal type
  ☐ Top ☐ Bottom ☐ Top and Bottom
- Horizontal terminal type
  ☐ Left ☐ Right ☐ Left and Right





Symbol	Parameter	Dimensions (mm)	Symbol	Parameter	Dimensions (mm)
A	Glass size		D,E*	Display area	X
B	Glass size		F*	Glass thickness	
C*	Size of terminal		G	Pitch of terminal	

Note C* : in the case of pin connected LCD panels, the dimensions should normally be 2.5mm.
D,E*: The window frame of the case should be designed smaller than this dimension.

2. Operation mode

☐ TN positive
☐ TN negative
☐ STN positive
☐ STN negative

3. Display condition

☐ Reflective type
☐ Transmissive type
☐ Transflective type
☐ Others

4. Viewing angle direction

☐ 12:00
☐ 3:00
☐ 6:00
☐ 9:00

5. Terminal

☐ Rubber connector
☐ Pin Terminal
(No. of pins pcs.)
☐ Special treatment of pin
☐ Heat seal
☐ FPC

6. Driving method and environmental conditions

☐ Static • Driving frequency ________ Hz
☐ Dynamic • Driving LSI ________________
______ Duty _____ Bias • Operating temp. _______ °C- _______ °C
• Driving voltage _____ V • Storage temp. _______ °C- _______ °C

7. Options

☐ Separate type polarizer (front/back)
☐ Non-glare polarizer
☐ Color polarizer (color)
☐ Black mask color
☐ Print (color)
☐ Display color matching

8. Quotation and others

- Quantity __________ /month
  __________ /total lot
- Applications ______________
- Quotation date ______________
- Block copy Yes, No
- Request for module Yes, No

9. Planned quantity and schedule

Item	Submission of block copy	Approval of drawings	Delivery of engineering samples	Approval of engineering samples	Delivery of commercial samples	Initial mass production
Date						
Quantity	______	______		______		

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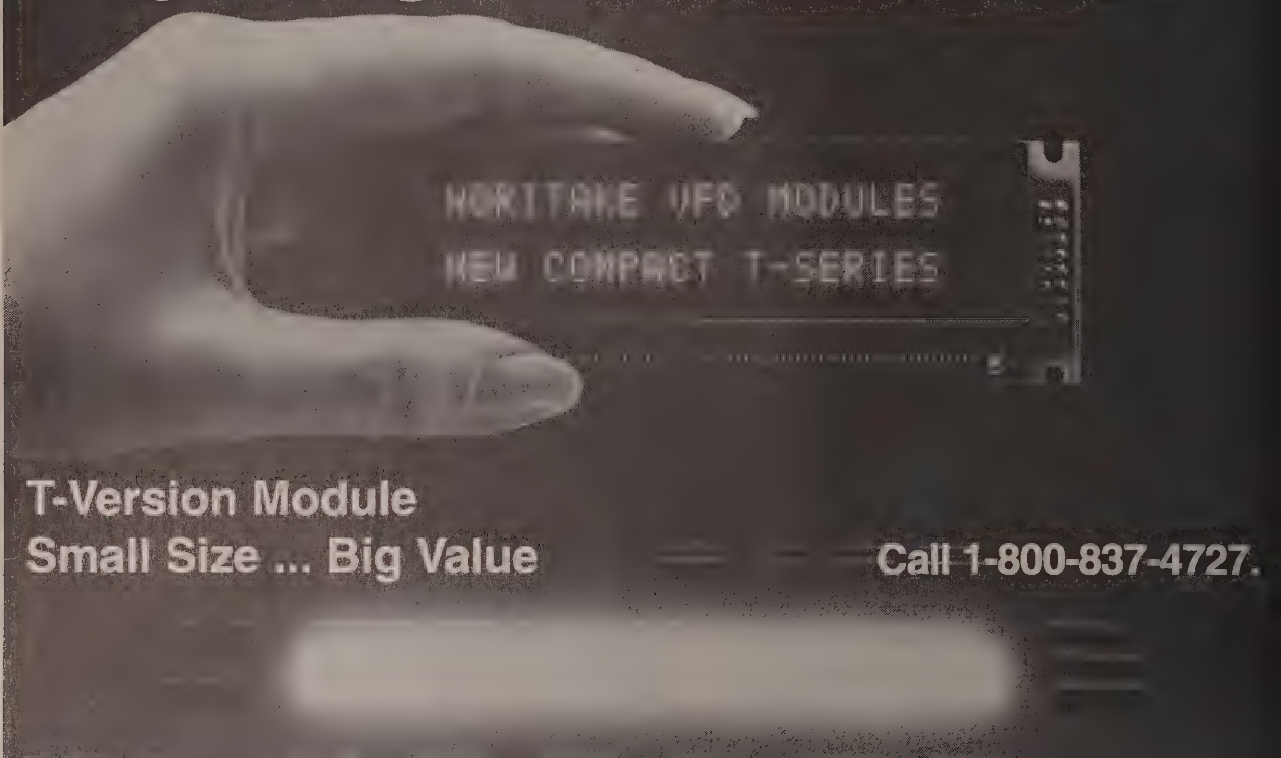
Noritake



T-Version Module
Small Size ... Big Value

Call 1-800-837-4727.

Features:
- Low power
- Long-term reliability
- Easy user interface
- Surface mount technology
- Parallel and serial input
- Built-in test function
- ASCII, European, Japanese Katakana characters
- Many modules to choose from
- 5V operation
- Flickerless/quick mode
- 4 step luminance control

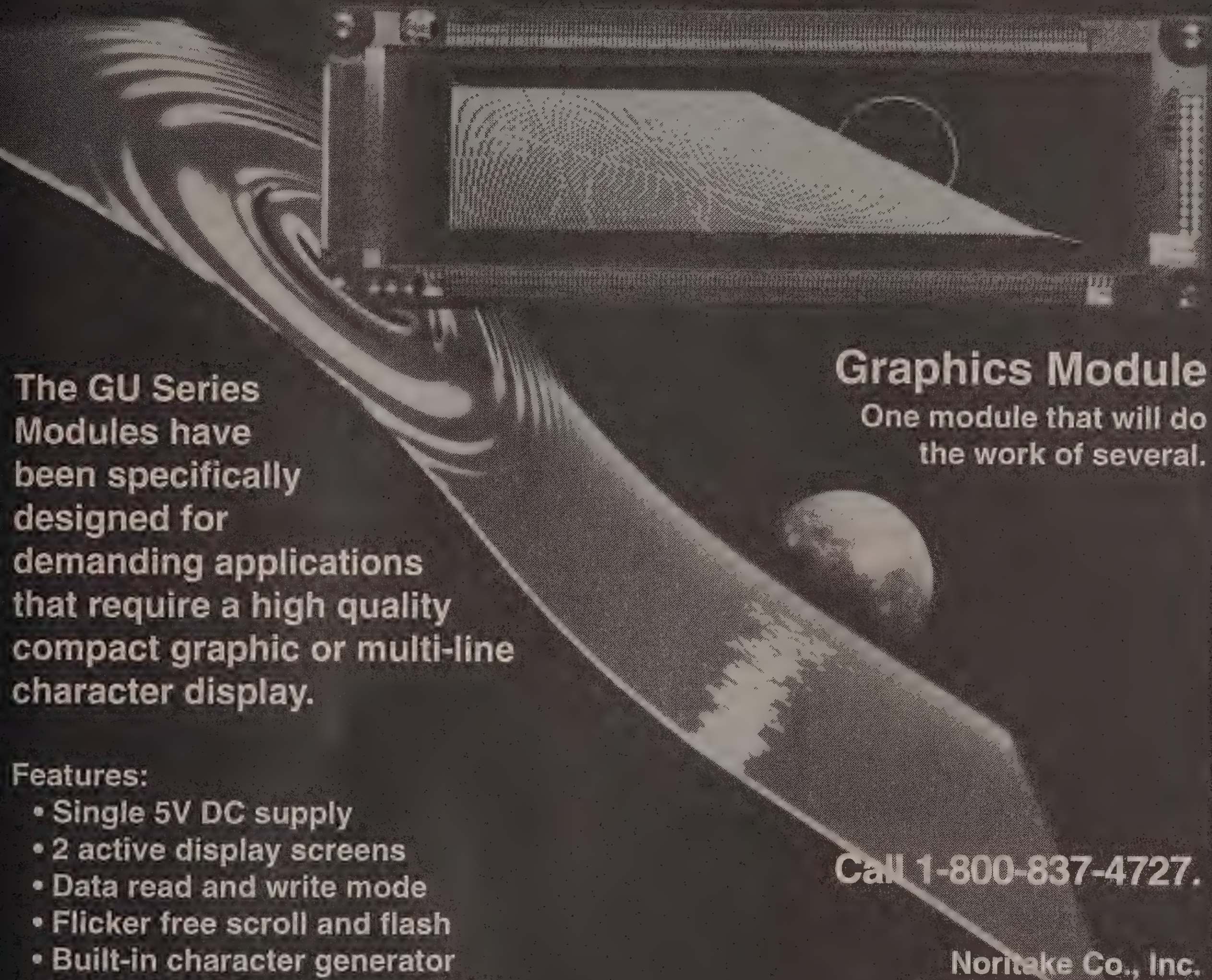
Noritake Co., Inc.
2635 Clearbrook Dr.
Arlington Heights, IL 60005

Part Number	Number of Characters	Character Height (mm)	Display Area (mm)	PC Board Size (mm)	Character Format	Supply Current (mA)	No. of UDFs*	Weight (grams)
CU165ECPB-T20**	1 x 16	5	62 x 5	100 x 28	▦	250	16	40
CU169SCPB-T21A	1 x 16	9	131 x 9	196 x 58	▦	TBD	8	113
CU205SCPB-T20A	1 x 20	5	92 x 5	128 x 32	▦	130	8	55
CU209SCPB-T20A	1 x 20	9	111 x 9	164 x 34	▦	300	8	70
CU209SCPB-T21A	1 x 20	9	164 x 9	214 x 41	▦	400	8	TBD
CU20155SCPB-T20A	1 x 20	15	250 x 15	300 x 60	▦	800	8	250
CU405SCPB-T20A	1 x 40	5	179 x 6	226 x 40	▦	350	8	110
CU16025SCPB-T20A	2 x 16	5	62 x 14	96 x 35	▦	150	16	65
CU20025SCPB-T20A	2 x 20	5	79 x 15	124 x 40	▦	320	8	70
CU20026SCPB-T20A	2 x 20	5	100 x 16	155 x 39	▦	320	8	100
CU20029SCPB-T20A	2 x 20	9	162 x 24	205 x 47	▦	700	8	170
CU200211SCPB-T60A	2 x 20	11	196 x 29	248 x 69	▦	1,200	4	280
CU40026SCPB-T20A	2 x 40	5	189 x 16	240 x 43	▦	700	2	150
CU20045SCPB-T23A	4 x 20	5	90 x 26	150 x 64	▦	400	2	120
CU20049SCPB-T20A	4 x 20	9	164 x 42	222 x 74	▦	1,100	2	380
CU200413SCPB-T20A	4 x 20	13	209 x 59	266 x 126	▦	1,800	2	800

* User Definable Fonts ** Serial input only; test function not available Write or call for our complete catalog, application notes and specification sheets.

itron®

Noritake



The GU Series Modules have been specifically designed for demanding applications that require a high quality compact graphic or multi-line character display.

Graphics Module

One module that will do the work of several.

Features:

- Single 5V DC supply
- 2 active display screens
- Data read and write mode
- Flicker free scroll and flash
- Built-in character generator
- Bright Vivid Blue-green display
- High speed 8 bit data bus interface

Call 1-800-837-4727.

Noritake Co., Inc.
2635 Clearbrook Dr.
Arlington Heights, IL 60005

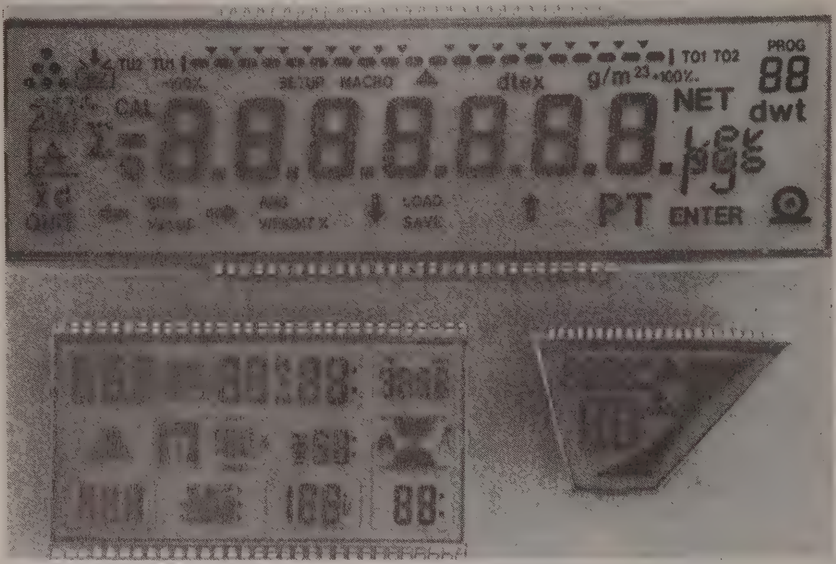
Part Number	Number of Display Dots	Dot Pitch (mm)	Display Area (mm)	PC Board Size (mm)	Supply Current (mA)	ASIC		Display Capacity		4 Step Luminance Control
						Font Format	C.G.*	No. of Char. Page	No. of Graphic Page	
GU60X32-302**	60 x 32	0.75	45 x 24	91 x 91	150	6 x 8	YES	-	-	-
GU192X16-304	192 x 16	0.8	153 x 13	230 x 45	800	-	-	-	20	YES
GU256X16-302	256 x 16	1.2 x 1.6	307 x 25	354 x 72	1,500	-	-	-	16	YES
GU256X32-302	256 x 32	0.65	166 x 21	220 x 60	600	6 x 8	YES	8	4	YES
GU128X64-302	128 x 64	0.65	83 x 41	170 x 78	900	6 x 8	YES	8	8	YES
GU256X64-312	256 x 64	0.4	102 x 25	166 x 45	1,000	6 x 8	YES	8	4	YES
GU256X64-332	256 x 64	0.55	140 x 35	200 x 70	1,000	6 x 8	YES	8	4	YES
GU256X64-352	256 x 64	0.65	166 x 41	230 x 78	1,400	6 x 8	YES	8	4	YES

Japanese Character (KATAKANA) Fonts models are also available. * C.G.: Character Generator ** 12V power supply
Write or call for our complete catalog, application notes and specification sheets.

OCULAR LCD Displays and LCD Modules

How a Texas-Based Company Offers a Global Advantage.

With Ocular LCDs, there's no need to choose between dependable domestic service and competitive off-shore pricing. We deliver the best of both worlds.



High quality LCDs feature bright, high-contrast graphics.

Ocular LCD products are engineered, prototyped and perfected in our Texas headquarters. CAD-generated, laser-plotted photomasks ensure accuracy that consistently meets your specifications. We fabricate samples in our Texas clean room facility, presenting prototypes for client approval. Then we economically produce your designs at our dedicated facilities on the Pacific Rim, using advanced array processing techniques in a state-of-the-art manufacturing environment. That's how Ocular meets your schedules… on spec, on budget, on time.

Ocular LCDs feature:

- High contrast and brightness
- Low power consumption
- Wide temperature range
- Quick switching time
- Unlimited sizes up to 35 square inches
- Optional back lighting

LCDs and Modules

Ocular manufactures a complete line of LCDs and LCD modules. When you need to streamline production and reduce manufacturing costs, our SMT and chip on-board capabilities can help to integrate any hardware you specify into our custom LCD modules.

Our custom and standard LCD modules include:

- Choice of rugged metal bezels or injection-molded plastic housings
- Optional keypads and other hardware
- Optional EL or LED back lighting
- Optional on-board intelligence

Fast, Attentive Service

At Ocular, no LCD requirement is too large or too small. Our experienced engineers bring designs from concept to completion with short lead times for prototypes and production. And we can expedite any job upon request.

At our Texas facility, we offer pick-and-place capability for LCD modules. We handle short-run and special-project production for LCDs and modules as well. And we provide quality assurance testing of every shipment.

For state-of-the-art liquid crystal technology, look to Ocular— the company that combines domestic and off-shore advantages for all your standard and custom production needs.

Affordable Ocular modules fit custom requirements.

Request our catalog by phone or fax today.

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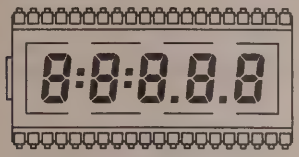
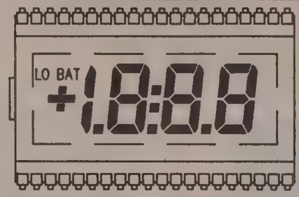
Standard LCD Products

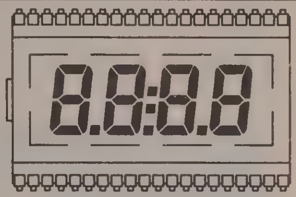
MODEL 51, CHARACTER HEIGHT 0.35"



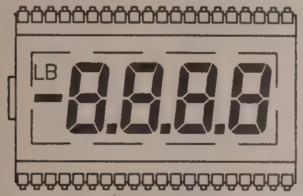
MODEL 36, CHAR. HEIGHT 0.50"



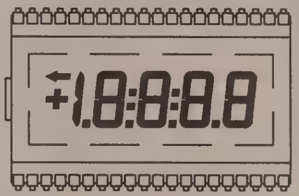
MODEL 40, CHAR. HEIGHT .35", 0.50", 0.70", 1.00"



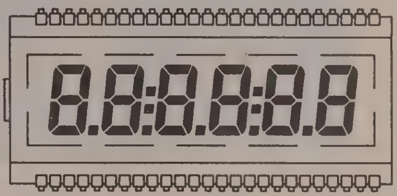
MODEL 41, CHAR. HEIGHT 0.50"



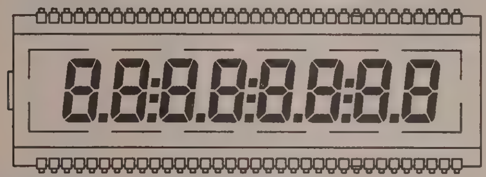
MODEL 45, CHAR. HEIGHT 0.35"



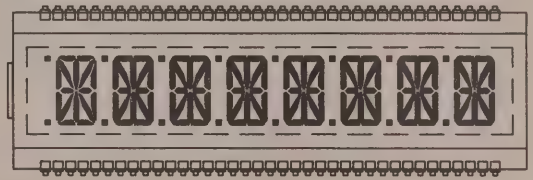
MODEL 60, CHAR. HEIGHT 0.50", 0.70" 1.00"



MODEL 81, CHAR. HEIGHT 0.50"



MODEL 80, CHAR. HEIGHT 0.50"



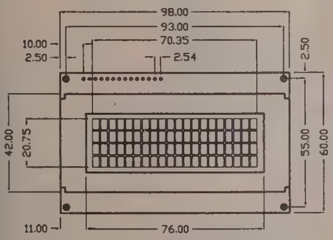
STANDARD LCD ORDERING OPTIONS:

TEMPERATURE RANGE	OPERATING	STORAGE	POLARIZER MODE	CONNECTOR
INDUSTRIAL GRADE	–40° TO 85°C	–55°C TO 90°C	REFLECTIVE	DUAL IN LINE PINS
COMMERCIAL GRADE	–10°C TO 55°C	–20°C TO 60°C	TRANSFLECTIVE	ELASTOMERIC (NOT AVAILABLE ON ALL MODELS)
			TRANSMISSIVE	

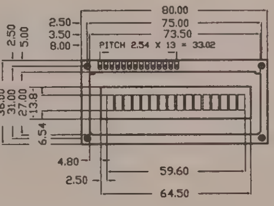
Standard Intelligent LCD Modules

Shown below are some of OCULAR's LCD modules. Designed to conform to the industry standards, Ocular's standard LCD modules can be used as drop in replacements, both electrically and mechanically, for most existing designs.

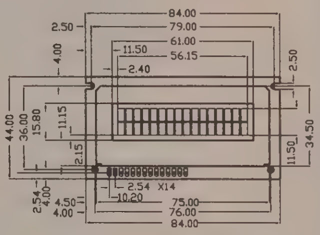
OM4-20 4X20 CHAR., 5X8 DOT.


98.00
93.00
70.35
10.00
2.50
2.54
2.50
42.00
20.75
55.00
60.00
11.00
76.00

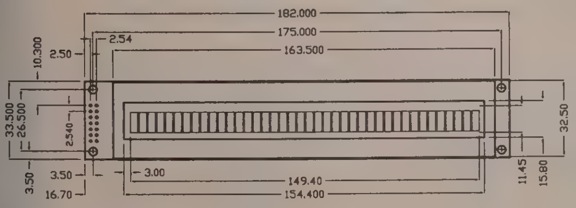
OM1-16 1X16 CHAR., 5X8 DOT.


80.00
75.00
73.50
2.50
3.50
8.00
2.50
5.00
PITCH 2.54 X 13 = 33.02
36.00
31.00
27.00
13.8
6.54
4.80
2.50
59.60
64.50

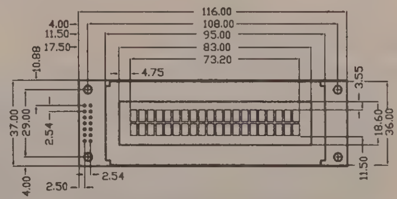
OM2-16 2X16 CHAR., 5X8 DOT.


84.00
79.00
61.00
56.15
2.50
4.00
11.50
2.40
2.50
44.00
36.00
15.80
11.15
2.15
11.50
34.50
2.54 X14
10.20
2.54
4.00
4.50
4.00
75.00
76.00
84.00

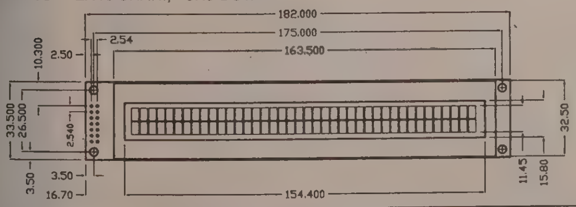
OM1-40 1X40 CHAR., 5X10 DOT.


182.000
175.000
163.500
2.54
10.300
2.50
33.500
26.500
2.540
32.50
3.50
3.50
16.70
3.00
149.40
154.400
11.45
15.80

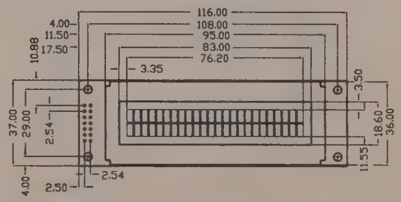
OM2-20 2X20 CHAR., 5X8 DOT.


116.00
108.00
95.00
83.00
73.20
4.00
11.50
17.50
10.88
4.75
3.55
37.00
29.00
2.54
18.60
36.00
11.50
4.00
2.50
2.54

OM2-40 2X40 CHAR., 5X8 DOT.


182.000
175.000
163.500
2.54
10.300
2.50
33.500
26.500
2.540
32.50
3.50
3.50
16.70
154.400
11.45
15.80

OM2-24 2X24 CHAR., 5X8 DOT.


116.00
108.00
95.00
83.00
76.20
4.00
11.50
17.50
10.88
3.35
3.50
37.00
29.00
2.54
18.60
36.00
11.55
4.00
2.50
2.54

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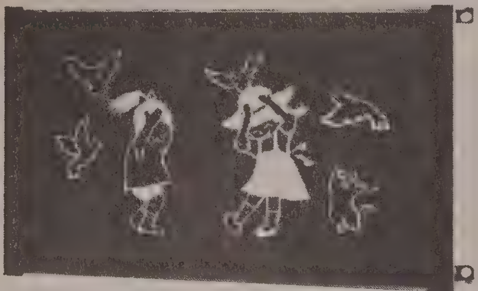
OKAYA ELECTRIC AMERICA, INC.

503 Wall Street, Valparaiso, IN. 46383

Ph: 219-477-4488
Fax: 800-852-0106

PLASMA DISPLAY MODULES



FEATURES

- Ultra-high brightness attained in the compact panel.
- Sharp display and sway-free dots minimizing eye fatigue.
- View angle as wide as 120°.
- High reliability.
- Working temperature range as wide as -20°C ~ + 75°C.
- No mercury contained in panel for safety.
- LCD controller integrated.

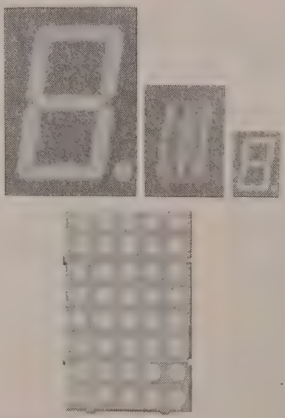
APPLICATIONS

- Indicating terminal in production process.
- Interface of medical machinery.
- Indicating terminal of various testers.

SPECIFICATIONS

Type	RU-16-4RDC2	RU-32-8RDC2-2	RU-40-6RDC2	RU-40-12RDC2	RUG-96-48RDC2	RUG-224-96RDC2	RUG-256-128RDC2	RUG-320-168RDC2	RUG-512-160RDC2	RUG-512 256RD12
Character col x row	16 x 4	32 x 8	40 x 6	40 x 12	96 x 48 (Dot)	224 x 96 (Dot)	256 x 128 (Dot)	320 x 168 (Dot)	512 x 160 (Dot)	512 x 256 (Dot)
Dot Pitch V x H (mm)	1.27	1.0	0.8 x 1.0	0.8 x 1.0	1.27	1.0	0.8	0.6	0.65	0.38
Outline L x H x D (mm)	186 x 94 x 50	296 x 135 x 50	279 x 95 x 48	279 x 155 x 41	186 x 94 x 50	296 x 135 x 50	279 x 155 x 41	269 x 145 x 34	406 x 156 x 34	260 x 140 x 34
Luminous Intensity (approx)	685 cd/m²	500 cd/m²	685 cd/m²	500 cd/m²	685 cd/m²	500 cd/m²	500 cd/m²	250 cd/m²	250 cd/m²	200 cd/m²

LED - NUMERIC/DOT MATRIX



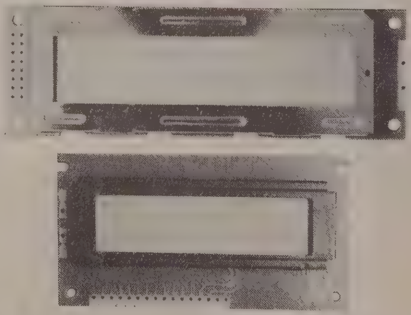
LED - NUMERIC

- Single, dual and triple digit configurations.
- Character height values from 0.3" to 1.5".
- Single and dual 15 segment alphanumeric displays available.
- Source colors in red, orange, yellow and green.
- Luminous intensity from 650 to 4000 MA.
- Common anode and common cathode models.
- Super-brights and low current devices available.

LED - DOT MATRIX

- Display heights of 0.68" to 4.6".
- Dot configurations of 5 x 7 to 8 x 8 in 3 and 5 mm.
- Emitted colors of red, orange, yellow, green.
- Luminous intensity from 300 to 3000 MA.
- Common anode and common cathode models.
- Dual color devices available.

LCD MODULES



INTELLIGENT DOT MATRIX LCD MODULES

- Dot matrix modules with on-board controller.
- Character and graphic type modules.
- Chip-on-board techniques for low cost.
- Twisted nematic or super twisted nematic type LCD's. with LED and EL backlighting options.
- Custom integrated display assemblies with key pads, cable, connectors, beepers, etc, welcomed.
- Standard configurations: 16 x 1, 16 x 2, 20 x 2, 24 x 2, 20 x 4, 40 x 2.

FOR COMPLETE INFORMATION AND SERVICE, CALL OR FAX US NOW!

SUPERTWIST LCD MODULE PRODUCT SELECTOR

ALPHA/NUMERIC DOT MATRIX

EXTENDED TEMPERATURE RANGE

Model	Display Format CharxLine	Font Matrix WxH Pix	Character Size Incl. Cursor WxH mm	Frame Viewing Area WxH mm	Driving Duty Cycle	PCB Size WxH mm	TN Type Temp. Range		STN Type Temp. Range		Backlight Options		Connection	
							Nrml	Wide	Nrml	Wide	EL	LED	Style	Edge Location
TC081S	8 X 1	5 X 8	6.45 X 10.75	61.0 X 15.8	1/8	84.0 X 44.0	¤	¤	–	–	¤	¤	SIL	BTM
TC122A	12 X 2	5 X 8	2.65 X 5.50	46.7 X 17.5	1/16	55.7 X 32.0	¤	¤	¤	¤	–	¤	SIL	BTM
TC161C	16 X 1	5 X 8	2.37 X 5.41	45.0 X 12.0	1/16	61.0 X 30.0	¤	¤	¤	¤	¤	¤	SIL	TOP
TC161D			3.20 X 5.95	64.5 X 13.8		80.0 X 36.0	¤	¤	¤	¤	¤	¤	SIL	TOP
TC161F			3.20 X 5.95	64.5 X 13.8	1/8	80.0 X 36.0	¤	¤	¤	¤	¤	¤	SIL	TOP
TC161V	16 X 1	5 X 8	3.15 X 6.30	61.0 X 9.6	1/16	80.0 X 25.0	¤	¤		–	¤	¤	SIL	TOP
TC161S			3.15 X 6.30	61.0 X 15.8		80.0 X 36.0	¤	¤	¤	–	¤	¤	SIL	TOP
TC161A			4.84 X 8.06	99.0 X 13.0		122.2 X 33.2	¤	¤	¤	–	¤	¤	SIL	TOP
TC161E	16 X 1	5 X 8	4.84 X 8.06	99.0 X 13.0	1/8	122.2 X 33.2	¤	¤	¤	–	¤	¤	SIL	TOP
TC161T			4.15 X 9.50	80.0 X 20.5	1/16	100.0 X 42.0	¤	¤	¤	–	¤	¤	SIL	TOP
TC161B			7.20 X 14.54	120.0 X 23.0	1/8	151.0 X 40.0	¤	¤	¤	¤	¤	¤	DIL	END
TC162G	16 X 2	5 X 8	3.65 X 4.35	64.5 X 13.8	1/16	80.0 X 36.0	¤	¤	¤	¤	¤	¤	SIL	TOP
TC162S			2.95 X 5.55	61.0 X 15.8		80.0 X 36.0	¤	¤	¤	–	¤	¤	SIL	TOP
TC162W	16 X 2	5 X 8	2.95 X 5.55	61.0 X 15.8	1/16	84.0 X 44.0	¤	¤	¤	–	¤	¤	SIL	BTM
TC162E			2.95 X 5.55	60.0 X 16.0		84.0 X 44.0	¤	¤	¤	¤	¤	¤	SIL	BTM
TC162C	16 X 2	5 X 8	2.96 X 5.56	62.0 X 16.0	1/16	85.0 X 30.0	¤	–	¤	–	¤	¤	DIL	END
TC162U			2.95 X 5.55	61.0 X 15.8		85.0 X 32.5	¤	¤	¤	–	¤	¤	DIL	END
TC162F	16 X 2	5 X 8	3.55 X 5.55	62.0 X 16.0	1/16	85.0 X 36.0	¤	¤	¤	¤	¤	¤	DIL	END
TC162X			4.07 X 7.76	80.0 X 20.5		100.0 X 42.0	¤	¤	¤	–	¤	¤	SIL	TOP
TC162B	16 X 2	5 X 8	4.84 X 8.06	99.0 X 24.0	1/16	122.0 X 44.0	¤	¤	¤	¤	¤	¤	SIL	BTM
TC162D			4.84 X 9.66	99.0 X 24.0		130.6 X 38.0	¤	¤	¤	¤	¤	¤	DIL	END
TC162T	16 X 2	5 X 8	5.05 X 9.55	99.0 X 24.0	1/16	122.0 X 44.0	¤	¤	¤	–	¤	¤	SIL	BTM
TC162H			6.00 X 9.63	120.0 X 23.0		151.0 X 40.0	–	–	¤	¤	¤	¤	DIL	END
TC164A	16 X 4	5 X 8	2.95 X 4.75	61.8 X 25.2	1/16	87.0 X 60.0	¤	¤	¤	¤	¤	¤	SIL	TOP
TC201S	20 X 1	5 X 8	6.70 X 11.50	155.1 X 16.0	1/8	182.0 X 33.5	¤	¤	–	–	¤	¤	DIL	END
TC201B			7.20 X 14.54	149.0 X 23.0		180.0 X 40.0	–	–	¤	¤	¤	¤	DIL	END
TC202U	20 X 2	5 X 8	3.70 X 4.85	80.0 X 20.5	1/16	100.0 X 38.8	–	–	¤	–	–	¤	SIL	TOP
TC202A			3.20 X 5.55	83.0 X 18.6		116.0 X 37.0	¤	¤	¤	¤	¤	¤	DIL	END
TC202B	20 X 2	5 X 8	6.00 X 9.63	149.0 X 23.0	1/16	180.0 X 40.0	–	–	¤	¤	¤	¤	DIL	END
TC204C	20 X 4	5 X 8	2.29 X 4.02	58.6 X 21.1	1/16	77.0 X 47.0	¤	¤	¤	–	¤	¤	SIL	TOP
TC204A			2.95 X 4.75	76.0 X 25.5		98.8 X 60.2	¤	¤	¤	¤	¤	¤	SIL	TOP
TC204B			5.66 X 9.80	143.0 X 57.0		191.0 X 86.0	–	–	¤	¤	–	¤	DIL	END
TC242T	24 X 2	5 X 8	3.20 X 5.55	80.0 X 20.5	1/16	100.0 X 38.8	¤	¤	¤	–	–	¤	SIL	TOP
TC242A			3.20 X 5.55	93.5 X 15.8		118.0 X 36.0	¤	¤	¤	¤	¤	¤	DIL	END
TC242D *	24 X 2	5 X 8	3.20 X 5.55	93.5 X 15.8	1/16	118.0 X 36.0	¤	¤	¤	¤	–	¤	DIL	END
TC242B			6.00 X 9.63	178.0 X 23.0		208.0 X 40.0	–	–	¤	¤	¤	¤	DIL	END
TC402C	40 X 2	5 X 8	2.67 X 4.60	130.8 X 13.2	1/16	149.4 X 27.0	¤	¤	–	–	¤	¤	SIL	TOP
TC402A			3.20 X 5.55	152.2 X 16.5		182.0 X 33.6	¤	¤	¤	¤	¤	¤	DIL	END
TC404A	40 X 4	5 X 8	2.78 X 4.89	147.0 X 29.5	1/16	190.0 X 54.0	¤	¤	¤	¤	¤	¤	DIL	END
TC404B			5.20 X 14.58	244.0 X 68.0		280.0 X 88.0	–	–	¤	¤	¤	¤	SIL	END

* Dual Color (Red/Green) LED Backlight

¤ : Available / – : Unavailable

GRAPHIC MODULE PRODUCT SELECTOR

CUSTOM MODULES GRAPHIC/CHARACTER

TEMPERATURE COMPENSATION CIRCUIT

Model	Display Matrix WxH Pix	Pix WxH mm	Frame ViewingArea WxH mm	Driving Duty Cycle	PCB Size WxH mm	Built-In Controller	STN Type Temp. Range		Backlight Options		Connection	
							Nrml	Wide	EL	LED	Style	Edge Location
TG0803A	80 X 32	0.48 X 0.48	46.0 X 18.0	1/32	84.0 X 44.0	HD61202/3	¤	–	¤	¤	DIL	LEFT
TG1203S	120 X 32	0.42 X 0.53	62.5 X 23.5	1/16	84.0 X 44.0	SED1520F	¤	–	¤	–	SIL	BOTTOM
TG1206A	128 X 64	0.40 X 0.56	62.0 X 43.5	1/64	94.5 X 67.5	HD61202/3	¤	¤	¤	¤	SIL	RIGHT
TG1212A	128 X 128	0.46 X 0.46	69.0 X 69.0	1/128	88.0 X 88.0	HD61830B	¤	¤	¤	–	DIL	BOTTOM
TG1608S	160 X 80	0.41 X 0.41	76.0 X 40.0	1/80	100.0 X 64.0	HD61830	¤	–	¤	¤	SIL	BOTTOM
TG1612S	160 X 128	0.54 X 0.54	101.0 X 82.0	1/128	129.0 X 102.0	HD61830	¤	–	¤	–	DIL	RIGHT
TG2406G	240 X 64	0.42 X 0.42	112.0 X 31.5	1/64	149.0 X 57.0	HD61830A	¤	¤	¤	¤	DIL	RIGHT
TG2406F		0.49 X 0.49	132.0 X 39.0		180.0 X 65.0	T6963	¤	¤	¤	¤	DIL	RIGHT
TG2406A					180.0 X 75.0	HD61830B	¤	¤	¤	¤	DIL	RIGHT
TG2406B						T6963C	¤	¤	¤	¤	DIL	RIGHT
TG2406E						NONE	¤	¤	¤	¤	SIL	RIGHT
TG2406C					190.0 X 75.0	HD61830	¤	¤	CCFT		DIL	RIGHT
TG2406D						T6963C	¤	¤			DIL	RIGHT
TG2412A	240 X 128	0.40 X 0.40	114.0 X 64.0	1/128	144.0 X 104.0	HD61830	¤	¤	¤	¤	SIL	BOTTOM
TG2412B						T6963C	¤	¤	¤	¤	SIL	BOTTOM
TG2412C					154.0 X 104.0	HD61830	¤	¤	CCFT		SIL	BOTTOM
TG2412D						T6963C	¤	¤			SIL	BOTTOM
TG2512T	256 X 128	0.365 X 0.365	108.0 X 56.0	1/128	129.0 X 76.2	MSM6255	¤	–	¤	–	DIL	BOTTOM
TG3225S	320 X 256	0.38 X 0.38	142.0 X 115.0	1/256	168.0 X 150.0	MSM6255	¤	–	¤	–	DIL	BOTTOM

CCFT = Cold Cathode Fluorescent Tube

¤ : Available / – : Unavailable

CUSTOM GLASS ONLY AVAILABLE

MINIGLOSSARY

OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

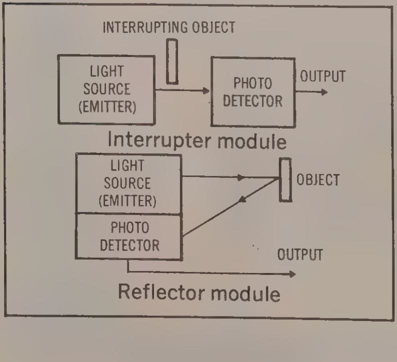
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

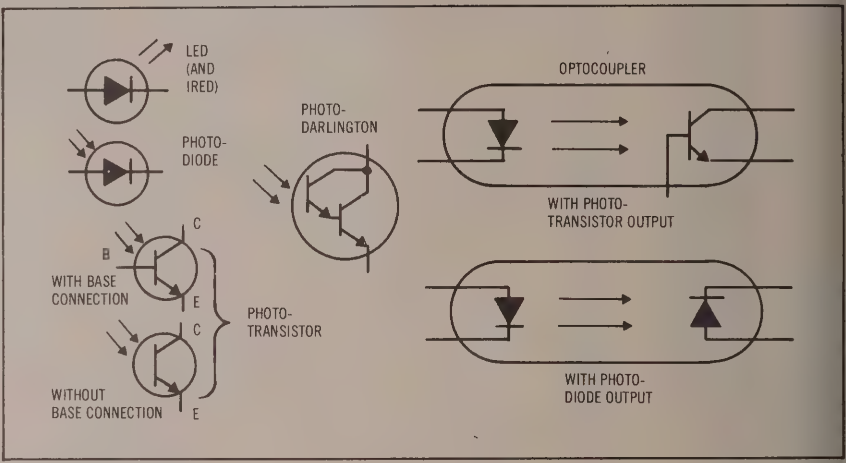
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

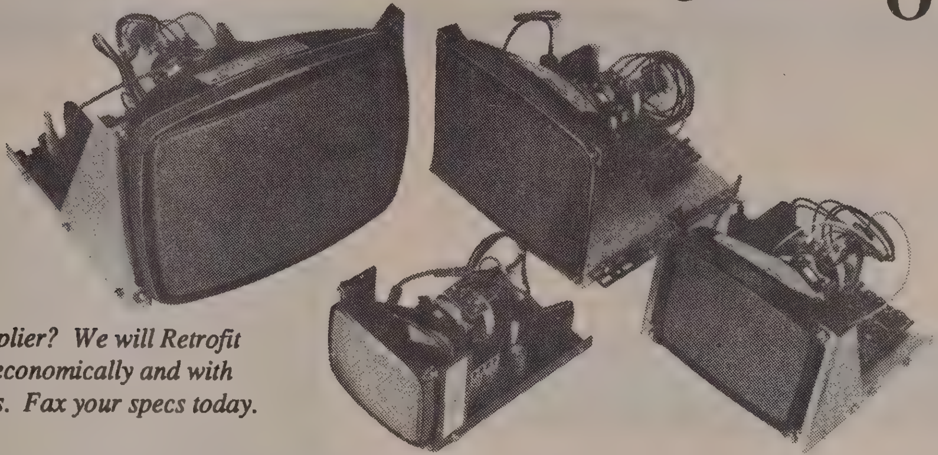
Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

High Quality Monochrome Monitors
Chassis, Kit & Tube Mount Configurations



Is your existing design being discontinued/price escalated by your supplier? We will Retrofit your existing design, economically and with our upgraded features. Fax your specs today.

Our Standard Practice: Customize to your input signal & mechanical requirements

Quality Features

- All circuitry on one PCB for reliability
- Accepts TTL or Composite Video signals
- All controls easily accessible from monitor top
- Highlighted Video feature compatible with the IBM PC/compatible Hightlighted Video
- Display thermally stabilized
- Electronic horizontal video centering
- Protected against incorrectly applied sync signals
- Display can be run without signal applied
- Vertical oscillator easily changed from 47 to 63 Hz.
- Vertical sync input polarity easily changed
- 0°, 5° or 10° tilt standard on 7", 9" and 12" chassis models
- Meets UL, CSA and DHHS rules on radiation

Options

- Wide range of Phosphors
- Remote Brightness and Contrast
- Kit form or space saving chassis
- 120 VAC Power Supply
- +12VDC power connector
- 10 or 20 pin header
- TTL/Composite Video on one board

Specifications

Input Signals:

TTL

Signal: Positive Polarity +2.5V to +5.0V. Reverse polarity signals may require board modification

Video Input Impedance: 470 ohms

Bandwidth: Within 3db from 10Hz to 26MHz

Vertical Input Impedance: greater than 1K ohms

Typical Signal: 180 microseconds

Acceptable Range: 100 to 1200 microseconds

Horizontal Input Impedance: Greater than 6K Ohms

Typical Signal: 4.5 microseconds

Acceptable Range: 2.5 to 30 microseconds

Composite Video:

Signal: 0.7V to 1.8V of composite peak to peak video

Input Impedance: 75 ohms

Bandwidth: Within 3db from 10Hz to 26MHz

Geometric Distortion:

Within 2% EIA standard DOT/Ball chart. Variation between adjacent characters <10% in alphanumeric display application.

Scanning Frequencies:

Factory adjusted for operation within 1kHz of center frequencies at 15.7kHz, 18.6kHz, 21.6kHz, 31.5kHz or 44 kHz.

Monitor Size	Mount Style	CRT SPECIFICATIONS Neck	Deflection	View Area	Power @12VDC	Center Resolution	Dimensions (Inches) Height	Width	Depth	Weight (Lbs) Kit	Shipping
5" Diagonal	Chassis	20mm	70°	15 in^2 max	650mA	650 Lines	4.60	4.88	8.61	3.0	4.5
7" Diagonal	Chassis	20mm	85°	26 in^2 max	1150mA	700 Lines	5.90	7.95	8.20	10	12
9" Diagonal	Chassis	20mm	85°	35 in^2 max	1150mA	750 Lines	7.25	9.50	9.50	10	12
9" Diagonal	Yoke	20mm	85°	35 in^2 max	1150mA	750 Lines	PCB: 5.33 x 7.010			10	12
12" Diagonal	Chassis	20mm	90°	55 in^2 max	1250mA	900 Lines	9.25	11.50	11.00	11	13
12" Diagonal	Yoke	20mm	90°	55 in^2 max	1250mA	900 Lines	PCB: 5.33 x 7.010			10	12

OMNI VISION INC.

High Quality Monochrome Monitors

168 N. Brandon Dr. • Glendale Heights, IL 60139 • Phone: 708/893-1720 • FAX:708/893-9991

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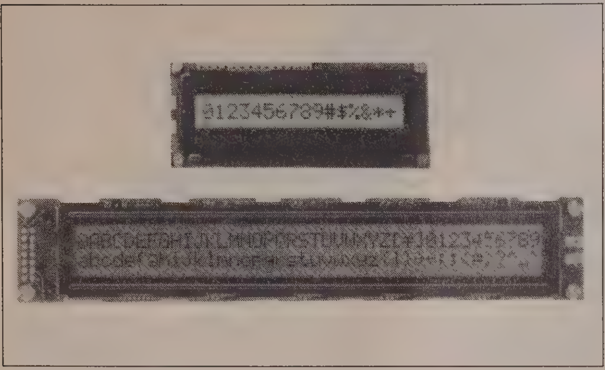
Optrex Corporation.

LIQUID CRYSTAL DISPLAY MODULE

Character Type/DMC Series



Features

(1) 8-bit or 4-bit MPU interface is available.
(2) 160 JIS type characters such as Alphabet, Numeral and Kana and 32 special characters and symbols can be displayed by internal character generator (ROM).
(3) Random symbols can be displayed by character generator (RAM).
(4) Many instructional functions by means of program such as "clear display," "home cursor," "on/off cursor," "blink character," "shift display," "shift cursor," "read/write display data," etc. are available.
(5) Compact and light weight design enable easy assembly on device.
(6) Single "+5V" power supply (except for Extended Temperature Type).
(7) Low power consumption.

Standard Module Formats:

Display Format	*1) Type No.	Display Fonts	Character Size (W×H mm)	Dot Size (W×H mm)	Module Dimensions (W×H×D mm)	*2) Variation						
						TN Type				*3) NTN Type		
						R	H	EL	LED	R	EL	LED
16 characters × 1 line	DMC16106A	5×11 dots	3.2×8.2	0.6×0.7	80×36×10	○	○	○	—	—	—	—
	DMC16106C	5×8 dots	3.2×5.95	0.6×0.7	80×36×10	○	○	○	—	—	—	—
	DMC16117A	5×8 dots	3.2×5.95	0.6×0.7	80×36×10	○	○	○	—	○	○	—
	DMC16128	5×7 dots+Cursor	4.84×9.66	0.92×1.1	122×33×11	○	○	○	—	—	—	—
	DMC16129	5×7 dots+Cursor	4.84×9.66	0.92×1.1	122×33×11	○	○	○	—	—	—	—
	DMC16101A-EB	5×11 dots	8.2×3.2	0.7×0.6	85×36×10	—	—	○	—	—	—	—
	DMC16105-LY	5×8 dots	3.2×5.95	0.6×0.7	80×36×15	—	—	—	○	—	—	—
	DMC16188-LY	5×8 dots	6.0×14.54	1.152×1.765	151×50×14.2	—	—	—	○	—	—	○
16 characters × 2 lines	DMC16207	5×8 dots	2.95×5.55	0.55×0.65	80×44×11	○	○	○	—	○	○	—
	DMC16230	5×7 dots+Cursor	4.84×9.66	0.92×1.1	122×44×11	○	○	○	—	○	○	○
	DMC16249B	5×8 dots	2.95×4.35	0.55×0.5	80×36×11	○	○	○	—	○	○	—
	DMC16202-LY	5×8 dots	2.95×5.55	0.55×0.65	84×45×15.1	—	—	—	○	—	—	○
	DMC16204	5×8 dots	2.95×5.55	0.55×0.65	84×40×10.9	○	—	—	○	—	—	—
	DMC16204-LY	5×8 dots	2.95×5.55	0.55×0.65	80×40×16.1	○	—	—	○	—	—	—
16 characters × 4 lines	DMC16433	5×8 dots	2.95×4.75	0.55×0.55	87×60×11	○	○	○	—	○	○	—
20 characters × 1 line	DMC20171	5×7 dots+Cursor	3.2×5.55	0.6×0.65	182×33.5×13	○	○	○	—	—	—	—
20 characters × 2 lines	DMC20215	5×8 dots	3.2×5.55	0.6×0.65	116×44×11	○	○	○	—	○	—	—
	DMC20261	5×8 dots	3.2×5.55	0.6×0.65	116×37×11	○	○	○	—	○	○	○
20 characters × 4 lines	DMC20434	5×8 dots	2.95×4.75	0.55×0.55	98×60×11	○	○	○	—	○	○	○
	DMC20481-LY	5×8 dots	2.95×4.75	0.55×0.55	98.5×61×15.6	—	—	—	○	—	—	○
24 characters × 1 line	DMC24138	5×11 dots	3.2×8.2	0.6×0.7	118×36×11	○	○	○	—	○	—	—
24 characters × 2 lines	DMC24227	5×8 dots	3.2×5.55	0.6×0.65	118×36×11	○	○	○	—	○	○	—
32 characters × 1 line	DMC32132	5×11 dots	3.2×8.2	0.6×0.7	174.5×31×11	○	○	○	—	—	—	—
32 characters × 2 lines	DMC32216	5×8 dots	3.2×5.55	0.6×0.65	175×44×11	○	○	○	—	—	—	—
	DMC32239	5×8 dots	3.45×5.55	0.65×0.65	174.5×31×11	○	○	○	—	○	○	—
40 characters × 1 line	DMC40131	5×11 dots	3.2×8.2	0.6×0.7	182×33.5×11	○	○	○	—	—	—	—
40 characters × 2 lines	DMC40202-LY	5×8 dots	3.2×5.55	0.6×0.65	182×34.5×15.1	—	—	—	○	—	—	○
	DMC40205-LY	5×8 dots	3.2×5.55	0.6×0.65	170×31.5×15.5	—	—	—	○	—	—	—
	DMC40218	5×8 dots	3.2×5.55	0.6×0.65	182×33.5×11	○	○	○	—	○	○	○
40 characters × 4 lines	DMC4057	5×8 dots	2.78×4.89	0.5×0.55	190×54×10	○	○	○	—	○	○	○
	DMC40401N	5×8 dots	2.78×4.89	0.5×0.55	190×54×11	—	—	—	—	○	—	○

OPTREX LCD Character Modules are available in many backlighting options as well as in standard TN and N-TN Fluid Technologies.

Type	Operating Temp.	Storage Temp.
Normal Temp.	0°C ~ +50°C	−20°C ~ +70°C
Extended Temp.	−20°C ~ +70°C	−30°C ~ +80°C

- **FOR ON-SITE DEMONSTRATIONS AND IN-DEPTH TECHNICAL ASSISTANCE REGARDING STANDARD AND *CUSTOM* DISPLAY REQUIREMENTS, PLEASE CONTACT US FOR AN IMMEDIATE RESPONSE:**

SATORI ELECTRIC (AMERICA) INC.
3830 DEL AMO BLVD., SUITE 101, TORRANCE, CA 90503
TEL. (310) 214-1791 FAX (310) 214-1721

Optrex Corporation.

LIQUID CRYSTAL DISPLAY MODULE

Graphic Type/**DMF** Series

Features

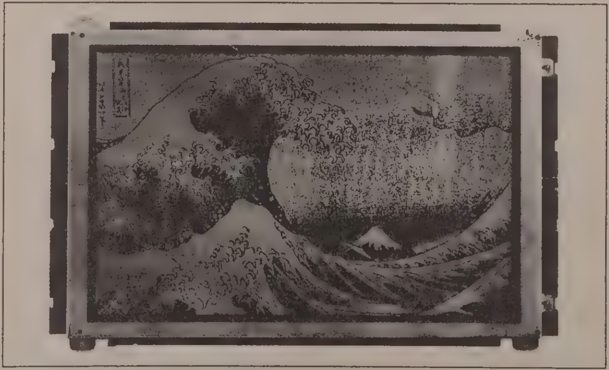
(1) **Low voltage operation, Low power consumption.**
(2) **Compact, Light, Thin.**
(3) **Graphic, Figure, and Character display.**
(4) **High contrast, Wide viewing angle as Super TN LCDP are employed.**
(5) **Large area display as CRT.**
(6) **Black and White Technology now available.**
(7) **Choices of EL or CCT Backlighting.**

Standard Module Formats:

Dot Pixels (W x H)	*1) Type No.	Dot Size (W x H mm)	Dot Pitch (W x H mm)	Module Dimensions (W x H x D mm)	Viewing Area (W x H mm)	Driving Methods (duty/bias)	*2) Variation				
							R	EL	FL	OHP	BW
112 x 128	DMF5002N	0.49 x 0.50	0.53 x 0.54	90.6 x 110.0 x 12.8	66.0 x 77.0	1/128D 1/12B	O	O	—	—	—
160 x 128	DMF608N	0.55 x 0.55	0.60 x 0.60	129.0 x 102.0 x 11.2	101.0 x 82.0	1/64D 1/9B	O	O	—	—	—
	DMF5001N	0.54 x 0.54	0.58 x 0.58	129.0 x 102.0 x 12.8	101.0 x 82.0	1/128D 1/12B	O	O	—	—	—
	DMF5003NY-FW*5)	0.54 x 0.54	0.58 x 0.58	(152.0 x 112.0 x 23.0)	(101.0 x 82.0)	1/128D 1/12B	—	—	O	—	—
240 x 64	DMF633N	0.48 x 0.48	0.53 x 0.53	180.0 x 75.0 x 15.0	132.0 x 39.0	1/32D 1/6B	O	O	—	—	—
	DMF5005N*5)	0.49 x 0.49	0.53 x 0.53	(180.0 x 65.0 x 12.0)	(132.0 x 39.0)	1/64D 1/9B	O	O	—	—	—
240 x 128	DMF660N	0.40 x 0.40	0.45 x 0.45	144.0 x 104.0 x 12.5	114.0 x 64.0	1/128D 1/12B	O	O	—	—	—
256 x 128	DMF682N*5)	0.43 x 0.43	0.47 x 0.47	(147.0 x 116.0 x 12.0)	(127.0 x 70.0)	1/64D 1/9B	O	O	—	—	—
480 x 64	DMF612N	0.41 x 0.41	0.47 x 0.47	260.00 x 58.00 x 12.0	229.5 x 36.0	1/64D 1/9B	O	O	—	—	—
480 x 128	DMF605AN	0.41 x 0.41	0.47 x 0.47	259.0 x 90.0 x 12.6	229.5 x 66.0	1/64D 1/9B	O	O	—	—	—
	DMF624AN	0.41 x 0.41	0.47 x 0.47	259.0 x 90.0 x 12.6	229.5 x 66.0	1/64D 1/9B	O	O	—	—	—
	DMF6102N*5)	0.43 x 0.43	0.47 x 0.47	(268.0 x 94.0 x 12.6)	(229.5 x 66.0)	1/128D 1/12B	O	O	—	—	—
640 x 200	DMF651AN	0.32 x 0.46	0.35 x 0.49	275.0 x 132.0 x 12.6	232.0 x 106.0	1/200D 1/13B	O	O	O	—	—
	DMF6107NWU-FW*5)	0.32 x 0.46	0.35 x 0.49	(296.0 x 152.0 x 19.8)	(232.0 x 106.0)	1/200D 1/13B	—	—	O	—	O
640 x 400	DMF666AN	0.33 x 0.33	0.36 x 0.36	282.0 x 183.0 x 13.0	238.5 x 152.0	1/200D 1/13B	O	O	O	—	O
	DMF665NB	0.33 x 0.33	0.36 x 0.36	378.0 x 260.0 x 24.0	238.5 x 152.0	1/200D 1/12B	—	—	—	O	—
	DMF675NB*5)	0.29 x 0.29	0.32 x 0.32	(263.0 x 191.0 x 5.0)	(210.0 x 131.0)	1/200D 1/13B	—	—	—	O	—
	DMF694NWU-FW*5)	0.33 x 0.33	0.36 x 0.36	282.0 x 201.0 x 27.0	238.0 x 152.0	1/200D 1/13B	—	—	O	—	O
640 x 480	DMF6106N*5)	0.30 x 0.30	0.33 x 0.33	(271.0 x 195.4 x 13.5)	(219.0 x 166.0)	(1/240D 1/14B)	O	O	—	—	—
640 x 480	DMF50260	0.27 x 0.27	0.30 x 0.30	(260.0 x 174 x 6.5)	(198.0 x 150.0)	(1/240D 1/14B)	O	O	O	O	O

Neutral Mode, Yellow Mode and Blue Mode etc, are available.

Various types of back light are available in its series, and stated with following abbreviations.
R. . . . .Reflective Type EL...With EL
FL . . . .With Cold Cathode Fluorescent Tube
OHP . .Transmissive for OHP
BW . . .Black and White with FL



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HARISON **PICC**

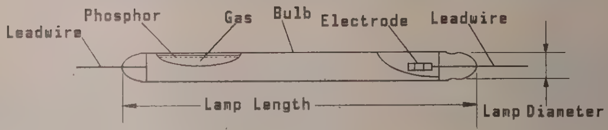
Miniature Cold Cathode Fluorescent Lamps

Features

- Three available whites
  (NWE) natural white, (DWE) daylight white, (BWE) blue white.
- Variable lengths from 50-340mm.
- Variable diameters from 3.0-6.5mm.
- Wire terminal termination.
- Wide color temperature range from 5000° to 8500°.
- Low power consumption.
- Tipless design for tight space requirements.
- Very low heat generation.
- Long life - up to 20,000 hours for larger diameter types.
- High brightness - up to 28,000 cd/M^2.

Applications

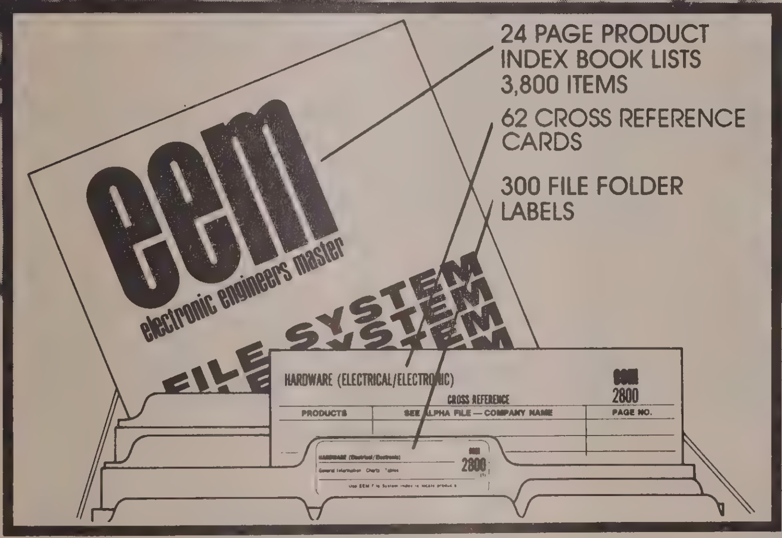
- Backlighting for liquid crystal displays.
- Lighting for panel legends.
- Slide and document scanners.
- Copy and FAX machines.



Lamp Selection Guide

LAMP PART NUMBER	TUBE DIAMETER (mm)	LENGTH (mm)	EFFECTIVE LENGTH (mm)	LAMP CURRENT (mA)	LAMP VOLTAGE (Vrms)	AVERAGE BRIGHTNESS (cd/m^2)	AVERAGE LIFE (Hrs)
HMBS3(NWE)130B	3.0	130 ± 1.5	100	5.0	310	27,500	15,000
HMBS3(NWE)200B	3.0	200 ± 1.5	170	5.0	450	27,500	15,000
HMBS38(NWE)130B	3.8	130 ± 1.5	100	5.0	300	19,500	20,000
HMBS38(NWE)200B	3.8	200 ± 1.5	170	5.0	420	19,500	20,000
HMBS(NWE)4130B	4.1	130 ± 1.5	100	5.0	290	14,000	20,000
HMBS(NWE)4200B	4.1	200 ± 1.5	170	5.0	390	14,000	20,000
HMBS5(NWE)130B	4.8	130 ± 1.5	100	5.0	280	12,000	20,000
HMBS5(NWE)200B	4.8	200 ± 1.5	170	5.0	370	12,000	20,000
HMBSH3(NWE)200B	3.0	200 ± 1.5	170	5.0	520	28,000	20,000
HMBSH38(NWE)130B	3.8	130 ± 1.5	100	5.0	320	21,000	20,000
HMBSH38(NWE)200B	3.8	200 ± 1.5	170	5.0	490	21,000	20,000
HMBSH4(NWE)130B	4.1	130 ± 1.5	100	5.0	310	16,000	20,000
HMBSH4(NWE)200B	4.1	200 ± 1.5	170	5.0	460	16,000	20,000
HMBSH5(NWE)130B	4.8	130 ± 1.5	100	5.0	300	13,000	20,000
HMBSH5(NWE)200B	4.8	200 ± 1.5	170	5.0	440	13,000	20,000
HMB4(NWE)130B	4.1	130 ± 1.5	100	5.0	260	12,000	15,000
HMB4(NWE)200B	4.1	200 ± 1.5	170	5.0	350	12,000	15,000
HMB5(NWE)130B	4.8	130 ± 1.5	100	5.0	250	10,000	15,000
HMB5(NWE)200B	4.8	200 ± 1.5	170	5.0	340	10,000	15,000
HMB6(NWE)130B	5.8	130 ± 1.5	100	5.0	240	7,000	20,000
HMB6(NWE)200B	5.8	200 ± 1.5	170	5.0	330	7,000	20,000
HMB7(NWE)130B	6.5	130 ± 1.5	100	5.0	230	5,500	20,000
HMB7(NWE)200B	6.5	200 ± 1.5	170	5.0	320	5,500	20,000

Pacific Industrial Components Corporation ❖ 24907 Avenue Tibbetts Unit C ❖ Valencia, California 91355
Phone (805) 257-7901 ❖ FAX (805) 257-6490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Polytronix, Inc. *LEADING THE WAY IN DISPLAY TECHNOLOGY*

Standard & Custom Liquid Crystal Modules

Polytronix, Inc. offers a wide variety of standard Twisted Nematic(TN) and Super Twisted Nematic(STN) display modules. These modules are available with a wide temperature range fluid and choice of back lighting. The standard modules are divided into character and graphic types. The (STN) displays are available in all models with a choice of yellow, green, blue or neutral backgrounds.

- ***Wide Viewing Angle and High Contrast***
- ***Fast Prototypes***
- ***High Reliability and Quality***
- ***Volume Production***
- ***Wide Operating Temperature Range***
- ***A Variety of Backlight***

TM

Graphic Modules

Display Format (Dot)	Model No.	Module size (WxHxT)	Effective Viewing Area (WxH)	Dot Pitch (WxH)	Dot Size (WxH)	Driving Method (Duty)	Approx. Weight (g)	Backlight			
								None	EL	LED	CCFT
128 x 16	PVG 120101	85 x 36 x 10	71.0 x 13.0	0.52 x 0.52	0.48 x 0.48	1/16	25	○	○	○	
128 x 32	PVG120301	85 x 45 x10	71.0 x 21.0	0.52 x 0.52	0.48 x 0.48	1/32	30	○	○	○	
128 x 64	PVG120601	113 x 65 x 10	73.4 x 38.8	0.52 x 0.52	0.48 x 0.48	1/64	80	○	○	○	
	PVG120602	93 x 70 x 8.5	70.76 x 38.8	0.52 x 0.52	0.48 x 0.48	1/64	65	○	○	○	
128 x 128	PVG121201	88.4 x 88.4 x 11	69.0 x 69.0	0.50 x 0.50	0.46 x 0.46	1/64	80	○			
160 x 160	PVG161601	106 x 106 x 11	85.0x 85.0	0.50 x 0.50	0.46 x 0.46	1/80	100	○			
192 x 64	PVG190601	120 x 62 x 11	100.0 x 37.0	0.50 x 0.50	0.46 x 0.46	1/64	80	○	○		
240 x 24	PVG240201	188 x 53 x 10	156.0 x 20.0	0.60 x 0.65	0.55 x 0.60	1/24	125	○			
240 x 64	PVG240601	180 x75 x 10	132.6 x 39.0	0.53 x 0.53	0.49 x 0.49	1/64	140	○	○		
	PVG240602	140 x 55 x 10	111.0 x 39.0	0.44 x 0.53	0.40 x 0.48	1/64	100	○	○		
	PVG240603	140 x 62 x 10	111.0 x 39.0	0.44 x 0.53	0.40 x 0.48	1/64	105	○	○		
	PVG240604	205 x 92 x 13	157.0 x 63.0	0.62 x 0.86	0.58 x 0.84	1/64	190	○	○		
240 x 128	PVG241201	176 x 96 x 12	134.0 x 76.0	0.53 x 0.53	0.49 x 0.49	1/128	150	○	○		
	PVG241202	128 x 77 x 12	78.0 x 44.5	0.30 x 0.30	0.27 x 0.27	1/128	90	○	○		
256 x 128	PVG251201	200 x 110 x 12	128.0 x 66.5	0.48 x 0.48	0.44 x0.44	1/64	200	○	○		
	PVG251202	147 x 116 x 12	127.0 x 70.0	0.47 x 0.47	0.43 x 0.43	1/64	155	○	○		
320 x 200	PVG322001	182 x 143 x 11	128.0 x 110.0	0.38 x 0.52	0.34 x 0.48	1/200	350	○	○		
	PVG322002	130 x 84 x 10	105.6 x 66.0	0.33 x 0.33	0.30 x 0.30	1/200	170	○	○		○
480 x 128	PVG481201	261 x 96 x 12	238.0 x 70.0	0.43 x 0.43	0.39 x 0.39	1/128	320	○	○		○
640 x 200	PVG642001	256 x 128 x 12	232.2 x 106.0	0.32 x 0.46	0.29 x 0.43	1/200	370	○	○		○
	PVG642002	200 x 93 x 9	176.8 x 70.0	0.27 x 0.33	0.24 x 0.30	1/200	250	○	○		○
640 x 400	PVG644001	270 x 198 x 12	236.0 x 153.6	0.33 x 0.33	0.30 x 0.30	1/200	410	○	○		○
640 x 480	PVG644801	256.5 x 160.0 x 10	183.0 x137.0	0.28 x 0.28	0.25 x 0.25	1/240					

Character Modules

No. of Display Char x Line	Model No.	Character Size Fonts (Dots w/cursor)	Module Size (WxHxT)	Effective Module Size (WxH)	Character Size (W x H)	Dot Size (WxH)	Driving Method (Duty)	Approx Weight (g)	Process & Color				Backlight			
									TN	STBN Yellow	STN Blue	STN Gray	None	EL	LED	CCFT
16 x 1	PVC 160101	5 x 7	80 x 36 x 9.5	64.5 x 14.0	3.07 x 6.56	0.55 x 0.75	1/16	25	○	○	○	○	○	○	○	
	PVC160102	5 x 10	85 x 36 x14	63.5 x 15.8	3.21 x 8.76	0.61 x 0.76	1/11	34	○	○	○	○	○	○	○	
	PVC160103	5 x 7	84 x 44 x 9.5	64.5 x 16.0	3.07 x 6.56	0.55 x 0.75	1/16	30	○	○	○	○	○	○	○	
	PVC160104	5 x 7	122 x 33 x 13	99.5 x 14.0	4.84 x 8.06	0.92 x 1.10	1/16	52	○	○	○	○	○	○	○	
	PVC160105	5 x 7	61 x 30 x 10.5	45.0 x 12.0	2.35 x 4.71	0.43 x 0.63	1/16	18	○	○	○	○	○	○	○	
16 x 2	PVC160201	5 x 7	84 x 44 x 9.5	61.0 x 16.1	2.95 x 4.75	0.55 x 0.55	1/16	34	○	○	○	○	○	○	○	
	PVC160202	5 x 7	80 x 36 x 11	61.0 x 17.6	2.95 x 4.75	0.55 x 0.55	1/16	34	○	○	○	○	○	○	○	
	PVC160203	5 x 7	84 x 44 x 9.5	61.0 x 16.1	2.95 x 4.75	0.55 x 0.55	1/16	34/35	○	○	○	○	○	○	○	
	PVC160204	5 x 7	85 x 36 x 9.5	63.5 x 15.8	2.96 x 5.56	0.56x 0.66	1/16	31.5	○	○	○	○	○	○	○	
	PVC160205	5 x 7	122 x 44 x 9.5	99.0 x 24.0	6.00 x 10.34	0.92 x 1.10	1/16	75	○	○	○	○	○	○	○	
	PVC160206	5 x 8	85 x 30 x 10	62.0 x 16.0	2.78 x 4.89	0.50 x 0.55	1/16	30	○	○	○	○	○	○	○	
	PVC160207	5 x 7	85 x 32.6 x 9.5	63.5 x 15.8	2.96 x 5.56	0.56 x 0.66	1/16	31.5	○	○	○	○	○	○	○	
16 x 4	PVC160401	5 x 7	87 x 60 x 9.5	61.8 x 25.2	2.95 x 4.75	0.55 x 0.55	1/16	65	○	○	○	○	○	○	○	
20 x 1	PVC200101	5 x 7	80 x 36 x 9.5	63.6 x 13.8	2.20 x 3.80	0.40 x 0.50	1/8	26	○	○	○	○	○	○	○	
	PVC200102	5 x 7	100 x 22 x 9.4	70.0 x 10.0	2.75 x 4.45	0.47 x 0.55	1/16	30	○	○	○	○	○	○	○	
	PVC200103	5 x 7	120 x 36 x 11.1	88.2 x 20.0	2.90 x 7.70	0.50 x 0.55	1/16	60	○	○	○	○	○	○	○	
20 x 2	PVC200201	5 x 7	116 x 39 x 9.5	83.0 x 18.6	3.20 x 5.55	0.60 x 0.65	1/16	42/55	○	○	○	○	○	○	○	
	PVC200202	5 x 7	115 x 36 x 11	83.0 x 18.6	3.20 x 4.85	0.60 x 0.65	1/16	42/55	○	○	○	○	○	○	○	
20 x 4	PVC200401	5 x 7	98 x 60 x 9.5	76.0 x 25.2	2.95 x 4.75	0.55 x 0.55	1/16	70	○	○	○	○	○	○	○	
	PVC200402	5 x 7	77 x 47 x 11.5	58.6 x 21.1	2.30 x 3.52	0.42 x 0.46	1/16	57	○	○	○	○	○	○	○	
24 x 1	PVC240101	5 x 10	126 x 36 x 10.1	100.0 x 13.8	3.15 x 8.70	0.55 x 0.70	1/11	50	○	○	○	○	○	○	○	
24 x 2	PVC240201	5 x 7	113 x 36 x 9.5	93.5 x 16.0	3.20 x 5.55	0.60 x 0.65	1/16	46	○	○	○	○	○	○	○	
	PVC240202	5 x 7	118 x 36 x 10.5	93.5 x 15.8	3.20 x 5.55	0.65x 0.70	1/16	50	○	○	○	○	○	○	○	
32 x 1	PVC320101	5 x 10	174.5 x 31 x 11.5	123.5 x 16.5	3.20 x 7.43	0.60 x 0.63	1/11	70	○	○	○	○	○	○	○	
32 x 2	PVC320201	5 x 7	174.5 x 31 x 10.2	141.2 x 16.7	3.45 x 4.83	0.65 x 0.56	1/16	72	○	○	○	○	○	○	○	
40 x 1	PVC400101	5 x 10	182 x 33.5 x 10.8	154.4 x 15.8	3.15 x 8.70	0.55 x 0.70	1/11	75	○	○	○	○	○	○	○	
40 x 2	PVC400201	5 x 7	182 x 33.5 x 10.8	154.4 x 15.8	3.20 x 5.55	0.60 x 0.65	1/16	75	○	○	○	○	○	○	○	
	PVC400202	5 x 7	149.4 x 27 x 10.8	130.8 x 13.2	2.70 x 4.03	0.50 x 0.46	1/16	55	○	○	○	○	○	○	○	
40 x 4	PVC400401	5 x 7	190 x 54 x 11	147.0 x 29.5	2.78 x 4.27	0.50 x 0.47	1/16	125	○	○	○	○	○	○	○	
80 x 2	PVC800201	5 x 7	264 x 50 x 15	207.0 x 16.0	2.05 x 3.31	0.37 x 0.42	1/16	150	○	○	○	○	○	○	○	
80 x 4	PVC800401	5 x 7	290 x 88 x 15	227.0 x 33.0	2.30 x 4.15	0.42 x 0.47	1/16	200	○	○	○	○	○	○	○	

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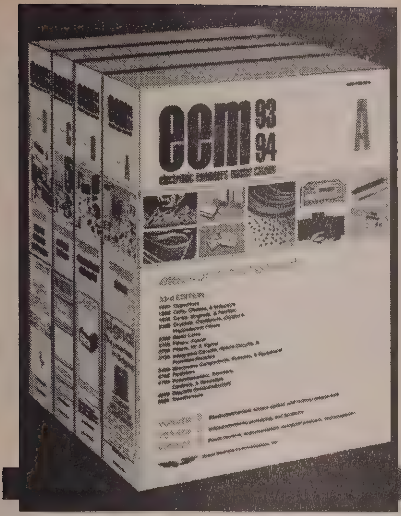

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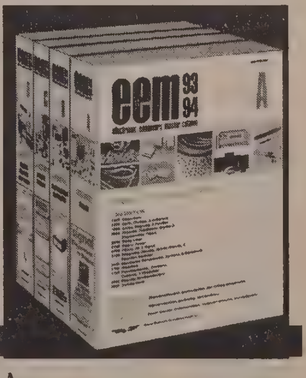

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Special Purpose CRT's

The CRT's in this category are indicative of the unique engineering capabilities of Raytheon Company that can be brought to bear on your specialized application. The types listed below represent a few of the dozens of special purpose CRT's designed by Raytheon to meet specific display problems.

	Screen Size Inch	Screen Shape	
CK2688	1.7	○	Matched Red, Green, Blue Tubes for Full-Color Simulator
CK1721	12	○	Internal Black Graticule in Phosphor Plane
CK1694	16	○	Internal Grey Semi-Opaque Graticule in Phosphor Plane
CK2663	21	○	Divided Screen - One Long Persistence, - One Short Persistence
CK1437	7	○	Rear Optical Window for Photography Use
CK1563	2	○	Dual-Gun Storage Tube for Scan Conversion
CK1414	2	○	Character and Symbol Generator, Internal Font

Note: All phosphors are available, including dual-color, dual-persistence; voltage penetration color; & special Raytheon proprietary formulations to suit different customer applications.

Ground Based/Shipboard Radar CRT's

Cathode-ray tubes in this category are used for military, air traffic control, and commercial marine applications. They provide the primary interface between the operator and the radar data to be evaluated. For military shipboard applications these tubes are often designed to withstand extreme requirements of shock, vibration, humidity and temperature. Many of these CRT's are supplied as complete packaged assemblies to withstand this type of environment. Tubes used in control towers and on the bridges of ships, where the ambient light may be high, are available with Rayvue® contrast enhancement filters spectrally matched to the phosphor of the tube. Where computer information is mixed with radar information, two-color, two-persistence phosphor blends are available to enhance the display.

Tube Type	Bulb O.D. Dimensions inch	Screen Shape	Neck OD (nominal)		Overall Length		Type of Focus*	Line Width Center inch	Comments
			inch	mm	inch	cm			
CK2741	12.3 x 12.3	□	1 1/8	28	15.6	39.6	EHV	.010	High Contrast
CK2728	16.9 x 16.9	□	1 7/16	36	22.3	56.6	M	.010	
CK2676	22.8 x 22.8	□	1 1/8	28	30.0	76.2	EHV	.015	Flat Face
CK2722	10.2 x 12.6	▭	1 7/16	36	19.1	48.5	EHV	.008	Full Potted Assembly
CK2700	12.4 x 15.5	▭	7/8	22	21.0	53.3	EHV	.015	Yoke Assembly
CK2641	12.4 x 15.5	▭	1 7/16	36	18.7	47.5	EHV	.008	Meets Tempest Rqmts.
CK2701	13.5 x 17.3	▭	1 1/8	28	19.3	49.0	EHV	.009	
CK1742	16.3 x 20.2	▭	1 7/16	36	25.7	65.2	ELV	.010	CAD CAM Usage
CK2704	17.4 x 22.5	▭	1 7/16	36	23.1	58.6	EHV	.008	
CK2608	17.4 x 22.5	▭	1 7/16	36	25.7	65.2	EHV	.011	Full Packaged Assembly
CK1764	12.5 Dia	○	1 7/16	36	18.5	47.0	ELV	.015	Rugged Assembly
CK2634	16.0 Dia	○	1 7/16	36	25.5	64.7	EHV	.013	Yoke Assembly
CK2736	16.0 Dia	○	1 1/8	28	21.8	55.3	EHV	.010	Yoke Assembly
CK2633	22.8 Dia	○	1 1/8	28	25.3	64.2	EHV	.008	

Note: All phosphors are available, including dual-color, dual-persistence; voltage penetration color; and special Raytheon proprietary formulations to suit different customer applications. *ELV = Low voltage focus, ERV = High voltage focus, M = Magnetic focus.

Airborne Display CRT's

Cathode-ray tubes for airborne applications usually require high reliability and a ruggedized construction to withstand shock and vibration stresses. A high contrast ratio is needed where the ambient light may be intense, as in the cockpit of an aircraft. Many avionics display tubes are supplied as packaged assemblies, incorporating tube, deflection yoke, magnetic shield, Rayvue® contrast enhancement filter, flying leads, mounting brackets, and connectors. Such assemblies are generally custom designed to meet specific system requirements.

Tube Type	Useable Screen Dimensions		Deflection Angle	Screen Shape	Neck OD (nominal)		Overall Length		Type of Focus*	Anode Voltage	Line Width Center	Comments
	inch	cm			inch	mm	inch	cm		kV	inch	
CK2703	2.6 Dia	6.6 Dia	70°	○		7/8	22	10.0	25.4	ELV	6	.010
CK2657	1.7 x 2.2	4.3 x 5.6	70°	▭	7/8	22	9.0	22.8	EHV	16	.0015	High Resolution
CK2656	2.1 x 2.8	5.3 x 7.1	70°	▭	7/8	22	6.0	15.2	ELV	16	.006	
CK2709	5.0 x 7.0	12.7 x 17.7	52°	▭	7/8	22	16.3	41.4	EHV	20	.012	Full Pkg. Assembly
CK2698	5.5 x 7.3	14 x 18.5	70°	▭	7/8	22	13.1	33.2	EHV	18	.006	
CK2696	3.4 x 3.4	8.6 x 8.6	70°	□	7/8	22	8.5	21.5	EHV	15	.005	Full Pkg. Assembly
CK2707	4.5 x 4.5	11.4 x 11.4	70°	□	7/8	22	10.2	26	EHV	20	.006	Full Pkg. Assembly
CK2632	4.8 x 4.8	12.2 x 12.2	70°	□	7/8	22	10.6	27	EHV	20	.007	Full Pkg. Assembly
CK1754	5.0 x 5.0	12.7 x 12.7	59°	□	7/8	22	13.1	33.2	EHV	20	.007	
CK2715	6.0 x 6.0	15.2 x 15.2	70°	□	7/8	22	12.1	30.7	EHV	20	.007	
CK2659	8.0 x 8.0	20.3 x 20.3	70°	□	7/8	22	14.2	36.0	EHV	10	.010	

Note: All phosphors are available, including dual-color, dual-persistence; voltage penetration color; and special Raytheon proprietary formulations to suit different customer applications. *ELV = Low voltage focus, EHV = High voltage focus.

Raytheon

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Head Up Display CRT's

These tubes are designed for airborne head up display applications with very high shock and vibration stresses found in modern fighter aircraft. They provide the extreme brightness levels required for complex optical systems.

Tube Type	Useable Screen Dimensions		Deflection Angle	Screen Shape	Neck OD (nominal)		Overall Length		Peak Line Brightness	Anode Voltage	Line Width Center	Comments
	inch	cm			inch	mm	inch	cm	FL	kV	inch	
CK2711	1.4 Dia	3.5 Dia	45°	○	7/8	22	6.2	15.7	12K	15	.007	
CK2726	2.7 Dia	6.8 Dia	45°	○	7/8	22	9.7	24.6	41K	20	.009	
CK2729	2.5 x 2.75	6.3 x 7	55°	□	7/8	22	7.5	19	14K	20	.005	
CK1757	2.6 Dia	6.6 Dia	70°	○	7/8	22	6.2	15.7	13K	20	.009	
CK2697	3.0 Dia	7.6 Dia	45°	○	7/8	22	8.0	20.3	12K	15	.010	
CK2740	2.0 Dia	5 Dia	45°	○	7/8	22	6.5	16.5	5K	20	.0017	Packaged Assembly

Note: All phosphors are available, including dual-color. dual-persistence, voltage penetration color; & special Raytheon proprietary formulations to suit different customer applications.

Summary of JEDEC registered phosphor characteristics, as published by EIA in Publication TEPAC 116, giving old (P1-P57) and new Worldwide (XX) designations.

Designation Old	Designation New	Color - See Chart	Principal Spectral Peak (nm)	Persistence Classification	Decay Time to 10% of Initial Brightness	Typical Applications
P1	GJ	yellow-green	525	medium	24 ms	Very high brightness displays - 60 Hz
P2	GL	yellow-green	535	med-short	~75 µS	Oscillograph
P4	WW	white	460	med-short	20 µS	Black and white TV and projection
					60 µS	
P7	GM	blue-yellow-	440	med-short	~50 µS	PPI radar
		green	555	long	350 ms	
P11	BE	blue	460	med-short	~50 µS	Photorecording
P12	LB	orange	590	long	200 ms	PPI Radar
P14	YC	blue-orange	440	med-short	25 µS	PPI Radar
		yellow	600	medium	5 ms	
P16	AA	violet	380	very short	0.12 µS	Flying spot scanners
P19	LF	orange	590	long 220 ms	PPI Radar	
P20	KA	yellow-green	560	med-short	~200 µS	Visual displays and photo recording
P22	X (xx)	blue-	450	med-short	40 µS	Color TV
		green	516	med-short	40 µS	
		red	630	med-short	1 ms	
P24	GE	green	510	short	~1.5 µS	Flying spot scanners
P25	LJ	orange	510	medium	45 ms	PPI Radar
P26	LC	orange	595	very long	~10 sec	PPI Radar
P28	KE	yellow-green	550	long	600 ms	PPI Radar and low refresh rate displays
P31	GH	green	522	med-short	40 µS	60 Hz refresh rate displays
P33	LD	orange	587	very long	7 sec	PPI Radar
P36	KF	yellow-green	550	very short	0.25 µS	Flying spot scanners
P37	BK	green-blue	470	very short	0.15 µS	Flying spot scanners
P38	LK	orange	600	very long	1 sec	Radar and low refresh rate displays
P39	GR	yellow-green	525	long	150 ms	40 Hz refresh rate displays
P40	GA	white	440	med-short	150 µS	PPI Radar and low refresh
		yellow-green	550	long	350 ms	rate displays
P43	GY	yellow-green	544	medium	1.2 ms	High brightness display. Works well
P44	GX					with contrast enhancement filters.
P45	WB	white	†	medium	1.8 ms	High brightness P4 alternate
P46	KG	yellow-green	530	very short	0.16 µS	Flying spot scanners
P47	BH	purple-blue	400	very short	0.08 µS	Flying spot scanners
P48	KH	yellow	400	very short	0.12 µS	Flying spot scanners
		green	525			
P49	VA	red	615	medium	1.2 ms	Graphic displays.
		green	525	medium	30 ms	Voltage-dependent color.
P50	VB	red	620	medium	5 ms	Graphic displays.
		green	535	med-short	20 ms	Voltage-dependent color, 8-15 kV.
P51	VC	red	620	medium	22 ms	Graphic displays.
		green	545	med-short	30 µS	Voltage-dependent color, 6-12 kV.
P53	KJ	green	544	medium	7 ms	High-luminence avionics applications
P57	LL	green	525	long	840 ms	Radar
		orange	588	very long	20 s	

Protective Panels and Coatings

Designation	Front Surface Etch	Front Surface AR	Front Surface EMI	Rear Surface AR	Rear Surface EMI
A	---(Untreated Panel)---				
B		X			
C			X		
D	X				
E		X			X

Designation	Front Surface Etch	Front Surface AR	Front Surface EMI	Rear Surface AR	Rear Surface EMI
F	X	X			
G	X		X		
H	X	X			X
J		X	X		
K	X	X	X		

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SAMSUNG LCD

Since it began producing B/W picture tubes in the early 1970s for the first time in Korea, Samsung Display Devices added its new business lines for color picture tubes (CPTs), monitors, terminals in the 1980s.

Also Samsung Display Devices currently manufactures a wide variety of computer products, LCDs and VFDs — a further step toward becoming a frontrunner in the world's visual and data display products manufacturing industry.

In May, 1990, Samsung Display Devices started to run a new LCD plant including STN production line whose capacity is the largest in the world.

But not satisfied with those achievement, Samsung Display Devices not only improves the quality of its products, but also diversifies the models and functions of them to make better and cheaper products.

In the near future, Samsung Display Devices will become the frontrunner of the world's visual data display products industry, making such advanced products as TFT for color TV or high resolution and high reliability display goods.

ORDERING INFORMATION

- Model No.
- Display Mode (TN, STN) and Background Color (Yellow Green, Blue, Neutral...)
- Backlight (None, E/L, LED, CCFL) and Backlight Color
- Temperature Range (Normal, Extended)
- Viewing Direction (6:00, 12:00, ...)
- Power Supply (Single Source, Double Source)
- Polarizer Type (Reflective, Transflective (Positive, Negative), Transmissive (Positive, Negative)
- Chassis Plating (Zinc, Dacro)
- Connector (None, Pin (Straight, Right-Angle), Flexible Cable)

Type		Operating Temp. (°C)	Storage Temp. (°C)
TN	Normal	0~50	−20~70
	Extended	−20~70	−30~80
STN	Normal	0~40	−10~60

■ For Graphic Display Modules

(Unit : mm)

DOTS OR PIXELS (W×H)	MODEL NO.	MODULE SIZE (W×H)	VIEWING AREA (W×H)	DOT PITCH (W×H)	DOT SIZE (W×H)	DRIVING METHOD (DUTY)	SUPPLY VOLTAGE	RECOMMENDED SUPPLY VOLTAGE		WEIGHT (g)	BACK-LIGHT		
											STN		
								VDD — Vss(V)	VEE — Vss(V)		NONE	EL	CCFL
120×32	UG-12A-01	152×56×10.5	90.0×32.0	0.70×0.80	0.65×0.75	1/32	DOUBLE	5.0	−4.6	120	○	○	
128×64	UG-13B-01	93×70×8.5	70.7×38.8	0.52×0.52	0.48×0.48	1/64	DOUBLE	5.0	−10.0	60	○		
	UG-13B-02	113×65×11.5	73.4×38.8	0.52×0.52	0.48×0.48	1/64	DOUBLE	5.0	−8.2	80	○	○	
240×64	UG-24B-01	180×75×11.0	132.0×39.0	0.53×0.53	0.48×0.48	1/64	DOUBLE	5.0	−15.0	140	○	○	
	UG-24B-02	180×75×10.5	132.6×39.0	0.53×0.53	0.48×0.48	1/64	DOUBLE	5.0	−11.2	140	○	○	
	UG-24B-03	180×65×12.0	132.0×39.0	0.53×0.53	0.49×0.49	1/64	DOUBLE	5.0	−8.6	140	○	○	
	UG-24B-04	149×57×12.0	117.0×41.0	0.47×0.47	0.44×0.44	1/64	DOUBLE	5.0	−12.0	95	○	○	
	UG-24B-05	200×66×23	132×39	0.53×0.53	0.49×0.49	1/64	DOUBLE	5.0	−11.5	234			○
	UG-24B-06	180×75×11.0	132×39	0.53×0.53	0.48×0.48	1/32	DOUBLE	5.0	−7.5	—	○	○	
	UG-24B-07	180×70×14	131×38	0.53×0.53	0.50×0.50	1/64	DOUBLE	5.0	−11.5	—			○
240×128	UG-24D-01	144×104×11.0	114.0×64.0	0.45×0.45	0.40×0.40	1/128	DOUBLE	5.0	−19.0	138	○	○	
	UG-24D-02	176×96×12.0	135.0×76.0	0.53×0.53	0.49×0.49	1/128	DOUBLE	5.0	−16.8	200	○	○	
256×128	UG-25D-01	147×116×12.0	127.0×70.0	0.47×0.47	0.43×0.43	1/128	DOUBLE	5.0	−17.0	180	○	○	
320×240	UG-32F-01	143×96.8×12.0	104.0×79.3	0.30×0.30	0.27×0.27	1/240	DOUBLE	5.0	−21.5	170	○	○	
	UG-32F-02	142×96×12	104.0×79.3	0.30×0.30	0.27×0.27	1/240	DOUBLE	5.0	−22.5	170	○	○	
	UG-32F-03	154×96×13.7	102.0×76.8	0.30×0.30	0.27×0.27	1/240	DOUBLE	5.0	−22.5	197			○
480×64	UG-48B-01	296.8×76.2×11.7	239.4×38.1	0.49×0.49	0.44×0.44	1/64	DOUBLE	5.0	−13.7	180	○	○	
	UG-48B-02	270×82×11.0	240.0×38.0	0.49×0.49	0.44×0.44	1/64	DOUBLE	5.0	−10.5	180	○	○	
	UG-48B-03	260×58×12.0	229.5×36.0	0.47×0.47	0.41×0.41	1/64	DOUBLE	5.0	−12.0	160	○	○	
480×128	UG-48D-01	270×110×11.1	242.0×69.0	0.48×0.48	0.43×0.43	1/128	DOUBLE	5.0	−13.7	320	○	○	
	UG-48D-02	268×94×11.5	231.5×66.0	0.47×0.47	0.43×0.43	1/128	DOUBLE	5.0	−13.0	320	○	○	
480×250	UG-48G-01	182.5×96×15.5	144×77	0.29×0.29	0.26×0.26	1/250	DOUBLE	5.0	−22.5	260			○
640×200	UG-64E-02	270×150×12.0	240.0×104.0	0.35×0.35	0.32×0.32	1/200	DOUBLE	5.0	−21.5	480	○	○	
	UG-64E-03	270×104×11.0	236.4×78.0	0.36×0.36	0.33×0.33	1/200	DOUBLE	5.0	−20.0	290	○	○	
	UG-64E-05	270×104×7.5	236.4×78.0	0.36×0.36	0.33×0.33	1/200	DOUBLE	5.0	−21.0	138	○	○	
	UG-64E-07	210.6×98.9×2.9	183×71.2	0.27×0.33	0.24×0.30	1/200	DOUBLE	5.0	−22.75	75	○		
640×400	UG-64H-02	290×170×13.0	238.0×152.0	0.36×0.36	0.33×0.33	1/200	DOUBLE	5.0	−21.7	560	○	○	
640×480	UG-641-01	257×158.5×10.0	180.0×135.0	0.27×0.27	0.24×0.24	1/240	DOUBLE	5.0	−16.2	420			○
	UG-641-02	263.5×169×9.0	198.0×150.0	0.30×0.30	0.27×0.27	1/240	DOUBLE	5.0	−17.8	—			○
	UG-641-03	253×174×7.0	196×147.6	0.30×0.30	0.27×0.27	1/240	DOUBLE	5.0	−22.25	340			○

★ The above spec. may be changed by Rev. No.

★ Customized modules are available.

SAMSUNG

DISPLAY DEVICES

SAMSUNG LCD

Type		Operating Temp. (°C)	Storage Temp. (°C)
TN	Normal	0~50	−20~70
	Extended	−20~70	−30~80
STN	Normal	0~40	−10~60

■ For Character Display Modules

(Unit : mm)

NO. OF DISPLAY CHAR.×LINE	MODEL NO.	CHARACTER FONTS	MODULE SIZE (W×H×T)	HOLE-HOLE DISTANCE (W×H)	VIEWING AREA (W×H)	CHARACTER SIZE (W×H)	DOT SIZE (W×H)	DRIVING METHOD (DUTY)	APPROX WEIGHT (g)	BACK-LIGHT					
										TN/			STN		
										NONE	EL	LED	NONE	EL	LED
8×1	UC-081-01	5×8 DOTS	84×44×10.0	79 (76) 36	61.0×15.8	6.45×10.75	1.25×13.0	1/8	36	○	○		○	○	
8×2	UC-082-01	5×7 DOTS WITH CURSOR	58×32×10.0	53×27	35×15.0	2.45×3.8	0.45×0.5	1/16	25	○					
16×1	UC-161-01	5×8 DOTS	80×36×10.5	75×31	64.5×13.8	3.07×6.56	0.55×0.75	1/16	28	○	○		○	○	
	UC-161-02	5×8 DOTS	80×36.7×10.5	75×31	64.5×13.8	3.07×6.56	0.55×0.75	1/16	30	○	○		○	○	
	UC-161-03	5×7 DOTS	115×35×10.0 (15.0)	110×30	99.0×13.0	4.90×7.95	0.90×1.05	1/16	38 (58)	○	○	○	○	○	○
	UC-161-04	5×8 DOTS	80×36×10.0	75×31	64.5×13.8	3.07×6.56	0.55×0.75	1/16	25	○	○		○	○	
	UC-161-05	5×7 WITH CURSOR	85×32.6×10.5	80×31	61.0×16.0	2.95×7.15	0.55×0.75	1/16	30	○	○		○	○	
	UC-161-06	5×8 DOTS	80×36×10.5	75×31	64.5×13.8	3.15×6.30	0.55×0.70	1/8	30	○	○		○	○	
	UC-161-07	5×11 DOTS	80×36×10.0	75×31	64.5×13.0	3.20×8.20	0.60×0.70	1/11	30	○	○		○	○	
	UC-161-08	5×7 WITH CURSOR	122×33×11.0	115×25	99.0×13.0	4.84×9.66	0.92×1.10	1/8	39	○	○		○	○	
	UC-161-10	5×7 WITH CURSOR	80×36×8.0	75×31	65.6×13.8	3.20×6.60	0.60×0.70	1/16	23	○	○		○	○	
	UC-161-14	5×8 DOTS	80×36×10.0	75×31	64.5×13.0	3.20×5.95	0.60×0.70	1/16	28	○	○		○	○	
16×2	UC-162-01	5×8 DOTS	84×44×10.5	79 (76)×36	64.5×13.8	2.78×4.89	0.50×0.55	1/16	32	○	○		○	○	
	UC-162-02	5×8 DOTS	80×36×10.5	75×31	64.5×13.8	2.78×4.89	0.50×0.55	1/16	30	○	○		○	○	
	UC-162-03	5×7 DOTS WITH CURSOR	122×44×10.5 (15.0)	115×37	99.0×24.0	4.84×9.66	0.92×1.10	1/16	35 (55)	○	○	○	○	○	○
	UC-162-04	5×8 DOTS	85×36×10.5	80×31	64.5×13.8	2.78×4.89	0.50×0.55	1/16	32	○	○		○	○	
	UC-162-05	5×8 DOTS	84×37×10.0	77.5×*	64.0×16.4	3.20×5.55	0.60×0.65	1/16	30	○	○		○	○	
	UC-162-06	5×8 DOTS	84×44×10.0	79 (76)×36	61.0×15.8	2.96×5.56	0.56×0.66	1/16	30	○	○		○	○	
	UC-162-07	5×8 DOTS	85×32.6×10.5	80×31	61.0×16.0	2.95×5.55	0.55×0.65	1/16	28	○	○		○	○	
	UC-162-08	5×8 DOTS	80×36×10.5	75×31	64.5×13.8	2.95×4.35	0.55×0.50	1/16	30	○	○		○	○	
	UC-162-09	5×8 DOTS	80×30×10.0	77×24	63.5×15.8	2.96×5.56	0.56×0.66	1/16	24	○	○		○	○	
	UC-162-10	5×8 DOTS	84×44×11.0	79 (76)×36	61.0×16.0	2.95×5.55	0.55×0.65	1/16	37	○	○		○	○	
	UC-162-11	5×8 DOTS	84×45×15.0	79 (76)×36	61.0×16.0	2.95×5.55	0.55×0.65	1/16	46		○	○		○	○
	UC-162-12	5×8 DOTS	90×36×15.0	75×31	64.5×13.8	2.95×4.35	0.55×0.50	1/16	42		○	○		○	○
	UC-162-14	5×8 DOTS	83.4×37.5×8.5	77.4×31.5	65.5×14.8	2.95×4.35	0.55×0.50	1/16	30	○	○		○	○	
	UC-162-16	5×7 DOTS WITH CURSOR	120×44×15.0	115×37	99.0×24.0	4.84×9.66	0.928×1.11	1/16	55			○			○
16×4	UC-164-01	5×8 DOTS	87×60×10.0	82×55	61.8×25.2	2.95×4.75	0.55×0.55	1/16	50	○	○		○	○	
20×1	UC-201-01	5×8 DOTS	116×38×10.0	108×29	83.0×18.6	3.20×5.95	0.60×0.70	1/16	44	○	○		○	○	
	UC-201-02	5×7 DOTS WITH CURSOR	182×33.5×11.0	175×26.5	154.0×15.3	6.70×11.50	1.30×1.30	1/8	73	○	○		○	○	
20×2	UC-202-01	5×8 DOTS	116×37×10.0	108×29	83.0×18.6	3.20×5.55	0.60×0.65	1/16	45	○	○		○	○	
	UC-202-04	5×8 DOTS	115×38×10.0	108×29	83.0×18.6	3.20×5.55	0.60×0.65	1/16	44	○	○		○	○	
	UC-202-05	5×8 DOTS	116×37×11.0	108×29	83.0×18.6	3.20×5.56	0.60×0.65	1/16	45	○	○		○	○	
	UC-202-06	5×8 DOTS	95×30×10.0	92×24	80.3×15.8	3.20×5.55	0.60×0.65	1/16	26	○	○		○	○	
	UC-202-07	5×8 DOTS	126×37×15.0	108×29	83.0×18.6	3.20×5.55	0.60×0.65	1/16	64			○			○
	UC-202-12	5×8 DOTS	116×37×15.0	108×29	83.0×18.6	3.20×5.55	0.60×0.65	1/16	64			○			○
20×4	UC-204-01	5×8 DOTS	98×60×11.0 (15.0)	93×55	76.0×25.2	2.95×4.75	0.55×0.55	1/16	55 (77)	○	○	○	○	○	○
24×1	UC-241-01	5×8 DOTS	126×36×10.6	121×31	100.0×13.8	3.07×6.56	0.55×0.75	1/16	45	○	○		○	○	
24×2	UC-242-01	5×7 DOTS WITH CURSOR	118×36×10.0	113×31	93.5×15.8	3.15×5.75	0.55×0.55	1/16	45	○	○		○	○	
	UC-242-02	5×7 DOTS WITH CURSOR	108.5×34.8×10.0	*	93.5×15.8	3.15×5.75	0.59×0.59	1/16	45	○	○		○	○	
	UC-242-03	5×8 DOTS	118×36×11.0	113×31	93.5×15.8	3.20×5.55	0.60×0.65	1/16	46	○	○		○	○	
	UC-242-04	5×8 DOTS	118×36×11.0	113×31	94.5×17.9	3.20×5.55	0.60×0.65	1/16	46	○	○		○	○	
	UC-242-05	5×7 DOTS WITH CURSOR	154×39×12.0	*	133×20.3	4.26×5.98	0.82×0.82	1/16	62	○	○				
40×1	UC-401-01	5×8 DOTS	182×38.5×11.0	175×26.5	154.5×15.8	3.05×6.56	0.55×0.75	1/16	80	○	○		○	○	
40×2	UC-402-01	5×8 DOTS	182×35×11.0	175×28	154.5×15.8	3.20×5.55	0.60×0.65	1/16	80	○	○		○	○	
	UC-402-02	5×8 DOTS	182×33.5×10.0	175×26.5	154.5×15.8	3.15×5.50	0.55×0.60	1/16	74	○	○		○	○	
	UC-402-03	5×8 DOTS	170×30×10.0	167×24	155.1×15.8	3.20×5.55	0.60×0.65	1/16	47	○			○		
	UC-402-04	5×8 DOTS	170×31.5×15.0	167×23.2	151.6×14.2	3.20×5.55	0.60×0.65	1/16	74			○			○
	UC-402-06	5×8 DOTS	182×33.5×10.0	175×26.5	154.5×15.8	3.20×5.55	0.60×0.65	1/16	74	○	○		○	○	
40×4	UC-404-01	5×8 DOTS	190×55×10.0 (15.0)	183×48	147.0×29.5	2.78×4.89	0.50×0.55	1/16	100 (130)	○	○	○	○	○	○
	UC-404-02	5×7 DOTS WITH CURSOR	171.5×56.6×10.0	166.5×51.6	147.0×29.5	2.78×4.89	0.5×0.55	1.16	40	○	○				
80×2	UC-802-01	5×8 DOTS	259.8×38.9×11.0	252.6×31.7	222.0×16.5	2.20×4.35	0.40×0.50	1/16	150	○			○		

★ The above spec. maybe changed by Rev. No.

★ Customerized modules are available.

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SAMSUNG

DISPLAY DEVICES

eem

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

SII

Seiko Instruments

LIQUID CRYSTAL DISPLAYS

DOT MATRIX MODULES

Seiko Instruments USA Inc.(SII) Dot Matrix Character Modules were designed with your application in mind. The expanded range offers a wide variety of sizes, all using industry standard controllers and drivers. They are now available with our grey-mode Supertwist option for enhanced contrast and viewing angle. The compact modules are also available with an electroluminescent (EL) backlight or LED panel for use in dark environments.

- ☐ 5 x 7 Dot Matrix plus cursor
- ☐ Character generator and data RAM on board
- ☐ Compact, lightweight and low cost
- ☐ Single 5 volt input
- ☐ 4 or 8 bit parallel interface
- ☐ EL or LED backlight available
- ☐ Wide temperature option available

Model	No. Characters x No. Lines	Outside Dim. (W x H x D)	Character Size	Dot Size (W x H)
M1641	16 x 1 line	80 x 36 x 11.3	3.07 x 5.73	0.55 x 0.75
L1651	16 x 1 line	151 x 40 x 11	6.00 x 14.54	1. 52 x 1.765
M1632	16 x 2 lines	85 x 30 x 11.3	2.78 x 4.27	0.50 x 0.55
L1642	16 x 2 lines	80 x 36 x 11.3	2.95 x 3.80	0.55 x 0.50
L1652	16 x 2 lines	122 x 44 x 11.3	4.84 x 9.66	0.92 x 1.10
L1614	16 x 4 lines	87 x 60 x 11.6	2.95 x 4.15	0.55 x 0.55
L2012	20 x 2 lines	116 x 37 x 11.3	3.20 x 4.85	0.60 x 0.65
L2014	20 x 4 lines	98 x 60 x 11.6	2.95 x 4.15	0.55 x 0.55
L2432	24 x 2 lines	118 x 36 x 11.3	3.20 x 4.85	0.60 x 0.65
L4042	40 x 2 lines	182 x 33.5 x 11.3	3.20 x 4.85	0.60 x 0.65
M4024	40 x 4 lines	190 x 54 x 11.3	2.78 x 4.27	0.50 x 0.55

GRAPHIC MODULES

SII offers a wide variety of graphic LCD modules featuring Supertwist (STN) technology. Their excellent contrast and viewing angle solve many of the problems associated with large LCD displays. Our new FSTN technology provides the desirable black and white display when combined with CFL edgelighting.

Options

- ☐ Standard 4 or 8 bit parallel interface
- ☐ Reflective, transflective, or transmissive polarizers
- ☐ Positive or Negative (transmissive only) image
- ☐ CFL or EL backlighting
- ☐ Black and white using FSTN technology

Model	Dot Format (Col. x Row)	Outside Dim. (W x H x D)	Viewing Area (W x H)	Dot Size (W x H)
F1016	100 x 64	140 x 110 x 14.3	100 x 68	0.85 x 0.85
G191C	192 x 128	98 x 86 x 13.4	77.5 x 54	0.33 x 0.33
G2436	240 x 64	180 x 75 x 11.3	134 x 41	0.49 x 0.49
G2446[1,2]	240 x 64	193 x 79 x 15.1	134 x 41	0.49 x 0.49
G242C[1,2]	240 x 128	180 x 110 x 15.1	134 x 76	0.47 x 0.47
G321D[2]	320 x 200	166 x 134 x 15.1	128 x 110	0.34 x 0.48
G321E	320 x 240	150 x 96 x 14	103 x 80	0.30 x 0.30
G648D	640 x 200	270 x 150 x 12	239 x 104	0.32 x 0.46
G645F[2]	640 x 400	324 x 190 x 18	218 x 138.8	0.30 x 0.30
G642G[2]	640 x 480	272 x 209.4 x 14.7	220 x 168	0.30 x 0.30
G643G[2]	640 x 480	255.5 x 172 x 10.6	208 x 153	0.27 x 0.27

1. Includes built-in controller 2. Available with CFL edgelight

CUSTOM DISPLAYS

With over 15 years of custom LCD experience, SII can meet your needs for custom LCDs or custom Liquid Crystal Display Modules (LCM). Special type styles or graphic patterns are possible in glass sizes from 1/4" x 1/2" up to 10" x 7". Static drive up to 1/240 duty cycle, colored polarizers, and a variety of backlighting methods round out Seiko Instruments custom capabilities. Complete design and applications assistance is only a phone call away. Contact SII when your design calls for custom LCDs or LCMs, you will like the results.

Seiko Instruments USA Inc. Electronic Components Division, 2990 W. Lomita Blvd., Torrance, CA 90505
Telephone: (310) 517-7829, Fax: (310) 517-7792
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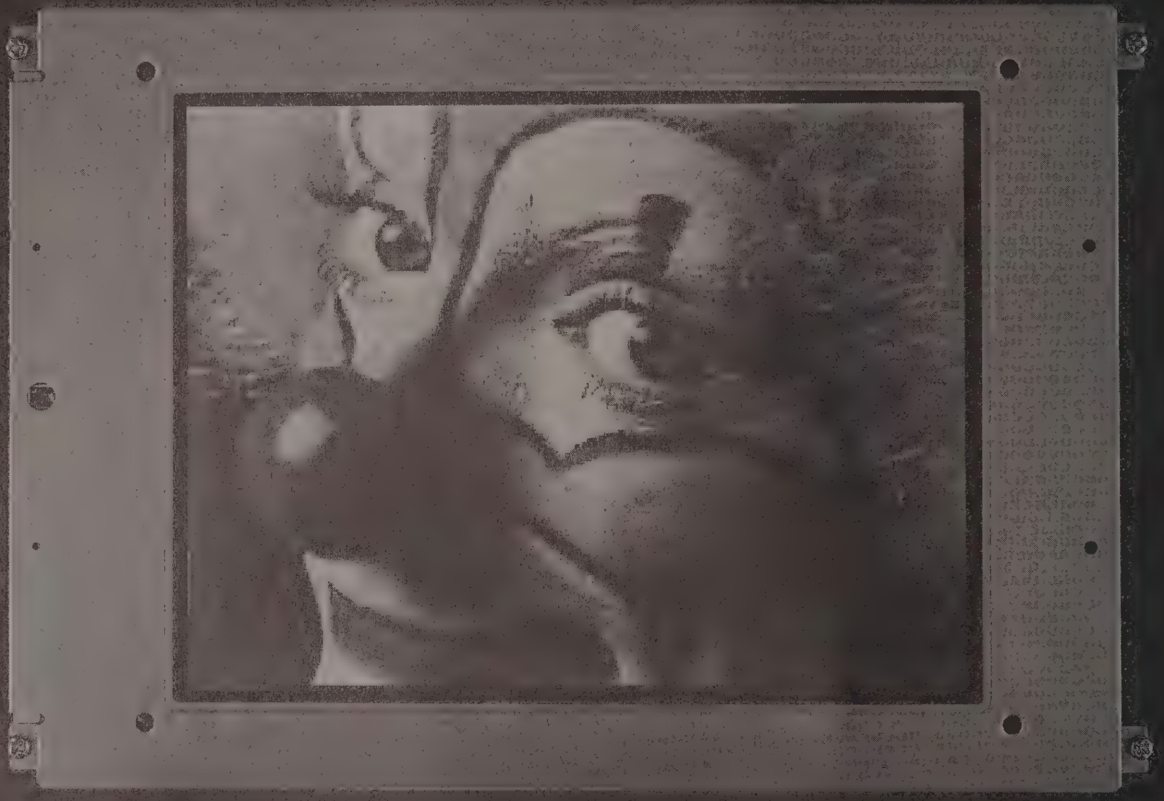
Passive Matrix LCD Color Display Rivals Active Matrix Quality!



COLOR

- 640 X RGB X 480 RESOLUTION
- FSTN COLOR DISPLAY
- 8.2 INCH DIAGONAL
- 1/480 DUTY CYCLE
- 15:1 CONTRAST RATIO
- DUAL - CFL BACK LIGHT (TOP AND BOTTOM)
- LIGHTWEIGHT (475 G) AND COMPACT (10.5 MMTH)

MONOCHROME

- SMALL SIZES (120 X 32)
- LARGE SIZES (640 X 480)
- STN AND FSTN DISPLAYS AVAILABLE
- LIGHTWEIGHT AND COMPACT
- EL, LED AND CFL AVAILABLE
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SUPERTWIST LCD MODULES

SUPERTWIST LCD SELECTION CHART

PART NUMBER	LINE × COLUMN	OVERALL SIZE (MM)	VIEWING AREA (MM)	CHAR SIZE (MM)	DUTY CYCLE	POWER SUPPLY (1)	POLARIZER (3)	BACKLIGHT (4)	OPER TEMP (5)
SSM10801	1 × 8	(58 × 32)	(26.8 × 5.8)	(4.45)	1/8	H	GA/YA/GB/YB/BE	EL & LED	A
SSM11601	1 × 16	(85 × 36)	(59.4 × 8.7)	(7.96)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11602	1 × 16	(80 × 36)	(58.7 × 6.3)	(5.5)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11603	1 × 16	(80 × 36)	(58.7 × 8.7)	(5.5)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11604	1 × 16	(80 × 36)	(58.7 × 5.8)	(4.45)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM11605	1 × 16	(80 × 36)	(59.6 × 6.6)	(5.73)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM11606	1 × 16	(115 × 35)	(94.9 × 7.9)	(7.95)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM11607	1 × 16	(151 × 40)	(114.0 × 14.5)	(12.71)	1/16	M/T	GA/GB	EL	B/C
SSM11612	1 × 16	(85 × 36)	(59.5 × 7.2)	(5.55)	1/16	M	YB/BE	EL & LED	B
SSM12001	1 × 20	(80 × 36)	(53.5 × 4.9)	(3.8)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM12002	1 × 20	(180 × 40)	(142.8 × 14.5)	(12.71)	1/16	M/T	GA/GB	EL	B/C
SSM12403	1 × 24	(208 × 40)	(171.6 × 14.5)	(12.71)	1/16	M/T	GA/GB	EL	B/C
SSM13202	1 × 32	(175 × 31)	(133.6 × 9.3)	(5.9)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM14001	1 × 40	(182 × 34)	(149.4 × 8.8)	(5.5)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM14003	1 × 40	(285 × 40)	(239.2 × 14.5)	(12.69)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM18001	1 × 80	(264 × 50)	(199.6 × 5.2)	(3.31)	1/8	H	GA/YA/GB/YB/BE	EL	A
SSM20801	2 × 8	(58 × 32)	(25.2 × 10.7)	(3.8)	1/16	M	YB/BE	EL & LED	B
SSM21601	2 × 16	(85 × 36)	(59.4 × 12.3)	(4.45)	1/16	M	YB/BE	EL & LED	B
SSM21602	2 × 16	(84 × 44)	(56.2 × 11.5)	(4.85)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM21603	2 × 16	(151 × 40)	(114.0 × 20.7)	(8.44)	1/16	M/T	GA/GB	EL	B/C
SSM22001	2 × 20	(116 × 37)	(83.0 × 11.5)	(4.85)	1/16	M	YB/BE	EL & LED	B
SSM22002	2 × 20	(180 × 40)	(142.8 × 20.7)	(8.44)	1/16	M/T	GA/GB	EL	B/C
SSM22401	2 × 24	(118 × 36)	(89.4 × 8.8)	(4.45)	1/16	M	YB/BE	EL & LED	B
SSM22402	2 × 24	(208 × 40)	(171.6 × 20.6)	(8.44)	1/16	M	GA/GB	EL	B
SSM22403	2 × 24	(118 × 36)	(88.3 × 11.5)	(4.85)	1/16	H	GA/GB/BE	EL & LED	A
SSM23202	2 × 32	(175 × 31)	(133.6 × 11.8)	(4.85)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM24001	2 × 40	(182 × 34)	(149.4 × 12.3)	(4.45)	1/16	M	YB/BE	EL & LED	B
SSM24002	2 × 40	(285 × 56)	(239.2 × 30.9)	(12.69)	1/16	M/T	GA/YA/GB/YB/BE	EL	B/C
SSM28001	2 × 80	(264 × 50)	(199.6 × 5.2)	(3.31)	1/16	M	GA/YA/GB/YB/BE	EL	B
SSM41601	4 × 16	(87 × 60)	(56.2 × 20.8)	(4.15)	1/16	H/M	GA/YA/GB/YB/BE	EL	D
SSM44001	4 × 40	(215 × 60)	(149.5 × 27.3)	(4.85)	1/16	M	GA/YA/GB/YB/BE	EL	B
SSM44002	4 × 40	(280 × 88)	(239.2 × 63.7)	(12.69)	1/16	M	GA/YA/GB/YB/BE	EL	B
SSM48001	4 × 80	(290 × 88)	(220.3 × 23.5)	(4.15)	1/16	M	GA/YA/GB/YB/BE	EL	B

*All parts are also available in Standard "TN" Fluids

DISPLAY ORDERING INFORMATION

SSM 0 00 00 X XX - X

Supertwist

Lines

Characters

Type

Voltage Required
H=5 VDC
M=±5 VDC
T=±5 VDC High Temperature

Polarizer

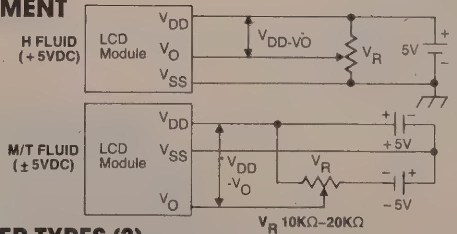
LED
R=Red
G=Green

TEMPERATURE RANGE: (4)

	"H"	"M"	"T"
Operating:	0°C +40°C	0°C +50°C	−20°C +70°C
Storage:	−20°C +70°C	−20°C +70°C	−40°C +90°C

"H/M" indicates that both are available

POWER SUPPLY REQUIREMENT



POLARIZER TYPES (3)

GA = Reflective/Positive image
Dark Blue on Light Gray
No EL Lamp

YA = Reflective/Positive image
Dark Blue on Yellow Green
No EL Lamp

GB = Transflective/Positive image
Dark Blue on Light Gray
With EL Lamp

YB = Transflective/Positive image
Dark Blue on Yellow Green
With EL Lamp

BE = Transmissive/Negative image
White on Dark Blue
With EL Lamp

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SHELLY LCD GRAPHIC DISPLAY MODULES

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- TN, STN, F-STN modes available.
- EL or CFL Backlighting.
- Gray, Yellow, Blue or White background
- Extended Temperature Range Available.
- Color Graphic Displays.
- Consult factory for sizes not shown.

GRAPHIC LCD DISPLAY MODULES

PART NUMBER	DISPLAY FORMAT	OVERALL W X H X D (mm)	VIEWING W X H (mm)	DOT PITCH (mm)	BACK LIGHT	OPERATING TEMP (C)
SGM01280032	120 X 32	152 X 56 X 15	90 X 32	0.70 X 0.80	EL	0 +40
SGM01200064	120 X 64	124 X 64 X 15	70.5 X 39.5	0.53 X 0.53	EL	0 +40
SGM02400064	240 X 64	180 X 65 X 12	132 X 39	0.53 X 0.53	EL	0 +40
SGM02400128	240 X 128	194 X 96 X 16	135 X 76	0.53 X 0.53	CFL	−10 +70
SGM03200200	320 X 200	166 X 95 X 11	120 X 77	0.36 X .036	CFL	+ 5 +40
SGM03200240	320 X 240	167 X 110 X 11	121 X 92	0.36 X .036	CFL	+ 5 +40
SGM04800064	480 X 64	290 X 73 X 12	246 X 38	0.50 X 0.50	EL	0 +40
SGM06400064	640 X 64	299.5 X 53 X 10	248 X 32	0.38 X 0.38	N/A	0 +40
SGM06400200	640 X 200	250 X 98.5 X 9	198 X 66	0.30 X 0.30	CFL	+ 5 +40
SGM06400400	640 X 400	324 X 190 X 19	238 X 154	0.36 X 0.36	CFL	+ 5 +40
SGM06400480	640 X 480	260 X 124 X 6.5	196 X 147.6	0.30 X 0.30	CFL	0 +45
SGM06400480	640 X 480	186 X 121 X 6.5	128 X 97.5	0.19 X 0.19	CFL	+5 +40
SGM03200240RGB	320 X RGB X 240	180 X 130 X 10	120.5 X 91.5	0.12 X 0.36	CFL	+10 +40
SGM06400480RGB	640 X RGB X 480	244 X 168 X 11	172 X 130	0.087 X 0.261	CFL	+10 +40
SGM06400480RGB	640 X RGB X 480	260 X183 X10	197 X 147	0.10 X 0.30	CFL	+10 +40

NOTE: Consult Factory for Sizes Not Shown or Extended Temperature Ranges.
Storage Temp: -20 to +60 (TYP)

PART NUMBER

SGM XXXX XXXX XX X X X X X

GRAPHICS

DOTS: ROW

DOTS: COLUMN

INTERNAL REFERENCE

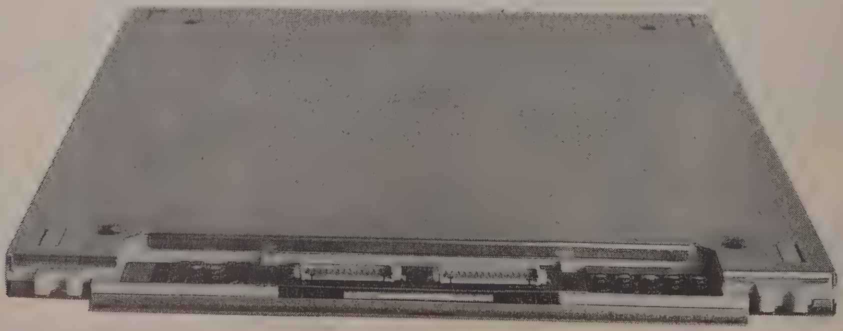
FLUID TYPE:
- T= TN
- H= HIGH TEMP TN
- S= SUPERTWIST
- F= FSTN

VIEW ANGLE:
- 1= BOTTOM/GLARE
- 2= BOTTOM/NON-GLARE
- 3= TOP/GLARE
- F= TOP/NON-GLARE

VIEW MODE:
- A= REFLECTIVE
- B= TRANSFLECTIVE POSITIVE
- C= TRANSMISSIVE POSITIVE
- D= TRANSFLECTIVE NEGATIVE
- E= TRANSMISSIVE NEGATIVE

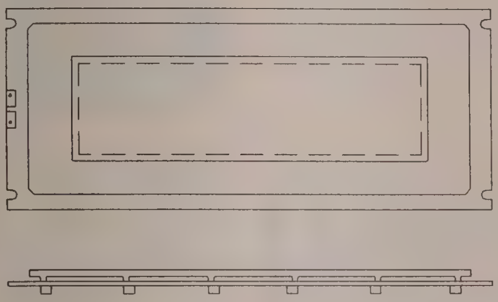
COLOR:
- Y= YELLOW (STN)
- B= BLUE (STN TRANSMISSIVE)
- G= GREY (TN OR STN)
- W= WHITE (FSTN)

BACKLIGHT:
- W= WHITE EL
- E= GREEN EL
- C= CFL
- N= NONE

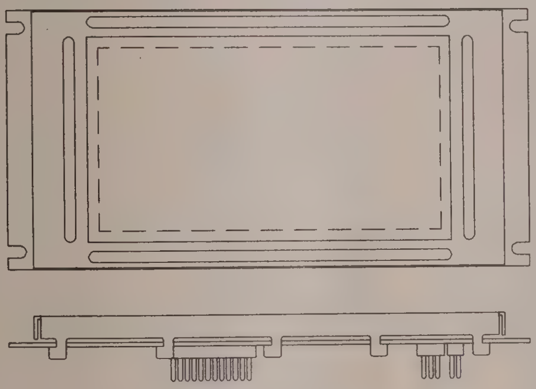


GRAPHIC MECHANICAL DRAWINGS

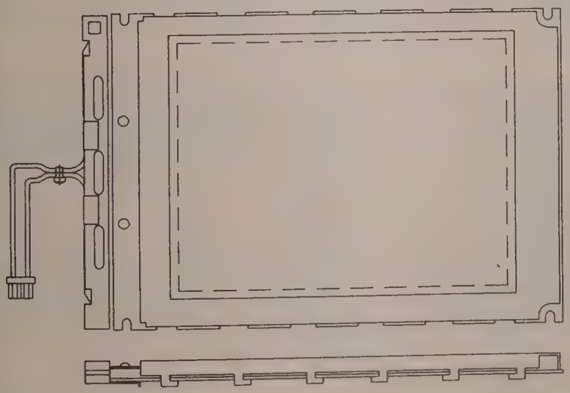
REPRESENTATIVE OUTLINE DRAWINGS



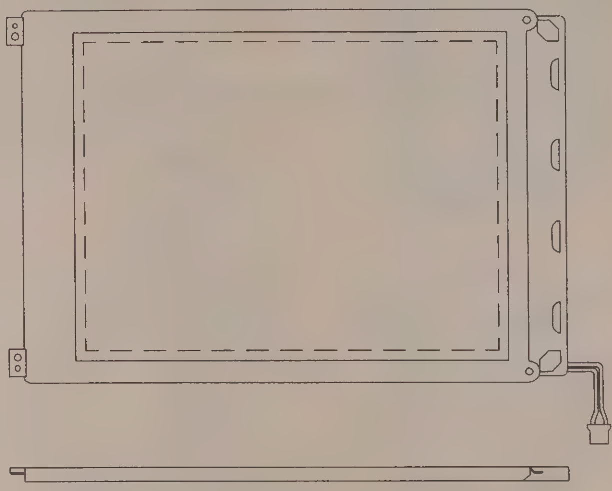
240 x 64



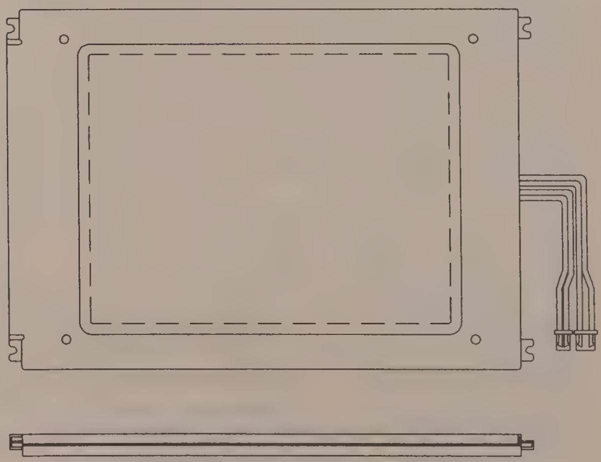
240 x 128



320 x 240



640 x 480



640 x 480 COLOR

Standish LCD

Division of Standish Industries, Inc.

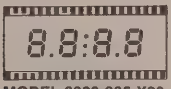
Liquid Crystal Displays

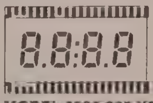
W7514 Hwy. V • Lake Mills, Wisconsin 53551
Phone 414/648-1000 • FAX 414/648-1001

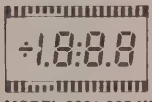
Standish LCD built their first display in 1972 — and since that time has maintained the leading edge position in LCD technology and manufacturing methods. That expertise and experience provides the unique ability to supply standard TN or STN LCDs, standard LCD modules, custom LCDs and custom LCD modules in quantities from 100 to 100,000, that meet exact customer requirements.

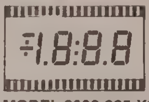
For detailed product information send for the Standish LCD Catalog. The 24-page catalog provides complete information about our standard LCDs plus application and design recommendations for custom LCDs. Also included are examples of color and backlighted techniques, theory of operation, and quality assurance and test standards.

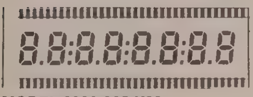
DIRECT DRIVE LIQUID CRYSTAL DISPLAYS

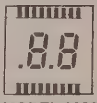

MODEL 3900-365-X20

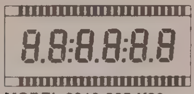

MODEL 3906-365-X20

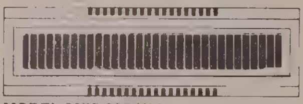

MODEL 3901-365-X20


MODEL 3902-365-X20


MODEL 3922-365-X20


MODEL 3935-365-X20

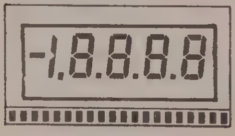

MODEL 3918-365-X20

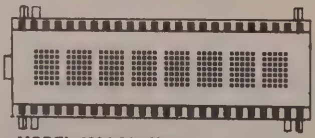

MODEL 3975-365-X20

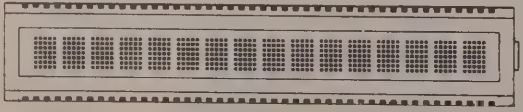
Ordering Information

Part Number	Description	Glass Size	Net Each
3900-365-X20	4.0 digit (.35") 40 contacts	2.00" x 0.90", 0.70"	$16.28
3901-365-X20	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3902-365-X20	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3906-365-X20	4.0 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3918-365-X20	6.0 digit (.5") 50 contacts	2.75" x 1.20", 0.90"	21.48
3919-365-X20	6.0 digit (.7") 50 contacts	3.70" x 1.50", 1.20"	23.40
3920-365-X20	6.0 digit (1.0") 70 contacts	5.40" x 1.80", 1.50"	48.23
3922-365-X20	8.0 digit (.5") 68 contacts	3.70" x 1.20", 0.90"	24.15
3935-365-X20	2.0 digit (.5") 18 contacts	1.20" x 1.20", 0.90"	15.50
3975-365-X20	Single 32-Bar Graph 35 contacts	4.00" x 1.20", 0.90"	31.89

MULITPLEX LIQUID CRYSTAL DISPLAYS


MODEL 4201-365-X20


MODEL 4284-365-X20

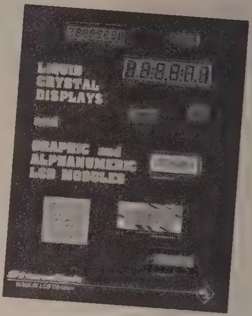

MODEL 4285-365-X20

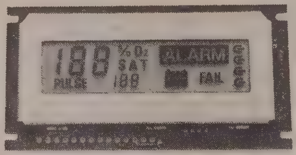
Ordering Information

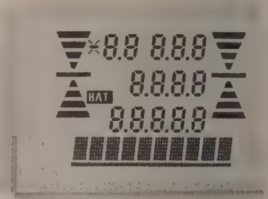
Part Number	Description	Glass Size	Net Each
4201-365-X20	4.5 digit (.4") 44 contacts	2.0" x 1.050", 0.9"	$16.28
4284-365-X20	8 Char., 5 x 7 dot matrix 48 contacts	(.3")2.5" x 0.8", 0.6"	15.96
4285-365-X20	16 Char., 5 x 7 dot matrix 88 contacts	(.3")4.7" x 0.9", 20.7"	22.91

LCD MODULES

The Standish LCD line of standard Liquid Crystal Display Modules offers stocked models for all applications. The line features Dot Matrix and Intelligent Graphic LCDs in TN or STN models. EL and LED backlighting optional, and modules with 8 character one line to 20 character 4 lines to 240 x 128 pixel Graphic Modules.







Alphanumeric Dot Matrix LCD Modules

Part Number	Description	LCD Type	Back-light	Net Each
SIM81XXXX-TLC-XX	8 Characters x 1 Line	TN	None	$30.20
SIM81XXXX-TLC-LE	8 Characters x 1 Line	TN	LED	$40.30
SIM161XXX-TLC-XX	16 Characters x 1 Line	TN	None	23.55
SIM161XXX-TLC-EL	16 Characters x 1 Line	TN	EL	34.00
SIM161XXX-TLC-LE	16 Characters x 1 Line	TN	LED	36.20
SIM162XXX-TLC-XX	16 Characters x 2 Lines	TN	None	31.75
SIM162XXX-SLC-XX	16 Characters x 2 Lines	STN	None	34.95
SIM162XXX-TLC-EL	16 Characters x 2 Lines	TN	EL	43.25
SIM162XXX-SLC-EL	16 Characters x 2 Lines	STN	EL	45.60
SIM162XXX-TLC-LE	16 Characters x 2 Lines	TN	LED	43.90
SIM162XXX-SLC-LE	16 Characters x 2 Lines	STN	LED	47.10
SIM202XXX-TLC-XX	20 Characters x 2 Lines	TN	None	43.35
SIM202XXX-SLC-XX	20 Characters x 2 Lines	STN	None	48.85
SIM202XXX-TLC-LE	20 Characters x 2 Lines	TN	LED	56.38
SIM202XXX-SLC-LE	20 Characters x 2 Lines	STN	LED	62.85
SIM402XXX-TLC-XX	40 Characters x 2 Lines	TN	None	62.20
SIM402XXX-SLC-XX	40 Characters x 2 Lines	STN	None	71.55
SIM402XXX-TLC-EL	40 Characters x 2 Lines	TN	EL	85.10
SIM402XXX-SLC-EL	40 Characters x 2 Lines	STN	EL	94.40
SIM402XXX-TLC-LE	40 Characters x 2 Lines	TN	LED	88.75
SIM402XXX-SLC-LE	40 Characters x 2 Lines	STN	LED	98.10
SIM204XXX-SLC-XX	20 Characters x 4 Lines	STN	None	70.88
SIM204XXX-SLC-EL	20 Characters x 4 Lines	STN	EL	87.10
SIM204XXX-SLC-EL	20 Characters x 4 Lines	STN	LED	88.50

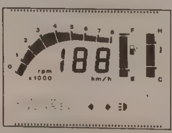
NOTE: DC/AC Inverter for EL backlight not supplied.
TN = Twisted Nematic STN = Supertwist

Graphic LCD Modules

SIM12864-SHC	128 x 64	STN	None	$99.00
SIM12864-SHCLE3	128 x 64	STN	LED	114.80
SIM12864-SHCEL	128 x 64	STN	EL	123.30
SIM12864-SHW	128 x 64	STN	None	106.95
SIM12864-SHWLE3	128 x 64	STN	LED	122.50
SIM12864-SHWEL	128 x 64	STN	EL	131.25
SIM24064B-SHC	240 x 64	STN	None	201.60
SIM24064B-SHCLE3	240 x 64	STN	LED	223.20
SIM240128-SHC	240 x 128	STN	None	266.80
SIM240128-SHCLE3	240 x 128	STN	LED	297.05

SHC -0 to +50°C SHW -20°C to +70°C

CUSTOM LCDS



Standish LCD technology offers flexibility of format design to complement your requirements. Custom designs are relatively inexpensive to tool. Options include unique symbols, glass shapes, "MIL-SPEC" conditions, color options, etc. Consult Standish LCD application specialists for design assistance.

SIGNALEX®

HIGH VISIBILITY DISPLAYS

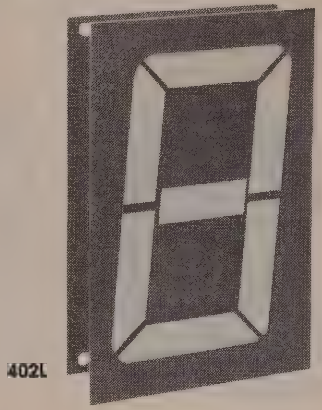
ENERGY-SAVING: Electromagnetically-operated Signalex displays require no power to maintain continuous indication. Inherently bi-stable, Signalex displays draw power only at the instant of change.

INHERENT MEMORY: Indication is maintained even with loss of power.

DIRECT ACCESS: Signalex displays can change from one number to any other—without a run-through of numbers. The unit immediately displays the transmitted number.

LOW MAINTENANCE: The rugged Signalex design assures long life and dependability. With no bulbs to replace, they are virtually maintenance-free.

HIGH-VISIBILITY: Signalex displays can be used indoors and out, in temperatures ranging from -40°C to +75°C. Their light-reflecting segments give high visibility in bright ambient light.



402L

7 SEGMENT MODELS

DISPLAY SIZES	1½″	4″	6″	9″	12″	18″	24″
SIGNALEX MODEL	152L	402L	602L	900L	1200L	1810L	2410L
Character Size H x W	1-9/16″ x 15/16″ (40 x 24 mm)	4-1/16″ x 2-5/16″ (103 x 59 mm)	6-1/16″ x 3-9/16″ (154 x 91 mm)	9″ x 6″ (229 x 152 mm)	12″ x 8″ (305 x 203 mm)	18″ x 12″ (46 x 31 cm)	24″ x 16″ (61 x 41 cm)
Vane Width	5/32″ (4 mm)	7/16″ (11 mm)	11/16″ (17 mm)	1-1/8″ (28 mm)	1-1/2″ (38 mm)	2-1/4″ (5.7 cm)	3″ (7.6 cm)
Frame Size H x W	1-7/8″ x 1-5/16″ (49 x 33 mm)	5″ x 3-1/4″ (127 x 83 mm)	7-1/4″ x 5-1/8″ (184 x 130 mm)	11″ x 8-1/4″ (279 x 210 mm)	14″ x 11″ (356 x 279 mm)	21″ x 16½″ (533 x 419 mm)	28″ x 22″ (711 x 559 mm)
Pulse Length, min.	30 ms	50 ms	90 ms	150 ms	200 ms	300 ms	400 ms
Pulse Power, Each Vane	0.35 W	0.93 W	1.4 W	3.6 W	3.6 W	9.0 W	9.0 W
Viewing Dist., max.	50 Feet (15 Meters)	160 Feet (50 Meters)	240 Feet (75 Meters)	360 Feet (110 Meters)	480 Feet (150 Meters)	720 Feet (220 Meters)	960 Feet (300 Meters)
Weight	2-1/4 oz. 65 gm.	8-1/2 oz. 240 gm.	12-2/3 oz. 360 gm.	1-1/2 lbs. 680 gm.	2-1/4 lbs. 1020 gm.	4-1/2 lbs. 2. kg	6 lbs. 2.7 kg

U.S. Patent Nos. 3,886,545; 4,117,478; U.S. Design Patent 249,985 and Patents Pending

Operation: Individually controlled segments, pulse-operated through a bi-stable magnetic circuit.

Voltage: 12V. DC ±10% standard. Other voltages available.

Coils: Standard is bifilar wound with 3 leads per segment. Model 152L has terminal pins for direct PCB mounting.

Temperature: -40°C to +75°C.

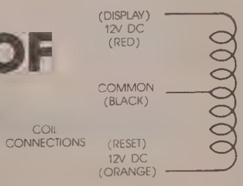
Relative Humidity: Up to 95% R.H. at any temperature in the range, provided no consideration present.

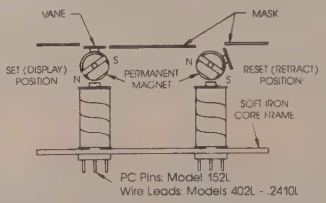
Power to Maintain Display: NONE

Vane Colors: White, Saturn-Yellow, Orange-Red Fluorescents. Black background standard. Other high-visibility colors available.

Maximum Coil Temperature: +105°C

PRINCIPLE OF OPERATION





Signalex® displays operate on a well-proven electromagnetic principle. A short pulse in a coil produces a magnetic field that acts upon a permanent magnet located in a rotor, part of which is the vane itself.

The magnet is either attracted or repelled, turning the rotor and vane with it. In either display or reset position the magnetic circuit is stable so that the vane can remain in either position with no power in the coil. The permanent magnet pole is attracted to the soft iron core which will hold the vane in position until a reverse pulse is passed.

The rotor and magnet assemblies are the only moving parts in the display. Their light weight and low inertia give fast response time. High lubricity plastic bearings are used.

THE STAVER COMPANY INCORPORATED

P.O. Box 220M, Bay Shore, NY 11706
(516) 666-8000 • FAX: (516) 666-8039

SIGNALEX®

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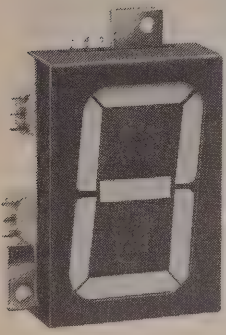
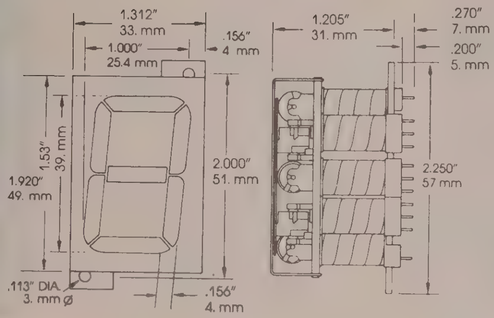
SIGNALEX®

HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODEL 152L

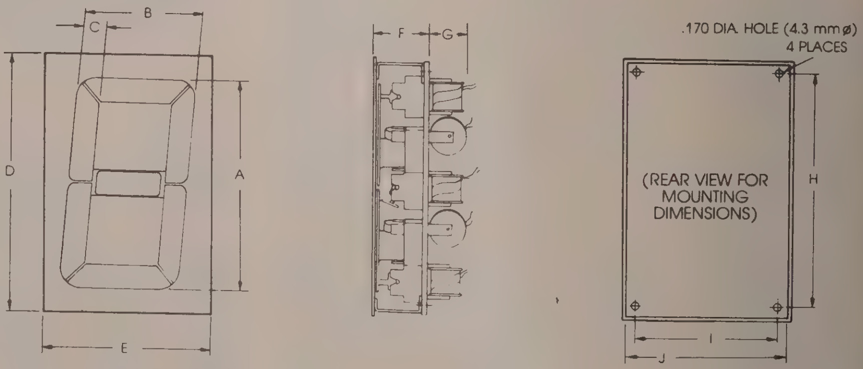



1.312"
33. mm
1.000"
25.4 mm
.156"
4 mm
1.205"
31. mm
.270"
7. mm
.200"
5. mm
1.53"
39. mm
1.920"
49. mm
2.000"
51. mm
2.250"
57 mm
.113" DIA.
3. mm ø
.156"
4. mm

The Signalex 152L is used world-wide in readout applications for toll booths, clocks, gas pumps, arcade games, oil rig instrumentation, currency exchange panels, and industrial controls. Since Signalex readouts draw no power while maintaining position, they are ideal for battery-powered systems as well as AC.

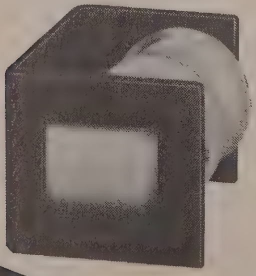
Connections: 3 per coil
(1 to display, 1 to reset, 1 common)
Pulse Power: 31ma at 12V.
Pulse Length: 30ms min., display or reset
Character Slope: 5°
Visibility: Up to 70° either side of perpendicular to the front face.
Temperature Range: -40°C to + 75°C
Materials: Front Mask: Steel, Bearings: Polyester.
Hazardous Areas: Recognized by Underwriters Laboratories, Inc.,
No. MH10471. BASEEFA Class 2 No. 4054 J.

MODELS 402L & 602L


B
C
D
A
E
F
G
.170 DIA. HOLE (4.3 mm ø)
4 PLACES
(REAR VIEW FOR MOUNTING DIMENSIONS)
H
I
J

(in.) Dim.	A	B	C	D	E	F	G	H	I	J
Model 402L	4-1/16	2-5/16	7/16	5	3-1/4	1-1/16	3/4	4-1/2	2-5/8	3-1/8
Model 602L	6-1/16	3-9/16	11/16	7-1/4	5-1/8	1-5/16	3/4	6-1/2	4-1/2	5

SIGNALEX® TYPE A



The Type A Indicator is a bi-stable electromagnetic annunciator showing alternate display faces in its window. It may be mounted for operation in any position. It is driven in either direction by 1.1 watt pulses as short as 30 ms and remains in its last position without power input until pulsed to the opposite position.

Signalex Type A indicators are used in hospital, apartment house, and commercial call boards, as well as in circuit indicators, alarm systems, and a variety of other applications.

THE STAVER COMPANY INCORPORATED
P.O. Box 220M, Bay Shore, NY 11706
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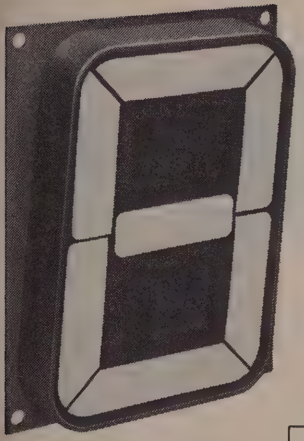
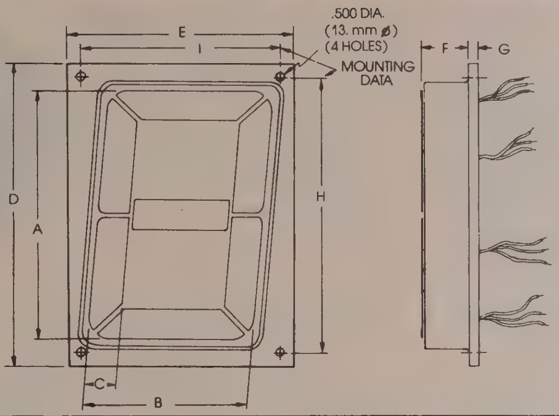
SIGNALEX®

HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODELS 900L & 1200L




.500 DIA.
(13. mm ø)
(4 HOLES)
MOUNTING
DATA
E
I
F
G
D
A
H
C
B

Length of Leads: 7″ Min. for 402L & 602L. 30″ Min. for 900L & 1200L

Bearings: High lubricity polyester, replaceable.

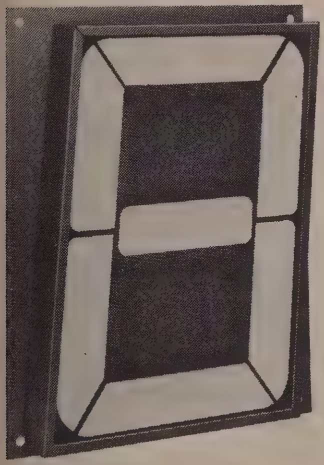
Vanes: Individually replaceable.

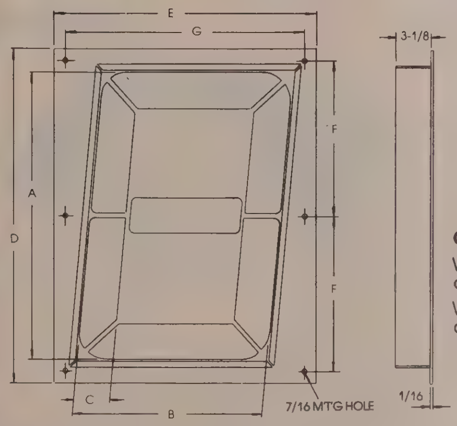
Visibility: 402L & 602L Series—To 60° either side. 900L & 1200L Series—To 75° either side.

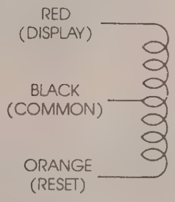
(in.) Dim.	A	B	C	D	E	F	G	H	I
Model 900L	9	6	1-1/8	11	8-1/4	2-1/32	3/16	10*	7-1/4*
Model 1200L	12	8	1-1/2	14	11	2-1/16	3/16	13	10

*Only Upper Left And Lower Right Holes Available For 900L

MODELS 1810L & 2410L




E
G
3-1/8
F
A
D
F
C
B
7/16 MT'G HOLE
1/16


RED
(DISPLAY)
BLACK
(COMMON)
ORANGE
(RESET)

Coil Connection (402L & larger) (7 coils per digit)

With black lead connected to (-), (+) on red lead displays white. (+) on orange lead resets to black.

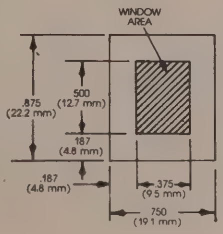
With black lead connected to (+), (-) on orange lead displays white. (-) on red lead resets to black.

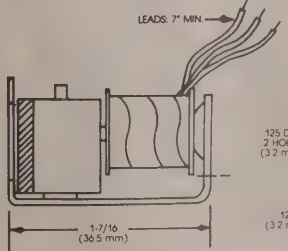
(in.) Dim.	A	B	C	D	E	F	G
TYPE 1810L	18″	12	2 1/4	21	16 1/2	19 1/2*	15
TYPE 2410L	24″	16	3	28	22	13	20

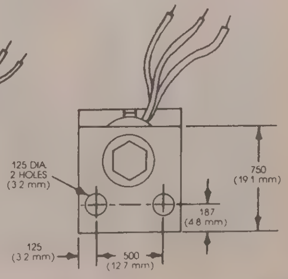
*20″ From Top to Bottom MT'G Hole. No Center Holes.

ANNUNCIATOR

Window Size: 3/8″ H x 1/2″ W (9.5 mm x 12.7 mm)
Displays per Window: 2
Operating Temp. Range: -40°C to +75°C
Operating Mode: Bi-stable, pulsed
Min. Pulse Length: 30ms. either display
Power/Pulse: 1.1W
Maximum Coil Temperature: +105°C
Coil Resistance: 125. Ω ± 10%
Standard Voltage: 12 V. DC*
Standard Colors: Black & White, Yellow, Red.*
Leads: 7″ Min.:
*Others Available.


WINDOW
AREA
.875
(22.2 mm)
500
(12.7 mm)
187
(4.8 mm)
.187
(4.8 mm)
.375
(9.5 mm)
750
(19.1 mm)


LEADS: 7″ MIN.
1-7/16
(36.5 mm)


125 DIA.
2 HOLES
(3.2 mm)
750
(19.1 mm)
187
(4.8 mm)
125
(3.2 mm)
500
(12.7 mm)

U.S. Patent No. 3,936,818

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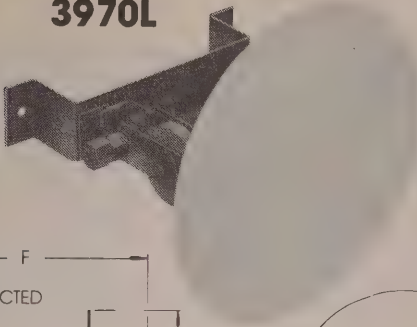
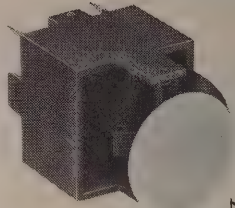
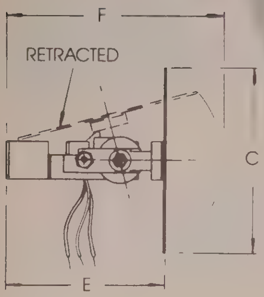
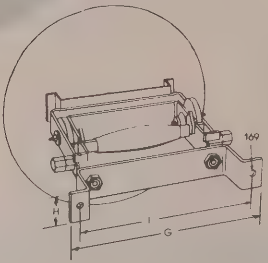
3970L

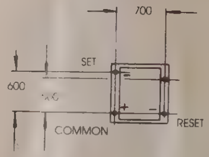


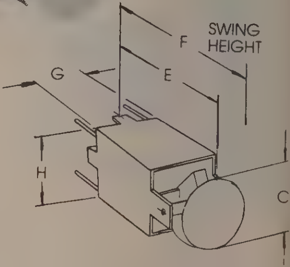
670RFR



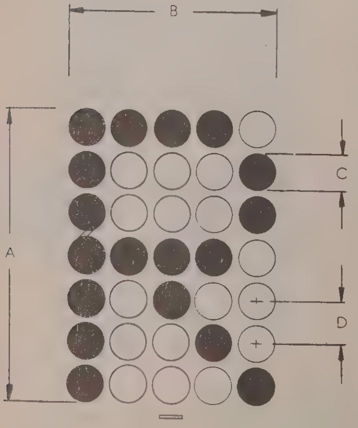

F
RETRACTED
C
E

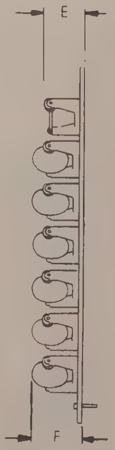


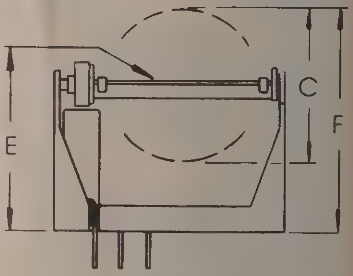

700
SET
600
COMMON
RESET

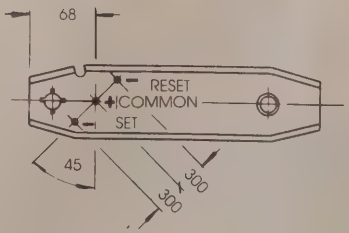

SWING HEIGHT
F
G
E
H
C

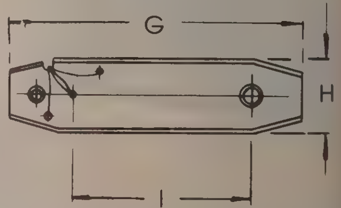
972-1872RFR








68
RESET
COMMON
SET
45
300
300



Model Number	Dim. A Char. Hgt.		Dim. B Char. Width		Dim. C Dot Dia.		Dim. D Dot Pitch		Dim. E Display Hgt.		Dim. F Swing Hght.		Dim. G Length		Dim. H Width		Dim. I Mounting	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
670RFR	6.00	152	4.25	108	.75	19.0	.875	22.2	1.33	33.8	1.57	39.7	.84	21.3	.84	21.3	—	—
972RFR	9.00	230	6.37	162	1.12	28.0	1.31	33.3	1.45	36.8	2.10	53.3	1.81	46.0	.75	19.0	.596	15.1
1272RFR	12.00	300	8.50	216	1.50	38.0	1.75	44.5	1.45	36.8	2.29	58.2	2.24	56.9	.75	19.0	1.026	26.1
1672RFR	16.00	406	11.37	289	2.00	51.0	2.34	59.5	1.45	36.8	2.54	64.5	2.74	69.6	.75	19.0	1.526	38.8
1872RFR	18.00	457	12.75	324	2.25	57.0	2.62	66.7	1.45	36.8	2.66	67.6	2.99	76.0	.75	19.0	1.776	45.1
3970L	39.50	1000	28.00	711	5.00	127.0	5.75	146.0	4.30	109.2	5.87	149.1	4.50	114	1.0	25.4	4.000	102.0

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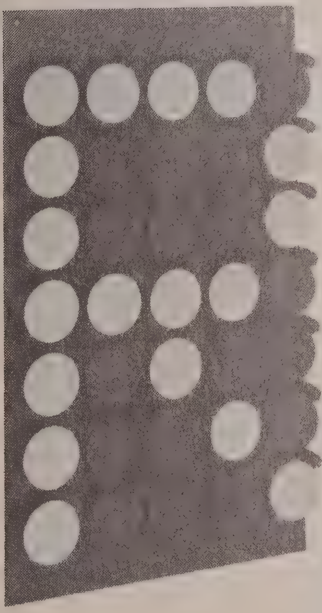
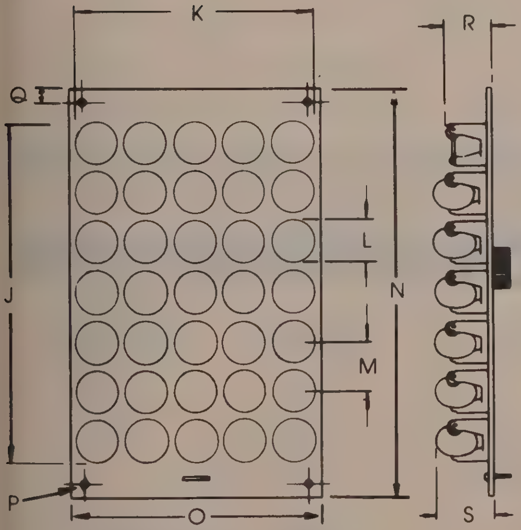
HIGH VISIBILITY ALPHANUMERIC DISPLAYS AND INDIVIDUAL GRAPHIC ELEMENTS

Signalex Individual Alphanumerics are bi-stable electromagnetic displays which require only a very short pulse to change position. Inherent latching memory requires no power except during the moment of change. The magnetic design permits operation of most models using 12vdc with a 2 msec. pulse and, at higher voltages, at 1 msec. or less.

The standard 7 by 5 matrix of 35 dots gives full alphanumeric capability, and is available in sizes which can create characters 6", 9", 12", 16", 18" and 39" high. The flexibility of Signalex individual alphanumerics permits the creation of custom displays. In addition to the standard (7 x 5) format, the 28-dot (7 x 4) numeric format, a 23-dot (7-Bar) format, or other desired shapes may be used.





670-1872RFR-35BC

SPECIFICATIONS—ALL MODELS

	670RFR-35BC	972-1872RFR-35BC
Pulse Length, Min. @ 12V	2ms	2ms
Pulse Length, Min. @ 18V	1ms	1ms
Maximum Duty Cycle @ 12V	5%	5%
Current Each Dot @ 12V	680ma	580ma
Coil Res. Center to Each Side	17.5 ohms	20.5 ohms
Coil Winding	Center Tapped Coil	
Coil Addressing	All Models	X-Y Matrix
Ground Polarity	Negative	Negative
Diodes	1N4004	1N4004
PCB Material	FR-4 or Equivalent	
Maximum Coil Temperature	All Models: +105C	
Operating Temperature Range	All Models: -40 C to +90 C	
Operating Rel. Humidity	All Models: Up to 95% @ +90 C*	
Standard Colors	All Models: White, Yellow, Red	

*Provided No Condensation Present

35 DOT 7 BY 5 ALPHANUMERIC MATRICES

	Dim. J Char. Hgt		Dim. K Char. Width		Dim. L Dot Dia.		Dim. M Dot Pitch		Dim. N Matrix Hgt		Dim. O Matrix Wdth		Dim. P Mtg. Hole		Dim. Q Hole Offset		Dim. R Thickness		Dim. S Swing Hgt.	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
670RFR-35BC	6	152	4.25	108	.75	19	.875	22.2	7.75	197	4.25	114	.178	4	.25	6	1.35	34	1.57	39.7
972RFR-35BC	9	230	6.37	162	1.12	28	1.31	33.3	11.87	301	6.53	166	.195	5	.25	6	1.80	43	2.07	52.6
1272RFR-35BC	12	300	8.50	216	1.50	38	1.75	44.5	15.00	386	8.72	224	.195	5	.50	13	1.80	43	2.25	57.2
1672RFR-35BC	16	406	11.37	289	2.00	51	2.34	59.4	19.50	502	11.69	301	.195	5	.50	13	1.80	43	2.54	64.5
1872RFR-35BC	18	457	12.75	324	2.25	57	2.62	66.7	21.63	557	13.09	337	.195	5	.50	13	1.80	43	2.66	67.6

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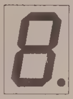
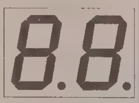
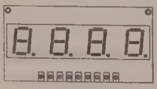
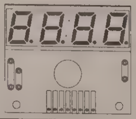
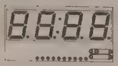
THREE-FIVE SYSTEMS, INC.

Three-Five Systems, Inc. offers many years of experience in optoelectronics and display system technology. In addition to having one of the most comprehensive standard product lines in the industry, we provide solutions to more complex requirements by building custom and semi-custom displays and display systems. Please contact us if you do not find the solution you are searching for on our pages in EEM.

NUMERIC DISPLAYS

PACKAGE	PART TYPE	DESCRIPTION	DIGIT COLOR	PART NUMBER
	.3" Single Digit	Common Anode, Right Hand Decimal Point	High Efficiency Red Yellow Green	5082-7611 5082-7621 HDSP-3601
	.3" ±1 Overflow Digit	Common Anode, Right Hand Decimal Point	High Efficiency Red Yellow Green	5082-7616 5082-7626 HDSP-3606
	.56" Single Digit	Common Anode, Right Hand Decimal Point	High Efficiency Red Yellow Green	HDSP-5501 HDSP-5701 HDSP-5601
	.56" Dual Digit	Common Anode, Right Hand Decimal Point	High Efficiency Red Yellow Green	HDSP-5521 HDSP-5721 HDSP-5621

INTEGRATED NUMERIC DISPLAYS

PACKAGE	PART TYPE	CHARACTERISTICS	COLOR	PART NUMBER
	Integrated Numeric Display	0.30" Digits Right Hand Decimal with Lens	Red Green High Efficiency Red	TSM5034 TSM5234 TSM5734
		0.30" Digits Right Hand Decimal	Red Green High Efficiency Red	TSM6034 TSM6234 TSM6734
	Integrated Numeric Display	0.50" Digits Right Hand Decimal with Colon	Red Green High Efficiency Red	TSM5055 TSM5255 TSM5755
	Integrated Numeric Display	0.50" Digits Right Hand Decimal with Colon	Red Green AlGaAs Red High Efficiency Red	TSM6055 TSM6255 TSM6655 TSM6755

THREE-FIVE SYSTEMS, INC.
Phoenix, Arizona
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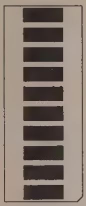
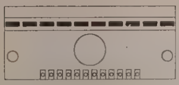
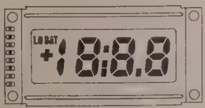
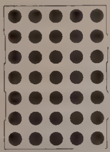
- **ALPHANUMERIC DISPLAYS**
- **NUMERIC DISPLAYS**
- **BARGRAPH DISPLAYS**
- **LCD MODULES**

BARGRAPH DISPLAYS

PACKAGE	PART TYPE	CHARACTERISTICS	COLOR	PART NUMBER
	**10 Element Vertical Bargraph	Analog Input Linear Output	10 Red 10 High Efficiency Red 10 Green 10 Yellow 3 High Eff. Red, 7 Green 6 Green, 2 Yellow, 2 Red 10 AlGaAs Red	TSM3934 TSM39341 TSM39342 TSM39343 TSM39345 TSM39348 TSM393411
		Analog Input/Logarithmic Output	10 High Efficiency Red 6 Green, 2 Yellow, 2 Red	TSM39351 TSM39358
	**10 Element Horizontal Bargraph	Analog Input Linear Output	10 Red 10 Green 10 Yellow 6 Green, 4 Red 8 Green, 2 Red 6 Green, 2 Yellow, 2 Red	TSM3914 TSM39142 TSM39143 TSM39146 TSM39147 TSM39148
		Analog Input Logarithmic Output	10 Red 10 High Efficiency Red 10 Green 10 Yellow 6 Green, 2 Yellow, 2 Red	TSM3915 TSM39151 TSM39152 TSM39153 TSM39158

****STANDARD BARGRAPH DISPLAYS** are available in a variety of color combinations. Consult the factory for more information.

ALPHANUMERIC / 3.5 DIGIT LCD / DOT MATRIX DISPLAYS

PACKAGE	PART TYPE	CHARACTERISTICS	COLOR	PART NUMBER
	Alphanumeric Display	14 Segment 0.50" Characters	Red Green AlGaAs Red High Efficiency Red	TSM7052B TSM7252B TSM7652B TSM7752B
	3.5 Digit LCD Module	Positive/Reflective Display	Non-Backlit	TSL0530-01
		Positive/Transflective Display	Yellow-Amber Yellow-Green AlGaAs Red Bicolor AlGaAs Red-Green	TSL0530-22 TSL0530-42 TSL0530-62 TSL0530-642
		Negative/Transmissive Display	Yellow-Amber Yellow-Green AlGaAs Red Bicolor AlGaAs Red-Green	TSL0530-23 TSL0530-43 TSL0530-63 TSL0530-643
	Integrated Light Block Display	5 x 7 Dot Matrix	Green Yellow AlGaAs Red High Efficiency Red Bicolor AlGaAs Red-Green Bicolor H.E. Red-Green	TFIB5257B TFIB5357B TFIB5657B TFIB5757B TFIB56257B TFIB57257B

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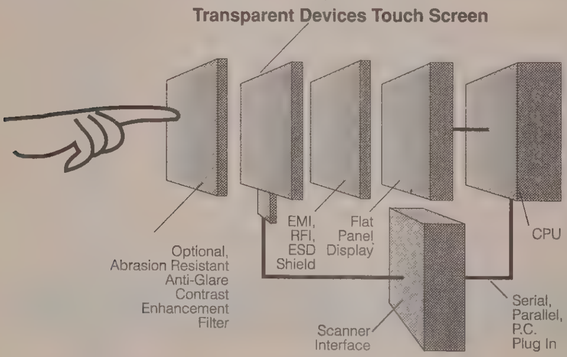
Touch Screens

TransparentDevices
The company in touch!

How do they work?

A Transparent Devices digital touch screen is a normally-open array of momentary-contact switches which are actuated by a touch. The touch screen is electronically scanned in the same manner as a membrane keyboard. The basic switch consists of two layers of electrically conductive polyester film with a 2 mil separation. The outer layer of the operating surface is protected by a tough, abrasion and chemical-resistant coating. Our touch screens are available in various sizes and shapes to compliment all types of displays in today's market.

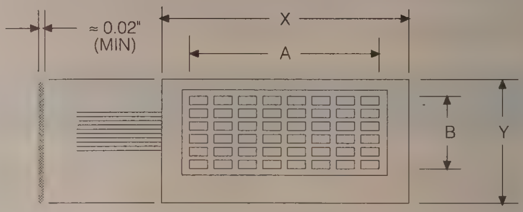

Transparent Devices Touch Screen
Optional, Abrasion Resistant Anti-Glare Contrast Enhancement Filter
EMI, RFI, ESD Shield
Flat Panel Display
CPU
Scanner Interface
Serial, Parallel, P.C. Plug In

Features:

- ***Custom and Standard Products***
- ***Standard Interface Electronics***
- ***Optional Optical Filters***
- ***Optional EMI/RFI Shielding***
- ***Made in U.S.A.***

How to select a standard touch screen

Numerous standard touch screens have been developed for popular displays in the market that enable rapid prototype and production start-ups. To select an off-the-shelf touch screen from the standard line of products - simply match the active area of your display with active area of the touch screen. If you find more than one part meeting your mechanical dimensions, select the one having the appropriate row/column resolution for your application.



A • B = ACTIVE AREA
X • Y = OVERALL AREA

Standard Touch Screens

Active Area A	Active Area B	Resolution	Part No.
2.45	2.45	4 X 4	1880
3.27	3.27	4 X 4	1146
3.23	3.98	4 X 4	2560
3.10	4.10	12 X 16	2000
3.45	4.20	6 X 9	2510
4.01	4.50	4 X 4	1610
2.52	4.50	8 X 8	2630
3.62	4.80	5 X 6	2660
4.30	4.99	13 X 8	2530
3.90	5.27	8 X 8	3003
4.60	5.60	16 X 24	1140
4.60	5.60	4 X 8	1342
2.99	5.83	5 X 10	1530
5.00	7.00	6 X 8	1052
5.58	7.40	8 X 10	2370
1.91	7.53	8 x 16	1120
1.91	7.53	8 X 16	1120
5.67	7.56	7 X 10	1108
5.71	7.61	10 X 10	4001
4.90	7.78	10 X 16	2610
4.90	7.80	8 X 8	1232
4.60	7.88	5 X 9	2130
6.00	8.00	16 X 16	2270
6.10	8.00	24 X 32	1730
4.30	8.15	16 X 32	1081
4.34	8.18	5 X 8	2170
5.43	8.58	9 X 6	2050
4.10	9.20	6 X 10	2040
3.11	9.45	6 X 18	1220
6.10	9.45	16 X 32	1440
7.25	9.75	32 X 16	5006
8.50	10.80	25 X 40	1036

853 Lawrence Drive, Newbury Park, CA 91320-2232, U.S.A
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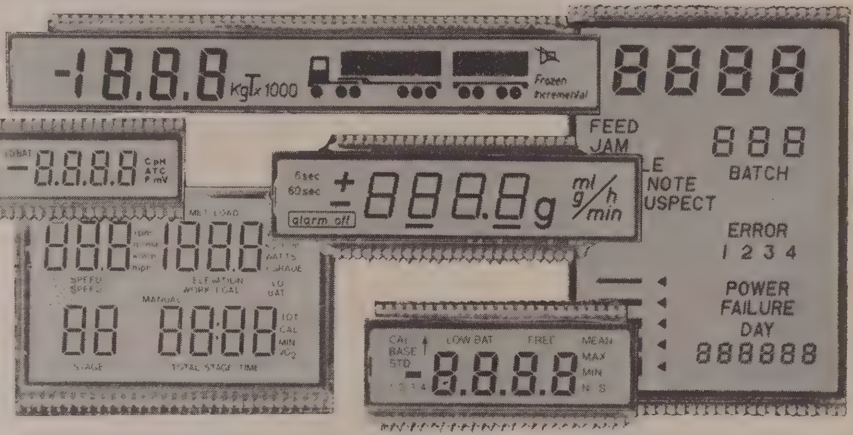
-18.8.8 kg x 1000
Frozen
-8.8.8.8 CpH ATC PmV
±888.8 g ml/h g/min
alarm off
FEED
JAM
NOTE
SUSPECT
BATCH
ERROR
1 2 3 4
POWER
FAILURE
DAY
888888
SPEED
ELEVATION
STAGE
TOTAL STAGE TIME
LOW BAT
FREE
MEAN
MAX
MIN
CAL
BASE
STD
-8.8.8.8

FEATURES

- Highest Quality
- LCD Prototypes from approved drawings in 6-9 weeks
- Supertwist available
- FLCD under development
- Send us your artwork for a quotation

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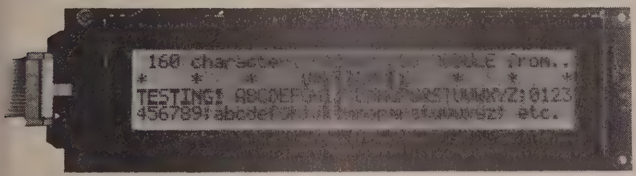
alpha-numeric modules


160 characters
TESTING! ABCDEFG
0123
456789! abcdef
etc.

- Wide temperature supertwist (SBE) ***NEW***
- High contrast
- Wide viewing angle
- Internal character generator
- LED & EL backlighting
- Character height ranging from 4mm to 12.7 mm.

Model Number	Characters x Lines	Digit Size	Module Size (WxH)
MDL-81809	8x1	10.75	84x44
MDL-16166	16x1	6.3	80x36
MDL-16188	16x1	9.2	122x33
MDL-161615	16x1	14.54	151x40
MDL-16265	16x2	5.6	84x44
MDL-201612	20x1	12.7	180x48
MDL-20188	20x1	9.2	146x33
MDL-202612	20x2	12.7	182x60
MDL-20265	20x2	5.6	116x37
MDL-20268	20x2	9.2	146x43
MDL-204612	20x4	12.7	182x90
MDL-20464	20x4	4.8	98x60
MDL-20464B	20x4	4.03	77x47
MDL-20468	20x4	9.2	146x63
MDL-24166	24x1	6.3	126x36
MDL-24265	24x2	5.2	118x36
MDL-40266	40x2	5.5	182x34
MDL-40466	40x4	5.5	196x56

All dimensions in mm.

partial list

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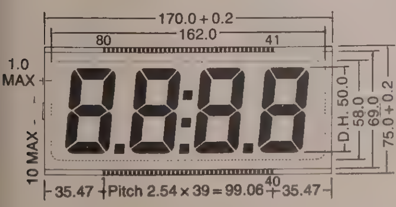
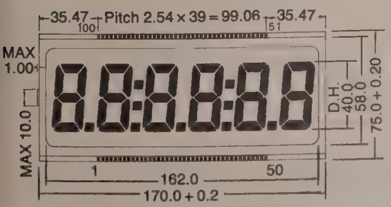
numeric lcd

VI-50402-DP Large 2-inch digit


170.0 + 0.2
162.0
80
41
1.0 MAX
10 MAX
D.H. 50.0
58.0
69.0
75.0 + 0.2
40
35.47
Pitch 2.54 x 39 = 99.06
35.47
8.8:8.8

VI-40602-DP Large 1.6 inch digit


35.47
Pitch 2.54 x 39 = 99.06
35.47
100
51
MAX 1.00
MAX 10.0
D.H. 40.0
58.0
75.0 + 0.20
1
50
162.0
170.0 + 0.2
8.8:8.8:8.8

graphic lcd modules

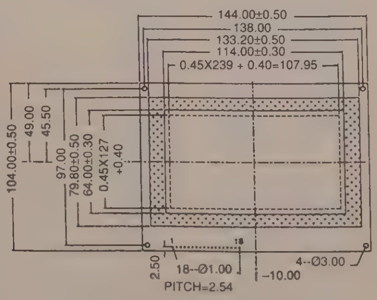
Model	Dots	Dot Size W X H	Dot Pitch	Effective Viewing Area	Module Size
MGLS - 8032A	80x32	0.43x0.43	0.48x0.48	46x18	84x44
MGLS - 8032B	80x32	0.43x0.43	0.48x0.48	46x18	84x44
MGLS - 8464	84x64	0.50x0.50	0.55x0.55	51x40	90x60
MGLS - 10032A	100x32	0.50x0.60	0.55x0.65	60x26.5	75x54
MGLS - 10032B	100x32	0.62x0.56	0.72x0.66	76x25.2	98x50
MGLS - 12032A	120x32	0.6x0.425	0.65x0.475	60x26.5	75x54
MGLS - 12032B	120x32	0.56x0.55	0.61x0.60	76x25.2	98x50
MGLS - 12864	128x64	0.39x0.55	0.44x0.60	62x44	78x70
MGLS - 12864T	128x64	0.39x0.55	0.44x0.60	62x44	78x70
MGLS - 19264	192x64	0.36x0.36	0.41x0.41	84x31	100x60
MGLS - 24064	240x64	0.48x0.48	0.53x0.53	132x39	176x65
MGLS - 32064	320x64	0.36x0.36	0.41x0.41	136.8x33.60	165x45
MGLS - 240128	240x128	0.40x0.40	0.45x0.45	114x64	144x104

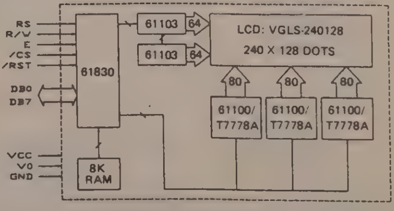
Built-in Graphic Controller and 8K SRAM

Additional designs available

MGLS-240128

240 x 128 DOTS


144.00±0.50
138.00
133.20±0.50
114.00±0.30
0.45X239 + 0.40=107.95
104.00±0.50
49.00
45.50
97.00
79.80±0.50
64.00±0.30
0.45X127 +0.40
2.50
18--Ø1.00
PITCH=2.54
4--Ø3.00
-10.00
18


RS
R/W
E
/CS
/RST
DB0
DB7
VCC
V0
GND
61830
61103
64
61103
64
LCD: VGLS-240128
240 X 128 DOTS
80
80
80
61100/ T7778A
61100/ T7778A
61100/ T7778A
8K RAM

WORLD PRODUCTS

CHARACTER TYPE

Model No.	Display Format Char x Line	Character Fonts	Module Size (W x H x T mm)	Viewing Area (W x H mm)	Character Size (W x H mm)	Dot Size (W x H mm)	Power VDD - (V)
WPC-161000	16 x 1	5 x 8 dots	80.0 x 36.0 x 10.0	64.5 x 13.8	3.07 x 6.56	0.55 x 0.75	5.0
WPC-161100		5 x 7 dots + cursor	122.0 x 33.0 x 10.0	99.0 x 13.0	4.84 x 8.06	0.92 x 1.10	5.0
WPC-162100	16 x 2	5 x 7 dots + cursor	122.0 x 44.0 x 10.0	99.0 x 24.0	4.84 x 8.06	0.92 x 1.10	5.0
WPC-162200		5 x 8 dots	85.0 x 29.5 x 10.0	62.5 x 16.1	2.78 x 4.89	0.55 x 0.50	5.0
WPC-162250		5 x 8 dots	85.0 x 35.0 x 10.0	62.2 x 17.9	2.95 x 5.55	0.55 x 0.65	*5.0
WPC-162300		5 x 8 dots	85.0 x 36.0 x 10.0	62.2 x 17.9	2.95 x 5.55	0.55 x 0.65	*5.0
WPC-162400		5 x 8 dots	84.0 x 44.0 x 10.0	62.2 x 17.9	2.95 x 5.55	0.55 x 0.65	*5.0
WPC-162500		5 x 8 dots	80.0 x 36.0 x 10.0	62.5 x 16.1	2.78 x 4.89	0.55 x 0.50	5.0
WPC-164000	16 x 4	5 x 8 dots	87.0 x 60.0 x 10.0	61.4 x 25.0	2.95 x 4.75	0.55 x 0.55	5.0
WPC-202000	20 x 2	5 x 8 dots	116.0 x 36.0 x 10.0	83.0 x 18.8	3.20 x 5.55	0.60 x 0.65	*5.0
WPC-202100		5 x 8 dots	108.0 x 39.0 x 10.0	83.0 x 18.8	3.20 x 5.55	0.60 x 0.65	*5.0
WPC-202200		5 x 7 dots + cursor	180.0 x 40.0 x 10.0	149.0 x 23.0	6.00 x 9.66	1.12 x 1.12	*5.0
WPC-204000	20 x 4	5 x 8 dots	98.0 x 60.0 x 10.0	76.0 x 25.2	2.95 x 4.75	0.55 x 0.55	5.0
WPC-242000	24 x 2	5 x 8 dots	118.0 x 36.0 x 10.0	94.5 x 18.0	3.20 x 5.55	0.60 x 0.65	5.0
WPC-402000	40 x 2	5 x 8 dots	182.0 x 33.5 x 10.0	154.0 x 16.5	3.20 x 5.55	0.60 x 0.65	*5.0
WPC-404000	40 x 4	5 x 8 dots	190.0 x 54.0 x 10.5	147.0 x 29.5	3.54 x 4.89	0.50 x 0.55	*5.0

Model No.	Power Consumption typ. (mW)	Built In Controller LSI	Driving Method		**Versions					
			Duty	Bias	TN	STN	H	R	EL	LED
WPC-161000	10	HD44780 or Equivalent	1/16D	1/4B	0	0	–	0	0	0
WPC-161100	10	HD44780 or Equivalent	1/16D	1/4B	–	0	–	0	0	0
WPC-162100	10	HD44780 or Equivalent	1/16D	1/4B	0	0	–	0	0	0
WPC-162200	10	HD44780 or Equivalent	1/16D	1/4B	0	0	–	0	0	0
WPC-162250	10	HD44780 or Equivalent	1/16D	1/4B	0	0	0	0	0	0
WPC-162300	10	HD44780 or Equivalent	1/16D	1/4B	0	0	0	0	0	0
WPC-162400	10	HD44780 or Equivalent	1/16D	1/4B	0	0	0	0	0	0
WPC-162500	10	HD44780 or Equivalent	1/16D	1/4B	0	0	–	0	0	0
WPC-164000	20	HD44780 or Equivalent	1/16D	1/4B	0	0	–	0	0	0
WPC-202000	15	HD44780 or Equivalent	1/16D	1/4B	0	0	0	0	0	0
WPC-202100	15	HD44780 or Equivalent	1/16D	1/4B	0	–	0	0	0	0
WPC-202200	15	HD44780 or Equivalent	1/16D	1/4B	–	0	0	0	0	0
WPC-204000	25	HD44780 or Equivalent	1/16D	1/4B	–	0	–	0	0	0
WPC-242000	20	HD44780 or Equivalent	1/16D	1/4B	0	0	–	0	0	0
WPC-402000	25	HD44780 or Equivalent	1/16D	1/4B	–	0	0	0	0	0
WPC-404000	50	HD44780 or Equivalent	1/16D	1/4B	–	0	0	0	0	0

Note *Except for extended temperature LCD.
**TN - Twisted Nematic
STN - Supertwisted Nematic
H - Extended Temperature
R - Reflective Type
EL - With EL Backlight
LED - With LED backlight

GRAPHIC TYPE

Model No.	Dot Number (W xH)	Module Size (W x H x T mm)	Viewing Area (W x H mm)	Dot Pitch (W x H mm)	Dot Size (H x H mm)	Power Supply (V) VDD - VSS
WPG-128 x 16	128 x 16	82.0 x 20.1 x 6.8	70.1 x 15.2	0.50 x 0.55	0.45 x 0.50	5.0
WPG-122 X 32		84.0 x 44.0 x 10.0	60.5 x 18.5	0.44 x 0.49	0.40 x 0.45	5.0
WPG-122 x 32-01		65.1 x 27.1 x 8.9	60.5 x 18.5	0.44 x 0.49	0.40 x 0.45	5.0
WPG-128 x 64	128 x 64	93.0 x 70.0 x 9.5	71.7 x 39.0	0.52 x 0.52	0.48 x 0.48	5.0
WPG-128 x 64-01		82.0 x 65.0 x 10.8	53.0 x 33.5	0.39 x 0.46	0.35 x 0.42	5.0
WPG-128 x 128	128 x 128	72.4 x 69.9 x 10.0	49.0 x 49.0	0.35 x 0.35	0.32 x 0.32	5.0
WPG-160 x 80	160 x 80	100.0 x 54.0 x 11.0	72.3 x 37.8	0.42 x 0.42	0.39 x 0.39	5.0
WPG-160 x 150	160 x 150	78.0 x 76.5 x 9.7	53.0 x 50.0	0.30 x 0.30	0.26 x 0.26	5.0
WPG-240 x 64	240 x 64	180.0 x 65.0 x 11.0	132.0 x 39.0	0.53 x 0.53	0.49 x 0.49	5.0
WPG-240 x 64-01		180.0 x 65.0 x 10.8	132.0 x 39.0	0.53 x 0.53	0.49 x 0.49	5.0
WPG-240 x 64-02		180.0 x 65.0 x 10.0	132.0 x 39.0	0.53 x 0.53	0.49 x 0.49	5.0

Model No.	Power Supply (V) VEE-VSS	Multiplex		Control LSI		Versions			
		Duty	Bias	Built-In	Attachable	STN	R	EL	LED
WPG-128 X 16	–	1/16	1/5B	SED1520	–	0	0	–	–
WPG-122 X 32	-2.0	1/32	1/6B	SED1520	–	0	0	0	0
WPG-122 X 32-01	-2.0	1/32	1/6B	SED1520	–	0	0	0	–
WPG-128 X 64	-4.5	1/64	1/9B	HD61202	–	0	0	0	0
WPG-128 X 64-01	-4.5	1/64	1/9B	HD61202	–	0	0	0	0
WPG-128 X 128	-9.0	1/128	1/12B	HD61830	–	0	0	0	0
WPG-160 X 80	-8.5	1/80	1/10B	HD61830	–	0	0	0	0
WPG-160 X 150	-11.0	1/150	1/13B		HD64646 /MSM6255	0	0	0	–
WPG-240 X 64	-8.2	1/64	1/9B	HD61830	–	0	0	0	–
WPG-240 X 64-01	-8.2	1/64	1/9B	T6963C	–	0	0	0	–
WPG-240 X 64-02	-8.2	1/64	1/9B	T6963C	–	0	0	0	–

WP® WORLD PRODUCTS INC.

SEE OUR OTHER DATA PAGES IN SECTIONS 1500, 4300, 4700 AND 4800.

19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

NEC ELECTROLUMINESCENT (EL) BACKLIGHTS

Standard Brightness (recommended brightness: 40 to 60cd/m²)

Luminous colors	Blue-green	Green	Yellow-green	White	Yellow
Symbol	C	G	YG	W	Y

Type	Features					
LO	Long Life		○	—	—	—
LP	Long Life	○	—	—	—	—
LA	Long Life	—	○	○	○	○
LL	Standard	○	—	—	○	—

Medium Brightness (recommended brightness: 90 to 120cd/m²)

Luminous colors	Blue-green	Green	Yellow-green	White	Yellow
Symbol	C	G	YG	W	Y

Type	Features					
LM	Long Life	—	○	○	Under development	Under development
LE	High efficiency	—	—	—	○	—

High Brightness (recommended brightness: 150 to 200cd/m²)

Luminous colors	White	Bluish-white
Symbol	W	BW

Type	Features		
LK	High brightness/ efficiency	○	—
LH	High brightness/ efficiency	○	○
LF	High brightness	○	—

*Luminous colors may vary slightly depending on type.

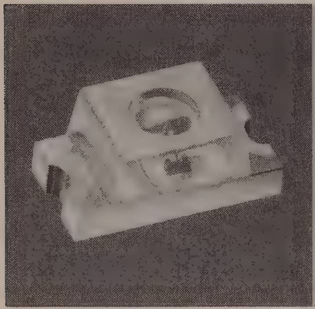
ELECTRICAL CHARACTERISTICS

Typical properties with area(S) - 300cm², at 20°C, 60%RH

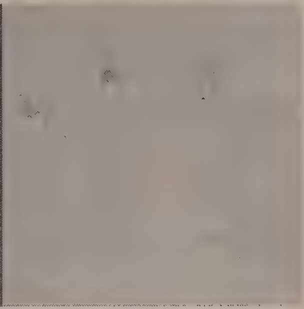
Type & Color	Operating Conditions	Brightness (cd/m²)	Current Density (mA/cm²)	Power Consumption (mw/cm²)	Chromaticity		Half-brightness time (reference)		
					X	Y	With AC Power Supply	With Inverter*	
LO-G	AC100V 400Hz	60	0.13	2.9	0.180	0.455	5000Hrs	1.3 to 2.0 times longer than AC power supply	Self-excited inverter
LP-C		60	0.14	3.1	0.180	0.415	2000Hrs		
LA-G		65	0.12	2.9	0.175	0.470	2400Hrs		
LA-YG		60	0.08	2.0	0.220	0.610			
LA-W		48	0.09	2.3	0.340	0.405			
LA-Y		40	0.065	1.4	0.455	0.470			
LL-C		50	0.16	3.2	0.180	0.395	2000Hrs		
LL-W		43	0.10	2.8	0.330	0.390			
LM-G		90	0.16	4.0	0.180	0.440	3500Hrs		
LM-YG		115	0.16	4.0	0.260	0.680	2800Hrs		
LE-W		61	0.10	2.6	0.330	0.390	1800Hrs		
LK-W	AC140V 800HZ	200	0.22	6.3	0.350	0.405	540Hrs	2 to 3 times longer tnan AC power supply	Separately excited inverter
LH-W		200	0.24	6.8	0.350	0.380	540Hrs		
LH-BW		200	0.24	7.2	0.320	0.380			
LF-W	AC135V 900Hz	200	0.28	10.0	0.350	0.390	630Hrs		

*Matched Inverters are Available

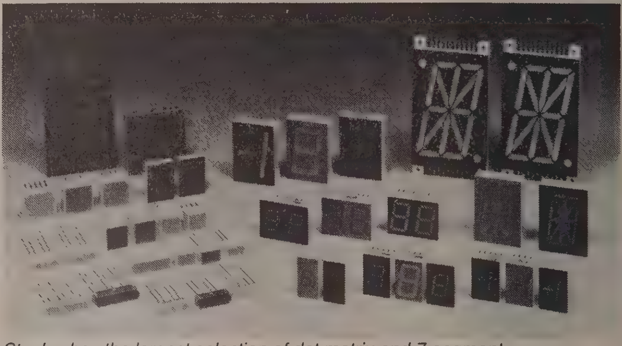
STANLEY WORLD LEADER IN LEDs AND LCDs STANLEY



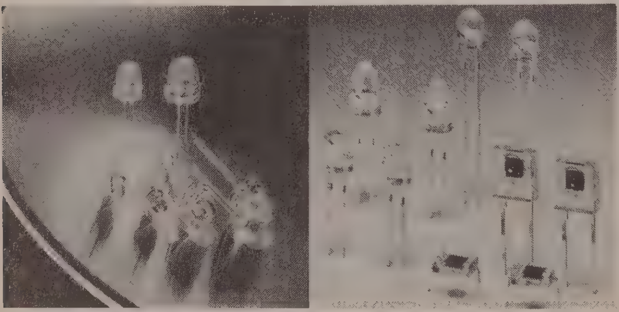
Stanley SMT LEDs are ideal for automatic insertion



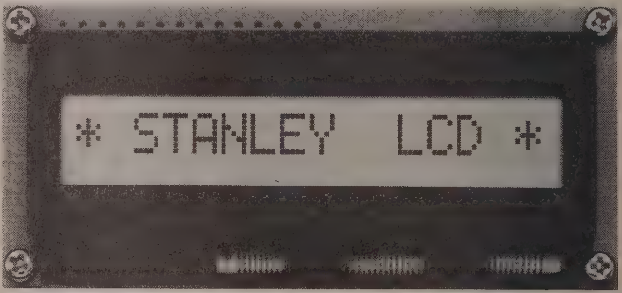
Stanley's infrared LEDs are suitable for optical switches, photosensors and wireless data transmission



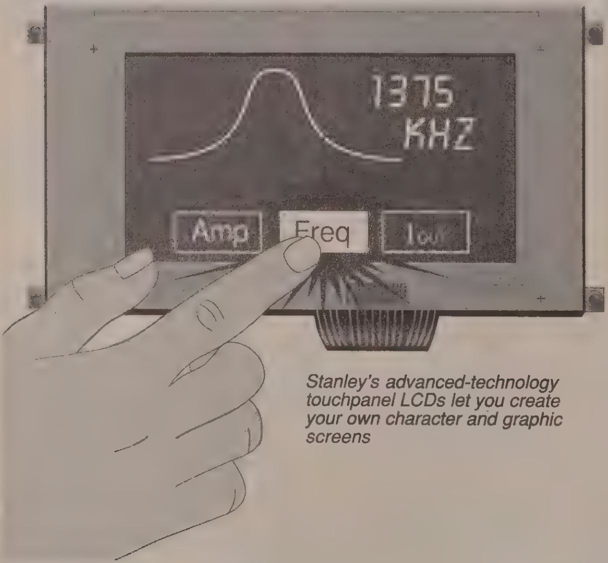
Stanley has the largest selection of dot matrix and 7-segment LEDs in the industry



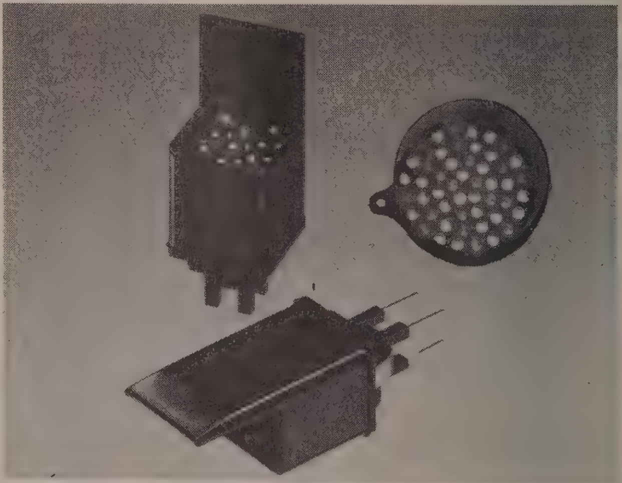
Superbright LEDs are available in red, green, yellow and orange



Thin, lightweight, GML character-type LCDs are available at 30% below competition



Stanley's advanced-technology touchpanel LCDs let you create your own character and graphic screens



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STANLEY
Brighter by Design℠

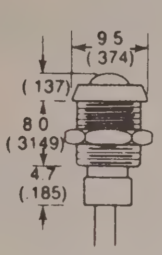
LAMPS AND INDICATOR LIGHTS

Manufacturer	Starting EEM Page No.	Light Type									Accessories/Hardware			Features				
		Incan-descent	LED	Neon	Fluores-cent	Electro-lumines-cent	Infra-red	Kryp-ton	Ultra violet	Xenon	Sockets/ Holders/ Clips	Caps & Lenses	In-verters	Panel Mount	Relamp-able PC Mount	Assem-blies	Rectan-gular	Water-proof
Arcolectric Corp.	B•1132	√	√	√										√		√	√	√
Atlas Specialty Lighting	B•1134	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√
BKL	B•1134					√								√		√	√	
Bulbtronics	B•1135	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Data Display Products	B•1136	√	√	√			√				√	√		√	√	√	√	√
Dialight Corp.	B•1141	√	√	√							√	√		√		√	√	√
Elma Electronics	B•1148		√								√	√		√	√	√		
Eltech	B•1149					√							√				√	
Genisco Electronics	B•1151	√		√							√	√		√	√	√		
Gilway Technical Lamp	B•1152	√	√	√	√		√	√	√	√	√	√		√	√	√	√	
Hamamatsu Corp.	B•1162									√				√		√		
IDEA, Inc.	B•1164		√				√				√			√		√		
Industrial Devices	B•1166	√	√	√							√			√	√	√	√	√
JKL Components	B•1168	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	
Kingbright Co.	B•1169		√											√		√	√	
Leading Edge	B•1170					√											√	√
Loctite Luminescent Systems, Inc.	B•1172					√							√	√		√	√	√
Lumitex, Inc.	B•1173	√	√															
Micro Lamps, Inc.	B•1174	√	√	√	√													
Minelco Inc.	B•1175	√	√									√		√		√	√	√
Oshino Lamps Ltd.	B•1176	√												√	√	√		
Osram Sylvania	B•1190	√		√	√			√			√	√		√		√		
Pro-Battery	B•1178	√		√	√	√	√	√	√	√	√	√	√	√		√	√	
Shelly Associates	B•1179	√	√	√		√												
Shogyo International Corp.	B•1180	√	√	√	√			√			√			√	√	√		
Shokai Far East Ltd.	B•1181	√	√	√	√		√	√	√	√				√				
Sloan Co.	B•1182	√	√	√							√	√		√	√	√		√
Stanley Co. Inc.	B•1188		√		√		√						√	√			√	
TMP Inc.	B•1195		√										√					
Visual Communications	B•1196	√	√								√	√		√	√	√	√	

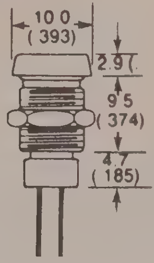
Arcolectric

NEON-INCANDESCENT–LED INDICATOR LIGHTS and LAMP HOLDERS

LH1000 LED SERIES



LH1048



LH1050

LH1000 Series T-1-3/4 LED holders are available in brass chrome finish or aluminum black anodized finish; also available in "Water Resistant" versions. **Mounting hole:** 5/16" dia. **Panel Thickness 1048 Series:** .216 max. **Panel Thickness 1050 Series:** .275" max.

Type *	Finish
LH1048	Chrome
LH1048B	Black
LH1050	Chrome
LH1050B	Black
SEALED VERSIONS	
LH1048S	Chrome
LH1048BS	Black
LH1050S	Chrome
LH1050BS	Black

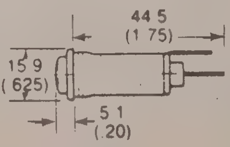
* These models do not include LED lamps. Select the LED lamps from the table if required.

Type	Color	Volt	MA	MCD	View
3700	Red	2.1	10	6	30
3701	Yellow	2.2	20	16	30
3702	Green	2.1	20	8	30

OPTIONS

1. PVC extended wire leads.
2. Inline resistors for voltages 6 to 28VDC.

LH67 SERIES



LH67 Series holders are snap-in mounting. Lamp replaces from rear of panel. Chrome bezel. **Panel Mounting:** .50" dia. **Panel Thickness:** .044". For thicker panels a push on lock washer is available, part number N17. Terminals .250" tab.

Model *	Color
LH677A	Amber
LH677B	Blue
LH677C	Clear
LH677G	Green
LH677R	Red

* This model includes 12 volt lamps

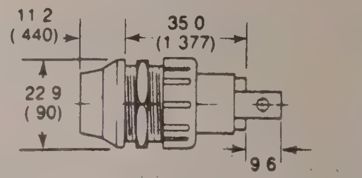
For optional voltage and/or replacement lamp for LH67 Series.

Model	Volts	Amps	Life AC	MSCP
BA76	6	0.6W	5k	0.20
BA712	12	2.0W	2.5k	0.60
BA724	24	1.0W	7k	0.24

OPTIONS

1. Wire leads version with non-replaceable incandescent lamps for 6 to 28V.
2. Matching non-replaceable neon lamp versions for 125V and 250V.

LH382 AND LH392 SERIES

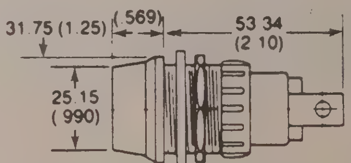


LH382 and LH392 are T-3-1/4 miniature bayonet holders. Model LH382 is all nylon black body and bezel. Model LH392 has a brass chrome plated finish bezel. Lamp is replaceable from front or rear of panel. Tab Style Terminals .250". **Mounting hole:** 3/4" dia. **Max. Panel Thk.:** .250". **Lens:** Transparent polycarbonate. See below for 6 to 28V lamp selection.

Type *	Color
LH382A	Amber
LH382B	Blue
LH382C	Clear
LH382G	Green
LH382R	Red
LH392A	Amber
LH392B	Blue
LH392C	Clear
LH392G	Green
LH392R	Red

* These models do not include lamps. Select from list below.

LH692 SERIES



LH692 T-3-1/4" miniature bayonet holder. Body/bezel brass chrome plated. **Terminals:** .250" tab style. **Mounting Hole:** 1.00" dia. **Lens:** .990" dia. transparent polycarbonate. Lamp replaces from front or rear of panel.

Model *	Color
LH692A	Amber
LH692B	Blue
LH692C	Clear
LH692G	Green
LH692R	Red

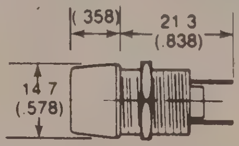
* These models do not include lamps. Select from list below.

INCANDESCENT T-3-1/4 MINIATURE BAYONET BASED LAMPS

Type	Volts	Amps	Life AC	MSCP
47	6.3	.15	3000	.52
1892	14.4	.12	1000	.75
1829	28.0	.07	1000	.62

LHM62 SERIES

LHM62 T-1-3/4 midget flange holder. Lamp replaceable from front of panel Solder terminals. **Panel Mounting:** .50" dia. **Panel Thickness:** .375".



Model *	Color
LHM62A	Amber
LHM62B	Blue
LHM62C	Clear
LHM62G	Green
LHM62R	Red

* These models do not include lamps. Select from list below.

Model	Volts	Amps	Life AC	MSCP
381	6.3	.20	20K	.40
382	14.0	.08	15K	.30
387	28.0	.04	7K	.30

SEE PAGE B•1670-1672,SECTION 5100 FOR SWITCHES

A FULL LINE CATALOG OF DRAWINGS AND SPECIFICATIONS AVAILABLE FREE OF CHARGE

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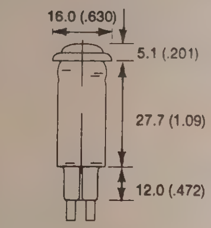
Arcolectric

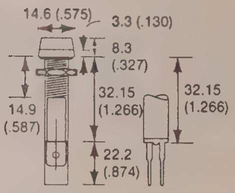
NEON-INCANDESCENT– LED INDICATOR LIGHTS and LAMP HOLDERS

UL, CSA,VDE, etc. MOST MODELS

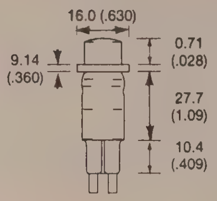
67


16.0 (.630)
5.1 (.201)
27.7 (1.09)
12.0 (.472)

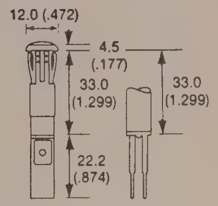
177


14.6 (.575)
3.3 (.130)
8.3 (.327)
14.9 (.587)
32.15 (1.266)
32.15 (1.266)
22.2 (.874)

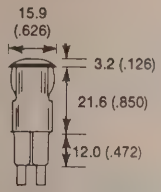
193


16.0 (.630)
9.14 (.360)
0.71 (.028)
27.7 (1.09)
10.4 (.409)

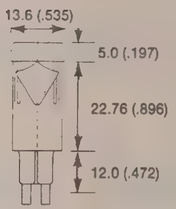
276


12.0 (.472)
4.5 (.177)
33.0 (1.299)
33.0 (1.299)
22.2 (.874)

589

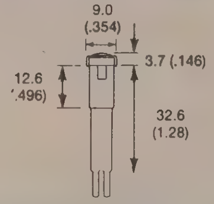

15.9 (.626)
3.2 (.126)
21.6 (.850)
12.0 (.472)

2870

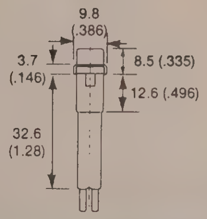

13.6 (.535)
5.0 (.197)
22.76 (.896)
12.0 (.472)

2950-2950B-2950C

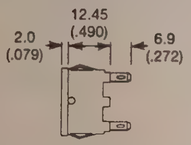
WHITE BEZEL BLACK BEZEL CHROME BEZEL


9.0 (.354)
3.7 (.146)
12.6 (.496)
32.6 (1.28)

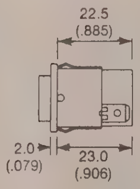
2951


9.8 (.386)
3.7 (.146)
8.5 (.335)
12.6 (.496)
32.6 (1.28)

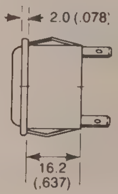
8630


12.45 (.490)
2.0 (.079)
6.9 (.272)

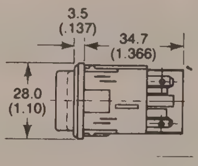
8580


22.5 (.885)
2.0 (.079)
23.0 (.906)

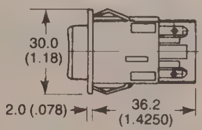
430-480


2.0 (.078)
16.2 (.637)

7030 ROUND


3.5 (.137)
34.7 (1.366)
28.0 (1.10)

7030 SQUARE


30.0 (1.18)
2.0 (.078)
36.2 (1.4250)

MODEL	MTG	TERMINALS			LAMPS		
	(INCHES)	C .250	H .187	WL WIRE	LED 2-28VDC	NEON 125-250V	INCANDESCENT 6-28V
67	.50	x	x	x		x	x
177	.50	x	x	x	x	x	x
193	.50	x	x	x		x	x
276	.375	x	x	x	x	x	x
*430	.480 x 1.07	x	x			x	x
*480	.878 x 1.07	x	x			x	x
589	.50	x	x	x		x	x
2870	.50	x	x	x		x	x
2950	.315			x	x	x	x
2950B,C	.315			x	x	x	x
2951	.315			x	x	x	x
7030AC	1.0	x				x	x
7030SA	.870 x 1.07	x				x	x
8580	.75 x .508		x			x	x
8630	.75 x .508		x			x	x

* Other cut out sizes available. • **Materials: Body:** nylon. **Lens:** transparent polycarbonate. **Lens colors for most models:** Amber, Blue, Clear, Green, Red.

SEE PAGE B•1670-1672,SECTION 5100 FOR SWITCHES

A FULL LINE CATALOG OF DRAWINGS AND SPECIFICATIONS AVAILABLE FREE OF CHARGE

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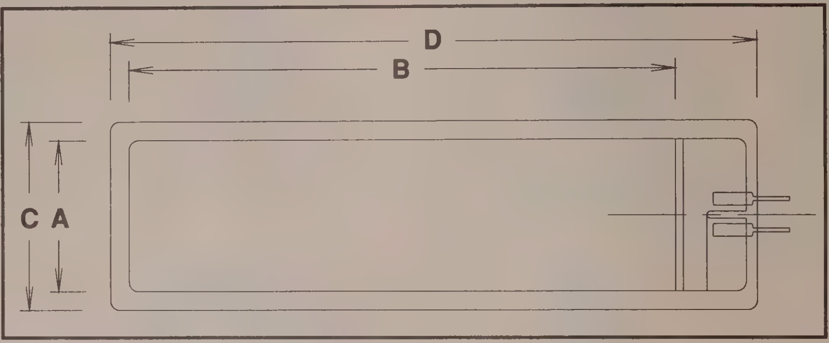
With *BKL*, you get light-speed delivery on standard or engineered EL lamps.



Drawings are available for all part numbers listed below. Lamps are made in the following colors: aviation green, blue green, yellow green, green, warm white, cool white and auto white.

Standard Sizes (dimensions in inches)

Part Number	Lit Area (AxB)	Package Size (CxD)
2010	0.67 x 1.85	0.91 x 2.36
2011	0.67 x 2.05	0.91 x 2.69
2013	0.67 x 2.30	0.91 x 2.94
2014	0.67 x 2.56	0.91 x 3.20
2022	0.82 x 2.30	1.06 x 2.94
2024	0.82 x 2.56	1.06 x 3.20
2032	0.97 x 2.56	1.21 x 3.20
2034	0.97 x 3.50	1.21 x 4.14
2036	0.97 x 4.80	1.21 x 5.31
2050	1.27 x 2.56	1.51 x 3.20
2052	1.27 x 3.50	1.51 x 4.01
2054	1.27 x 4.80	1.51 x 5.31
2062	1.57 x 3.50	1.81 x 4.14
2064	1.57 x 4.80	1.81 x 5.44
2072	2.00 x 3.50	2.24 x 4.14
2074	2.00 x 5.00	2.24 x 5.51
2075	2.00 x 8.00	2.24 x 8.64
2076	2.00 x 10.00	2.24 x 10.57
2092	4.00 x 6.00	4.24 x 6.64
2094	4.00 x 8.00	4.24 x 8.64
A1019	1.52 x 5.74	1.72 x 6.55
A1020	0.76 x 6.20	0.95 x 6.76
A1029	0.63 x 2.58	0.83 x 3.06
A1168	4.27 x 9.25	4.51 x 9.87
A1332	5.85 x 9.32	6.11 x 9.92
A1443	3.21 x 4.02	4.09 x 4.67
A1444	1.76 x 2.52	1.96 x 3.04
A1452	2.56 x 2.50	2.76 x 3.26
A1055	0.80 x 3.33	0.96 x 3.78
A1593	4.02 x 7.55	4.19 x 8.34
A1594	3.55 x 3.55	3.73 x 4.06
B1166	0.38 x 11.25	0.52 x 12.55

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- Improved efficiency
- Excellent moisture resistance
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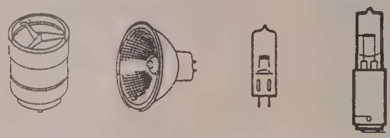
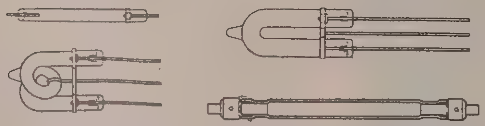


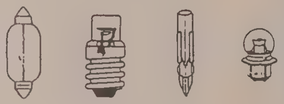
Xenon, Metal Halide, Halogen Bi-Pin, MR16 Reflector Types (Available with Tranversal & Axial Filaments) **Lamps For:** Point Sources, Projection Systems, Calibration, Microscopes, Audio Visual & Overhead Projectors, Microreaders, Searchlights, Inspection, Test Equipment, Infrared Heat Simulation

UV Flash & Xenon Flash Laser Lamps



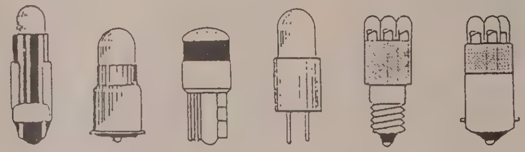
Pulse & C.W. UV **Lamps For:**
Phototypesetting, Printing, Semiconductors,
Laser Lamps for:
Industrial Fabrication, Surgical, etc.
Xenon Flash Lamps for: Signals, Defection,
Inspection.

Industrial, Electronic Miniature & Indicator Lamps (Foreign & Domestic)



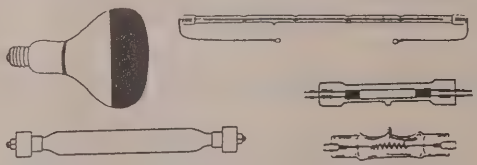
Halogen, Xenon, Miniature, Neon Fluorescent, Incandescent, Relampable Indicator Lights and Cartridge **Lamps For**: Communications, Automotive, Aircraft, Marine, Alarm Systems, Elevators, PC Boards, Etching, Detecting, Inspection, Test Equipment, Calibration, Instrumentation, Panels, Electrical & Consumer Products

Based LED Lamps



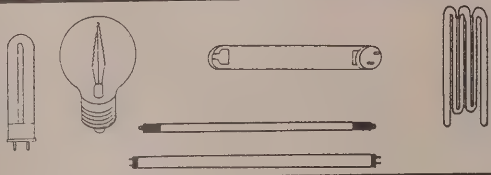
Industry Standard Incandescent Replacement LED's. Multi-chip (Cluster Type) LED's Wide range of bases: Subminiature & Minature Flange, Groove, Screw, Bayonet, Wedge, Bi-pin. Available in Red, Green, Amber, Yellow. Various intensities are available and built in resistors offer a range of voltages. Bulb sizes available are: T1, T13/4, T31/4, and Telephone Slide Sizes are T4.6, T5.5, T6.8, T2

UV Curing & Infra-Red Exposure Lamps



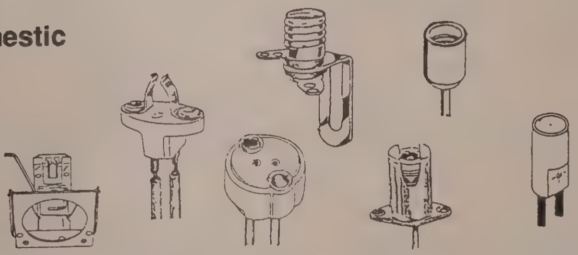
Ultraviolet(Long Wave) Light Sources, Capillary, Blacklight, Blacklight Blue, Infrared, Halogen, Metal Halide & Medium Pressure Mercury Arc **Lamps For:** UV Curing, Ink Drying, Silkscreening, Laminating, Exposure Systems, Plate Making, PC Board Mfg, Wood Finishing, Metal Decorating, Communications, Inspection, Epoxy Coat Inspection, Electronics, Laboratory, Research,Analysis, General Laboratory.

Germicidal Equipment Lamps



Short Wave (200-254 NM), Cold Cathode & Hot Cathode, Slimline "U" Shaped and Grid, Ozone **Lamps For:**
Water Sterilization (Drinking or Swimming)
Control Bacteria and Algae, Food Processing,
Bottled Beverage, Manufacturing of Cosmetics & Pharmaceuticals, Clean Rooms, Research,
Industrial Waste Water, Sanitation, Operating Rooms.

Lamp Sockets Foreign & Domestic Lamps



Sockets For: Miniature, Halogen, Fluorescent , Metal Halide, Wedge Base, Midget Grooved, Bayonet, Candelabra Screw, Intermediate Screw Bases, Compact, Fluorescent Holders, MR16 Halogen & 2 Pin Halogen, DoubleEnded (R7S) Halogen, Minican & European Bases.

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New full line catalog available

DDP® LED Colors: **Bright Red** (660nM), **Red** (630nM), **Orange** (610nM), **Amber** (605nM), **Amber/Yellow** (585nM), **Yellow** (570nM), **Green** (565nM), **Pure Green** (555nM), **Blue** (470nM), **Red/Green** (630nM/565nM pale yellow)

ALL DIMENSIONS IN INCHES (MM)

Surface-Mount LEDs

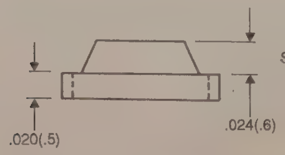
- Bright Red, Red, Orange, Amber, Green
- Ceramic Substrate
- Available on 8mm Tape & Reel

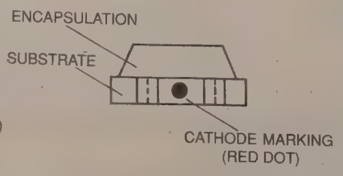
- **SF1-X Single Chip** (Replace X with -BR, -R, -O, -A, or -G)
- **SF1-X-2 Dual Chip** (Replace X with -BR, -R, -O, -A, or -G)
- **SF1-X/X Bi-Color** (Replace X with -BR/G, or -O/G)

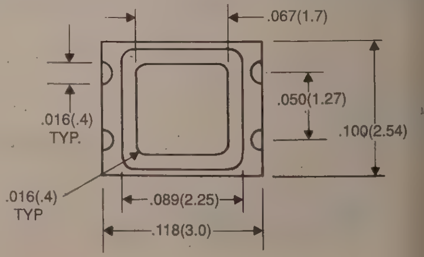
Electro-Optical Characteristics @ $T_A = 25°C$						Absolute Maximum Ratings @ $T_A = 25°C$				
Color	Chip Material	Peak Wavelength λ pk (nm)	Luminous Intensity Iv (mcd) Min/Typ	Viewing Angle 2θ ½ (deg)	Forward Voltage V_f @ 20mA Typ/Max	Power Dissipation (mW)	Derating Factor (mW/°C)	Maximum Continuous Current (mA)	Operating Temp. (°C)	Storage Temp. (°C)
RED (-BR)	GaAlAs	660	4.0/8.0(1)	160	1.7/2.6(1)	45	.33	15	-25 / +65	-30 / +75
RED (-R)	GaAsP	630	1.6/4.0	160	2.0/2.6	65	.33	25	-25 / +75	-30 / +85
ORG (-O)	GaAsP	610	3.0/8.0	160	2.1/2.8	80	.33	25	-25 / +75	-30 / +85
AMB (-A)	GaAsP	585	3.0/8.0	160	2.1/2.8	70	.33	25	-25 / +75	-30 / +85
GRN (-G)	GaAsP	565	6.0/12.0	160	2.1/2.6	65	.33	25	-25 / +75	-30 / +85

(1) Forward Current = 10mA.

Reverse Breakdown Voltage V_R(IR=100µA)=4Vdc, BR Series=3Vdc.
Flow, Reflow LED Soldering Temperature less than 10 seconds=260°C.







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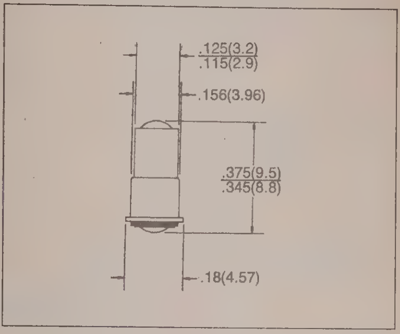
T-1 Sub-Midget LED Lamp

ED Colors Available: Bright Red, Red, Orange, Amber, Green, Pure Green, Blue
tandard Voltages: 2, 4, 5, 6, 12, 15, 24, 28, AC, DC or Bi-Polar

MF125

T-1 Flange LED, Dual-Chip

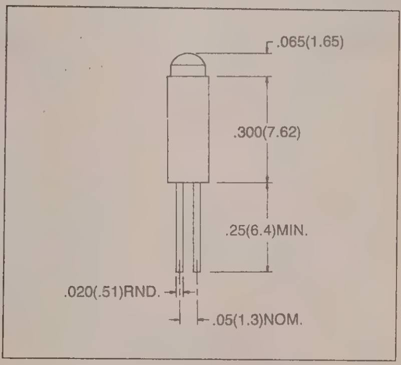
Replaces Incandescent#: 682, 685, 714, 718, 6839, 7240, 7241, 8022


.125(3.2)
.115(2.9)
.156(3.96)
.375(9.5)
.345(8.8)
.18(4.57)

BP125

T-1 Bi-Pin LED, Dual-Chip

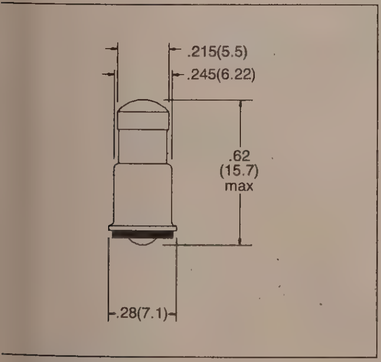
Replaces Incandescent#: 7265, 7680, 7683, 7714, 7715, 7839, 8099


.065(1.65)
.300(7.62)
.25(6.4)MIN.
.020(.51)RND.
.05(1.3)NOM.

T-1 3/4 Midget LED Lamp

ED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Green, Pure Green, Blue, Red/Green
tandard Voltages: 5, 6, 12, 15, 24, 28, 60, & 110 AC, DC or Bi-Polar

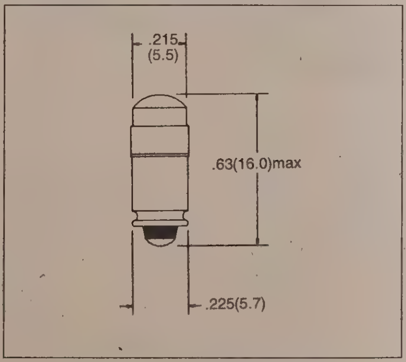
F200


.215(5.5)
.245(6.22)
.62
(15.7)
max
.28(7.1)

-1 3/4 Flange LED, 6-Chip

eplaces Incandescent #: 327, 328, 330, 45, 349, 350, 370, 376, 377, 380, 381, 82, 385, 387, 394, 459, 7332, 7333, 335, 7341, 8918

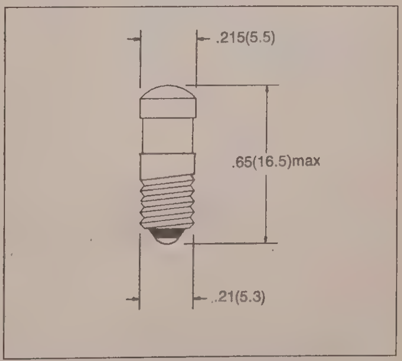
MG200


.215
(5.5)
.63(16.0)max
.225(5.7)

T-1 3/4 Groove LED, 6-Chip

Replaces Incandescent #: 334, 336, 337, 379, 386, 388, 398

MS200


.215(5.5)
.65(16.5)max
.21(5.3)

T-1 3/4 Screw LED, 6-Chip

Replaces Incandescent #: 335, 342, 369, 373, 378, 383, 399, 1768, 1775, 8362, 8369, 8384

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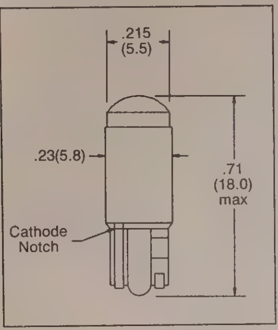
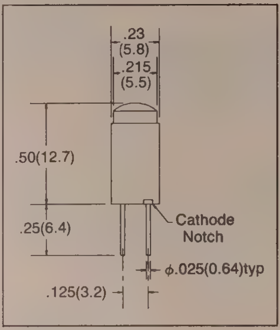
WB200


.215
(5.5)
.23(5.8)
.71
(18.0)
max
Cathode
Notch

T-1 3/4 Wedge LED, 6-Chip

Replaces Incandescent #: 17, 18, 37, 56, 70, 73, 74, 79, 84, 85, 86

BP202


.23
(5.8)
.215
(5.5)
.50(12.7)
.25(6.4)
Cathode
Notch
ϕ.025(0.64)typ
.125(3.2)

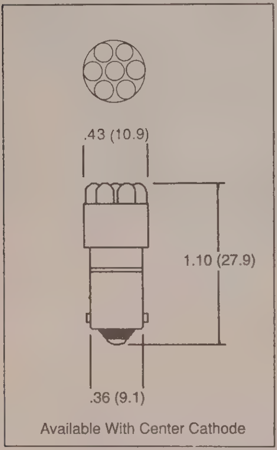
T-1 3/4 Bi-Pin LED, 6-Chip

Replaces Incandescent #: 2314, 2324, 2325, 2335, 2337, 2341, 2342, 3149, 7001, 7003, 7327, 7328, 7330, 7349, 7361, 7371, 7373, 7376, 7377, 7380, 7381, 7382, 7387, 7876, 7945

T-3 1/4 Miniature LED Lamp

LED Colors Available: Red, Amber, Amber/Yellow, Yellow, Green, Blue
Standard Voltages: 6, 12, 24, 28, 48, 60, 110 AC, DC or Bi-Polar

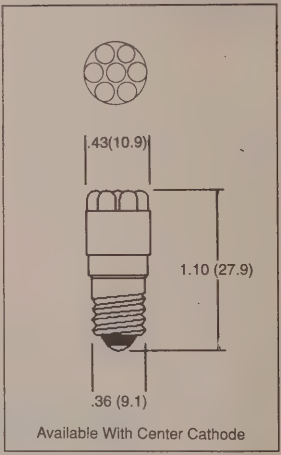
MBL400-7CL1


.43 (10.9)
1.10 (27.9)
.36 (9.1)
Available With Center Cathode

T-3 1/4 Bayonet LED, 7-Cluster

Replaces Incandescent #: 12MB, 12RB, 24MB, 24RB, 28MB, 28RB, 44, 47, 48MB, 48RB, 53, 57, 60MB, 60RB, 120MB, 120RB, 216, 239, 240, 256, 313, 316, 356, 363, 755, 756, 757, 1302, 1437, 1445, 1488, 1495, 1810, 1813, 1815, 1818, 1819, 1820, 1829, 1835, 1847, 1850, 1855, 1864, 1866, 1873, 1889, 1891, 1892, 1893, 1895

MSL400-7CL1


.43(10.9)
1.10 (27.9)
.36 (9.1)
Available With Center Cathode

T-3 1/4 Screw LED, 7-Cluster

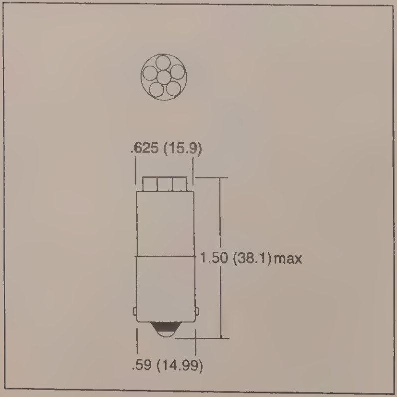
Replaces Incandescent #: 46, 52, 1446, 1449, 1483, 1487, 1821

T-4 1/2 Candelabra LED Lamp

LED Colors Available: Red, Amber, Amber/Yellow, Yellow, Green

Standard Voltages: 12, 15, 24, 28, 48, 60, 110 AC, DC or Bi-Polar

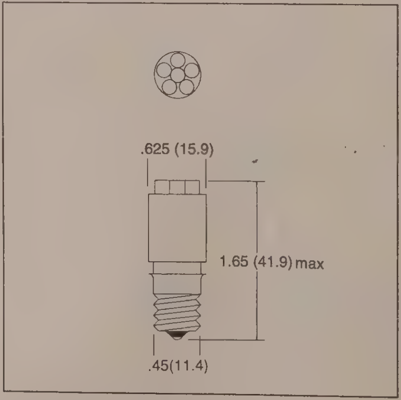
MB500-6CL3


.625 (15.9)
1.50 (38.1) max
.59 (14.99)

T-4 1/2 Bayonet LED, 6-Cluster

Replaces Incandescent #: 301, 303, 309, 311, 623, 1251, 1495, 1723, 1855

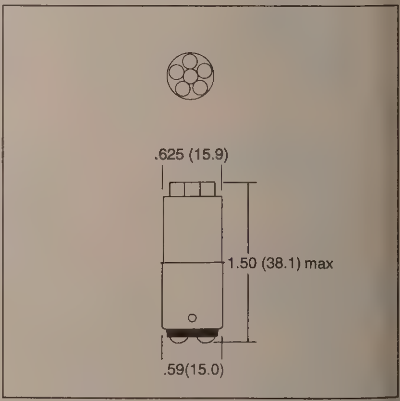
MS500-6CL3


.625 (15.9)
1.65 (41.9) max
.45(11.4)

T-4 1/2 Screw LED, 6-Cluster

Replaces Incandescent #: 3S6/5, 6S6, 12RC, 24RC, 28RC, 48RC, 60RC, 120RC

DCB500-6CL3


.625 (15.9)
1.50 (38.1) max
.59(15.0)

T-4 1/2 Double Contact Bayonet LED, 6-Cluster

Replaces Incandescent #: 302, 304, 306, 308, 1204, 1252, 1638, 1692

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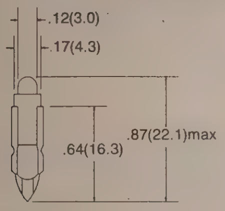
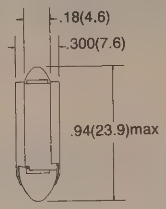
Telephone Slide-Based LEDs

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Amber/Yellow, Yellow, Green, Pure Green, Blue, Red/Green
Voltage Range: 2-110V AC, DC or Bi-Polar

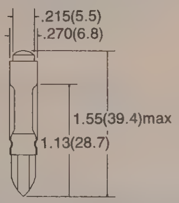
46SB (T4.6)


.12(3.0)
.17(4.3)
.87(22.1)max
.64(16.3)

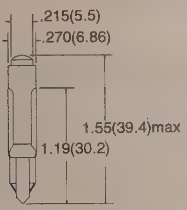
5TSB (T5)


.18(4.6)
.300(7.6)
.94(23.9)max

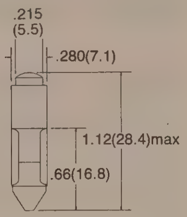
1SB (T6.8, ANS1 NO.1)


.215(5.5)
.270(6.8)
1.55(39.4)max
1.13(28.7)

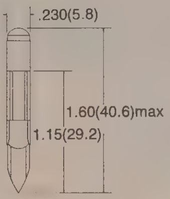
SB (ANS1 NO.2)


.215(5.5)
.270(6.86)
1.55(39.4)max
1.19(30.2)

5SB (ANS1 NO.5)


.215
(5.5)
.280(7.1)
1.12(28.4)max
.66(16.8)

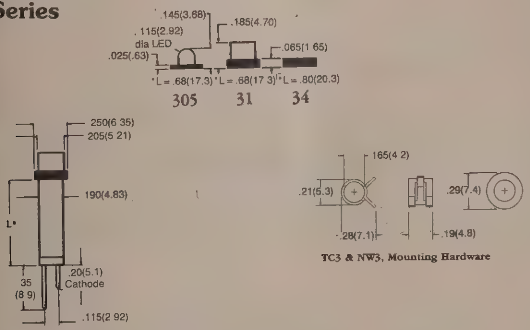
55SSB (T5.5)


.230(5.8)
1.60(40.6)max
1.15(29.2)

.190" Panel Mount LEDs

ED Colors Available: Red, Amber, Amber/Yellow, Yellow,
reen, Blue
tandard Voltages: 2, 5, 12, 24, 28, AC or DC

30 Series

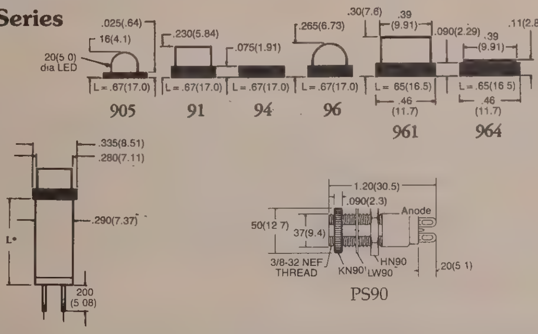

.145(3.68)
.115(2.92) dia LED
.025(.63)
.185(4.70)
.065(1.65)
L = .68(17.3)
L = .68(17.3)
L = .80(20.3)
305
31
34
250(6.35)
205(5.21)
190(4.83)
L*
.20(5.1) Cathode
35 (8.9)
.115(2.92)
165(4.2)
.21(5.3)
.29(7.4)
.28(7.1)
.19(4.8)

TC3 & NW3, Mounting Hardware

.290" Panel Mount LEDs

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Yellow, Green, Pure Green, Blue, Red/Green
Standard Voltages: 2, 5, 6, 12, 15, 24, 28, 48, 60, 110, 220, AC or DC

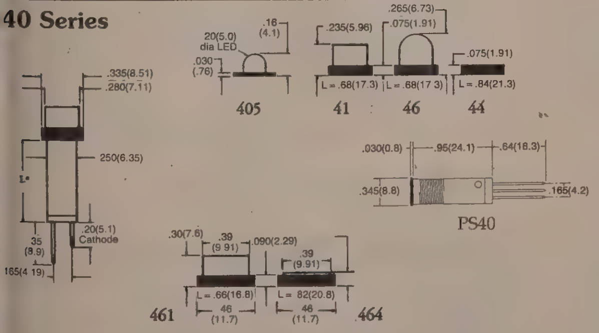
90 Series


.025(.64)
16(4.1)
20(5.0) dia LED
.230(5.84)
.075(1.91)
.265(6.73)
.30(7.6)
.39 (9.91)
.090(2.29)
.39 (9.91)
.11(2.8)
L = .67(17.0)
L = .67(17.0)
L = .67(17.0)
L = .67(17.0)
L = .65(16.5)
.46 (11.7)
L = .65(16.5)
.46 (11.7)
905
91
94
96
961
964
.335(8.51)
.280(7.11)
.290(7.37)
L*
200 (5.08)
1.20(30.5)
.090(2.3)
Anode
50(12.7)
37(9.4)
3/8-32 NEF THREAD
KN90
LW90
HN90
20(5.1)
PS90

250" Panel Mount LEDs

ED Colors Available: Red, Amber, Yellow, Green, Blue
tandard Voltages: 2, 12, 15, 24, 28, 48, 60, 110, 220 AC or DC

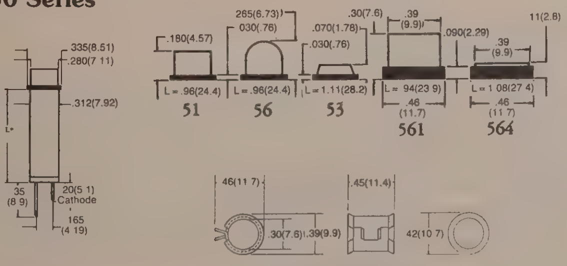
40 Series


.335(8.51)
.280(7.11)
250(6.35)
L*
.20(5.1) Cathode
35 (8.9)
165(4.19)
20(5.0) dia LED
.16 (4.1)
.030 (.76)
405
.235(5.96)
.265(6.73)
.075(1.91)
.075(1.91)
L = .68(17.3)
L = .68(17.3)
L = .84(21.3)
41
46
44
.030(0.8)
.95(24.1)
.64(16.3)
.345(8.8)
.165(4.2)
PS40
.30(7.6)
.39 (9.91)
.090(2.29)
.39 (9.91)
L = .66(16.8)
.46 (11.7)
L = 82(20.8)
.46 (11.7)
461
464

.312" Panel Mount LEDs

LED Colors Available: Bright Red, Ultra Red, Red, Orange, Amber, Yellow, Green, Pure Green, Blue, Red/Green
Standard Voltages: 2, 5, 6, 12, 15, 24, 28, 48, 60, 110, 220 AC or DC

50 Series

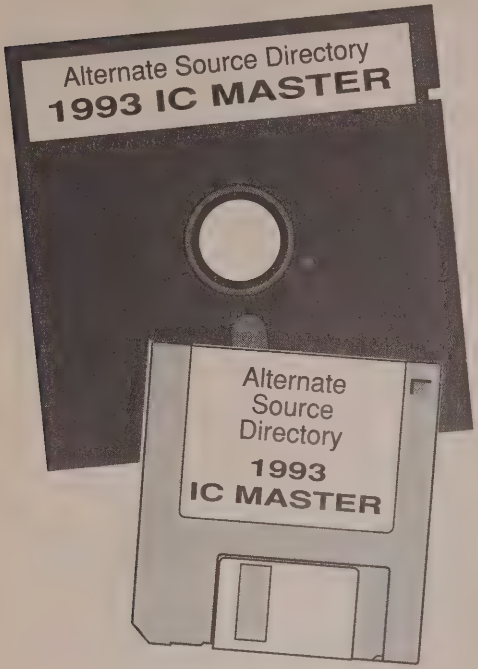

.335(8.51)
.280(7.11)
.312(7.92)
L*
35 (8.9)
20(5.1) Cathode
165 (4.19)
.180(4.57)
265(6.73)
030(.76)
.070(1.78)
.030(.76)
.30(7.6)
.39 (9.9)
.090(2.29)
11(2.8)
.39 (9.9)
L = .96(24.4)
L = .96(24.4)
L = 1.11(28.2)
L = 94(23.9)
.46 (11.7)
L = 1.08(27.4)
.46 (11.7)
51
56
53
561
564
46(11.7)
.45(11.4)
.30(7.6)
.39(9.9)
42(10.7)

TC5 & NW5, Mounting Hardware

Hearst Engineering Software

ICMASD

Alternate Source Directory



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Published annually in March

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New! MICROLED™ SERIES SURFACE MOUNT LEDS

Visible and infrared devices designed for surface mount applications
Two package types both with ceramic substrates for high reflectivity
and high power dissapation

Top View Visible

PART NO.	COLOR	VF	mA	MCD
597-3001-007	HER	2.1	20	7.2
597-3012-007	L/C RED	2.2	5.0	4.8
597-3301-007	GREEN	2.0	20	6.9
597-3401-007	YELLOW	2.3	20	7.0
597-3501-007	YEL-GR	2.2	20	7.2

Product on 7 inch reel, 3000 per reel

Top View Infrared Emitters

PART NO.	WAVELENGTH	VF	mA	PWR
597-3811-007	940	1.2	20	0.8
597-3831-007	880	1.3	20	1.3

Product on 7 inch reel, 3000 per reel
–3811 polarity indicator is cathode
–3831 polarity indicator is anode

Top View Infrared Detectors

PART NO.	WAVELENGTH	TYPE	AREA sq. mm	tf/tr
597-4121-007	850	TRANS.	.019	3 uS
597-4122-007	850	TRANS.	.019	3 uS
597-4412-007	950	PIN	0.2	6 nS

Product on 7 inch reel, 3000 per reel
–4121 and –4122 polarity indicator is collector
–4412 polarity indicator is anode

Right Angle Visible

PART NO.	COLOR	VF	mA	MCD
597-2001-013	HER	2.1	20	8.2
597-2301-013	GREEN	2.0	20	7.5
597-2401-013	YELLOW	2.3	20	7.4
597-2501-013	YEL-GR	2.2	20	7.8
597-2701-013	R/G BICOLOR	1.8	20	8.0

Product on 13 inch reel, 3000 per reel
All product pin 1 anode pin 3 cathode except–2701 pin 1 green anode pin 2 red anode pin 3 common cathode

Right Angle Infrared Emitters

PART NO.	WAVELENGTH	VF	mA	PWR
597-2811-013	940	1.2	20	0.8
597-2831-013	880	1.3	20	1.3

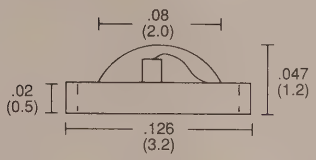
Product on 13 inch reel, 3000 per reel
–2811 product pin 1 anode pin 3 cathode
–2831 product pin 3 anode pin 1 cathode

Right Angle Infrared Detectors

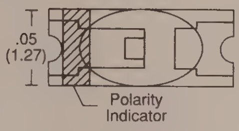
PART NO.	WAVELENGTH	TYPE	AREA sq. mm	tf/tr
597-1121-013	850	TRANS.	.019	3 uS
597-1412-013	950	PIN	0.2	6 nS

Product on 13 inch reel, 3000 per reel
–1121 pin 1 emitter, 2 base, 3 collector
–1412 pin 1 anode, 3 cathode

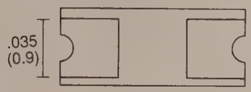
TOP VIEW PACKAGE



Side

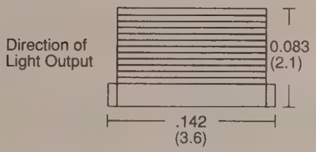


Top

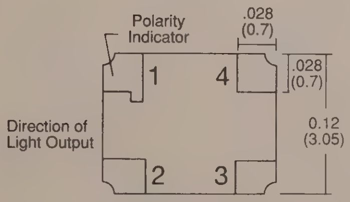


Bottom

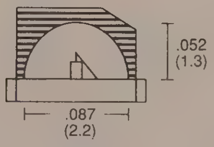
RIGHT ANGLE PACKAGE



Side



Bottom



End

ALL INDICATIONS ARE DIALIGHT

DIALIGHT 1913 Atlantic Avenue, Manasquan, NJ 08736 (908) 223-9400 Fax: (908) 223-8788

LED LAMPS & CIRCUIT BOARD INDICATORS (CBI®)

2mm, 3mm, 5mm Discrete LED Lamps-521 SERIES

Discrete LED lamps available in 2mm, 3mm, and 5mm red, green, yellow and 3 leaded bi-color. The lens can be diffused or non-diffused with or without integral resistors.

PART NO.	COLOR LED/LENS	VF	mA	MCD	SNAP-IN MOUNT	RG
521-9173	G/DIFF	2.1	10	10	B	1
521-9174	Y/DIFF	2.1	10	6.0	B	1
521-9462	R-G/DIFF	1.75/2.0	10	8.0	B	2
521-9450	R-G/DIFF	2.1/2.3	10	5.0/8.0		3
521-9183	R/DIFF	5.0	12	3.0	A	10
521-9186	R/DIFF	1.6	20	0.8		5
521-9195	R/DIFF	1.6	3	0.4		5
521-9445	R/DIFF	2.0	10	6.3	B	1
521-9210	G/DIFF	2.3	10	8.5	C	6
521-9211	Y/DIFF	2.2	10	10	C	6
521-9215	R/DIFF	5.0	10	4	C	12
521-9216	R/DIFF	2.2	10	10	C	6
521-9240	R/DIFF	2.0	10	6.0	B	7
521-9246	R/DIFF	2.2	10	7.0	A	4
521-9247	R/ND	2.2	10	60.0	A	4
521-9248	Y/DIFF	2.2	10	8.0	A	4
521-9249	Y/ND	2.2	10	50.0	A	4
521-9250	G/DIFF	2.3	10	8.0	A	4
521-9251	G/ND	2.3	10	70.0	A	4
521-9264	R/DIFF	2.5	25	5.0		8
521-9265	Y/DIFF	2.5	20	5.0		8
521-9266	G/DIFF	2.5	25	5.0		8
521-9270	G/DIFF	2.4	10	8.0	B	9
521-9271	Y/DIFF	2.4	10	6.0	B	9
521-9320	R/DIFF	1.8	2	2.0	A	11
521-9464	R/WC	2.2	20	125	A	4
521-9465	G/WC	2.2	20	120	A	4
521-9466	Y/WC	2.2	20	140	A	4

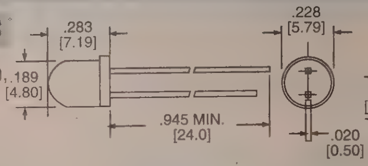

.283
[7.19]
.228
[5.79]
.189
[4.80]
.945 MIN.
[24.0]
.020
[0.50]

FIGURE 1

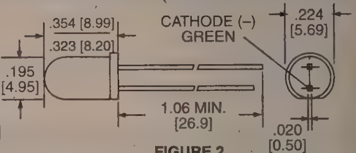

.354 [8.99]
.323 [8.20]
CATHODE (–)
GREEN
.224
[5.69]
.195
[4.95]
1.06 MIN.
[26.9]
.020
[0.50]

FIGURE 2

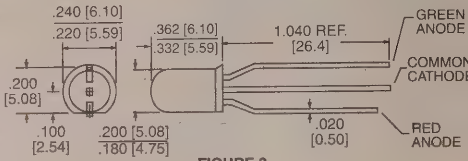

.240 [6.10]
.220 [5.59]
.362 [6.10]
.332 [5.59]
1.040 REF.
[26.4]
GREEN
ANODE
COMMON
CATHODE
.200
[5.08]
.100
[2.54]
.200 [5.08]
.180 [4.75]
.020
[0.50]
RED
ANODE

FIGURE 3

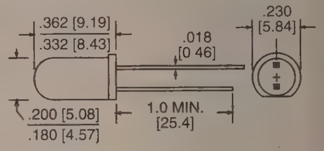

.362 [9.19]
.332 [8.43]
.018
[0 46]
.230
[5.84]
.200 [5.08]
.180 [4.57]
1.0 MIN.
[25.4]

FIGURE 4

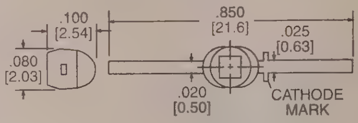

.100
[2.54]
.850
[21.6]
.025
[0.63]
.080
[2.03]
.020
[0.50]
CATHODE
MARK

FIGURE 5

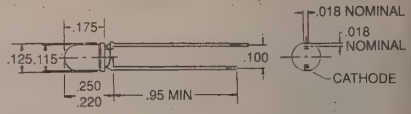

.175
.018 NOMINAL
.018
NOMINAL
.125
.115
.100
CATHODE
.250
.220
.95 MIN

FIGURE 6

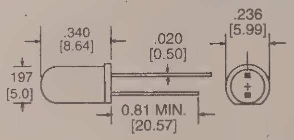

.340
[8.64]
.020
[0.50]
.236
[5.99]
.197
[5.0]
0.81 MIN.
[20.57]

FIGURE 7

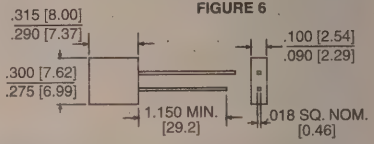

.315 [8.00]
.290 [7.37]
.100 [2.54]
.090 [2.29]
.300 [7.62]
.275 [6.99]
1.150 MIN.
[29.2]
.018 SQ. NOM.
[0.46]

FIGURE 8

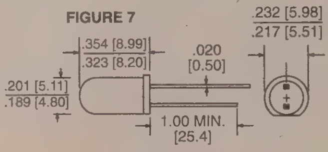

.232 [5.98]
.217 [5.51]
.354 [8.99]
.323 [8.20]
.020
[0.50]
.201 [5.11]
.189 [4.80]
1.00 MIN.
[25.4]

FIGURE 9

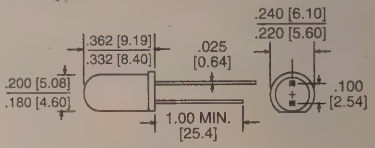

.240 [6.10]
.220 [5.60]
.362 [9.19]
.332 [8.40]
.025
[0.64]
.200 [5.08]
.180 [4.60]
.100
[2.54]
1.00 MIN.
[25.4]

FIGURE 10

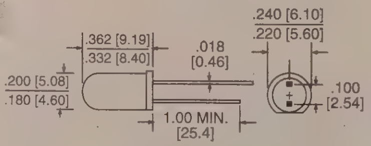

.240 [6.10]
.220 [5.60]
.362 [9.19]
.332 [8.40]
.018
[0.46]
.200 [5.08]
.180 [4.60]
.100
[2.54]
1.00 MIN.
[25.4]

FIGURE 11

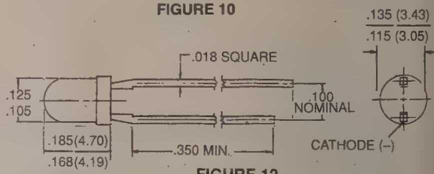
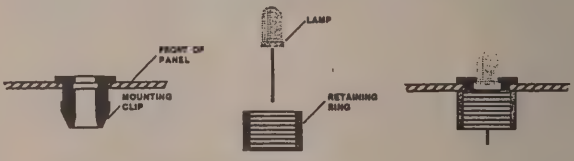

.135 (3.43)
.115 (3.05)
.018 SQUARE
.125
.105
.100
NOMINAL
.185(4.70)
.168(4.19)
.350 MIN.
CATHODE (–)

FIGURE 12

Snap-In Mounting Hardware

Mounting hardware for rear mounting of 521 series LEDs. Check chart below for correct product. Note recommended mounting hole and panel thickness below.

PART NO.	LED USED WITH	RECOM MTG HOLE	MAX PANEL THICKNESS	FIG.
515-0004	A	.265 (6.73)	7/64 (2.78)	13
515-0005	B	.265 (6.73)	7/64 (2.78)	13
515-0006	C	.165 (4.19)	.100 (2.54)	13


LAMP
FRONT OF PANEL
MOUNTING CLIP
RETAINING RING

FI/.URE 13

5mm Variable Height - 561 SERIES

Variable height CBIs available in 3 heights .5, .7, and 1 inch when mounting above the PC board. Available in red, green or yellow, high or super effiecient versions. Integral resistors are also available. Flat denotes cathode. Check the chart below for the product you require.

PART NO.	HEIGHT	COLOR	VF	mA	MCD	FIG.
561-0104-050	.500	R	5	13	3.0	14
561-0104-070	.700	R	5	13	3.0	15
561-0104-100	1.00	R	5	13	3.0	16
561-1101-050	.500	R	1.8	2	2	14
561-1101-070	.700	R	1.8	2	2	15
561-1101-100	1.00	R	1.8	2	2	16
561-1201-050	.500	Y	1.9	2	1.8	14
561-1201-070	.700	Y	1.9	2	1.8	15
561-1201-100	1.00	Y	1.9	2	1.8	16
561-1301-050	.500	G	1.8	2	1.8	14
561-1301-070	.700	G	1.8	2	1.8	15
561-1301-100	1.00	G	1.8	2	1.8	16
561-2101-050	.500	R	2.2	10	7.0	14
561-2101-070	.700	R	2.2	10	7.0	15
561-2101-100	1.00	R	2.2	10	7.0	16
561-2201-050	.500	G	2.2	20	10	14
561-2201-070	.700	G	2.2	20	10	15
561-2201-100	1.00	G	2.2	20	10	16
561-2301-050	.500	Y	2.2	10	6.3	14
561-2301-070	.700	Y	2.2	10	6.3	15
561-2301-100	1.00	Y	2.2	10	6.3	16

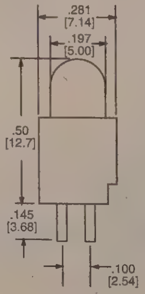

.281
[7.14]
.197
[5.00]
.50
[12.7]
.145
[3.68]
.100
[2.54]

FIGURE 14

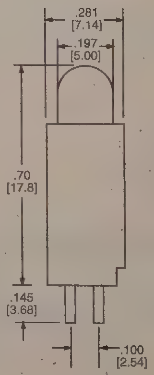

.281
[7.14]
.197
[5.00]
.70
[17.8]
.145
[3.68]
.100
[2.54]

FIGURE 15

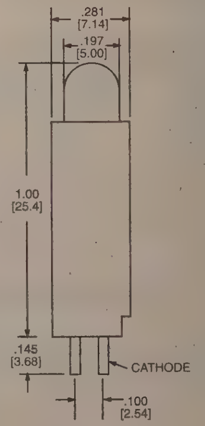

.281
[7.14]
.197
[5.00]
1.00
[25.4]
.145
[3.68]
CATHODE
.100
[2.54]

FIGURE 16

ALL INDICATIONS ARE DIALIGHT

DIALIGHT 1913 Atlantic Avenue, Manasquan, NJ 08736 (908) 223-9400 Fax: (908) 223-8788

SURFACE MOUNT PRISM® CBI®

Dialight introduces the first truly surface mountable CBI with a newly patented lens design that is compatible with the harsh SMT processing environment and automatic placement equipment.

2mm (Subminiature) Surface Mount- 595 SERIES

Surface mountable CBI available in high efficiency red, green and yellow.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
595-2101-013*	RIGHT	RED	1.7	20	9.5	27
595-2301-013	RIGHT	GREEN	2.1	20	5.6	27
595-2401-013	RIGHT	YELLOW	2.2	20	5.7	27

Available in 7" (17.8 cm) and13" (33 cm) reels.
For 7" reel - change part number from "-013" to "-007"

3mm Surface Mount - 591 SERIES

Surface mountable CBI available in high efficiency red, green and yellow.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
591-2001-013	RIGHT	RED	2.0	10	8	28
591-2301-013	RIGHT	GREEN	2.0	10	6.5	28
591-2401-013	RIGHT	YELLOW	2.0	10	5	28
591-2101-013*	RIGHT	RED	1.75	10	29	28

Available in 13" (33 cm) reels.

5mm Surface Mount - 590 SERIES

Surface mountable CBI available in high efficiency red, green and yellow.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
590-2001-013	RIGHT	RED	2.0	10	8	29
590-2101-013*	RIGHT	RED	1.75	10	29	29
590-2301-013	RIGHT	GREEN	2.0	10	6.5	29
590-2401-013	RIGHT	YELLOW	2.0	10	5	29

Available in 13" (33 cm) reels.

*AlGaAs red

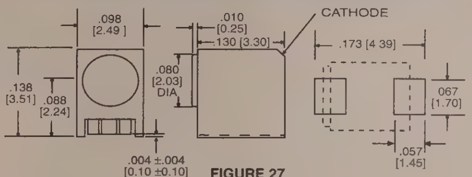

.098 [2.49]
.010 [0.25]
.130 [3.30]
CATHODE
.173 [4 39]
.080 [2.03] DIA
.138 [3.51]
.088 [2.24]
067 [1.70]
.057 [1.45]
.004 ±.004 [0.10 ±0.10]

FIGURE 27

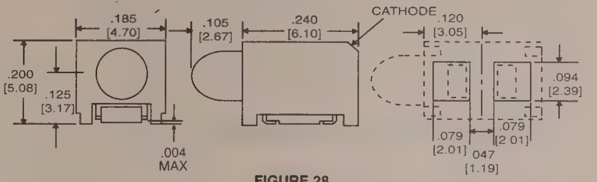

.185 [4.70]
.105 [2.67]
.240 [6.10]
CATHODE
.120 [3.05]
.200 [5.08]
.125 [3.17]
.094 [2.39]
.004 MAX
.079 [2.01]
.079 [2 01]
047 [1.19]

FIGURE 28

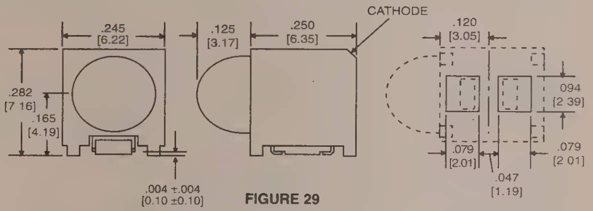

.245 [6.22]
.125 [3.17]
.250 [6.35]
CATHODE
.120 [3.05]
.282 [7 16]
.165 [4.19]
094 [2 39]
.004 ±.004 [0.10 ±0.10]
.079 [2.01]
.047 [1.19]
.079 [2 01]

FIGURE 29

(CBI®) CIRCUIT BOARD INDICATORS

2mm (Subminiature) Single - 555 SERIES

Incorporates a 2mm LED in either a right angle or top view package in red, green or yellow. Integral resistors are available for a wide variety of voltages compatible with our 555 quad series.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
555-2001	RIGHT	RED	1.6	20	0.6	24
555-2003	RIGHT	RED	5	6	1.2	24
555-2004	RIGHT	RED	5	17	2	24
555-2006	RIGHT	RED	14	10	1.5	24
555-2007	RIGHT	RED	5	3	0.6	24
555-2008	RIGHT	RED	24	3	0.6	24
555-2009	RIGHT	RED	5	1	0.6	24
555-2301	RIGHT	GREEN	2.4	20	1	24
555-2303	RIGHT	GREEN	5	4.7	0.5	24
555-2401	RIGHT	YELLOW	2.2	20	2	24
555-2403	RIGHT	YELLOW	5	4.7	0.6	24
555-3001	TOP	RED	1.6	20	0.6	25
555-3003	TOP	RED	5	6	1.2	25
555-3004	TOP	RED	5	17	2	25
555-3006	TOP	RED	14	10	1.5	25
555-3007	TOP	RED	5	3	0.6	25
555-3008	TOP	RED	24	3	0.6	25
555-3009	TOP	RED	5	1	0.6	25

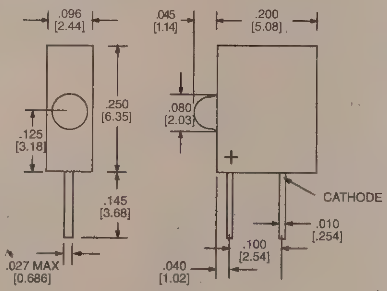

.096 [2.44]
.045 [1.14]
.200 [5.08]
.250 [6.35]
.080 [2.03]
.125 [3.18]
+
CATHODE
.145 [3.68]
.010 [.254]
.100 [2.54]
.027 MAX [0.686]
.040 [1.02]

FIGURE 24

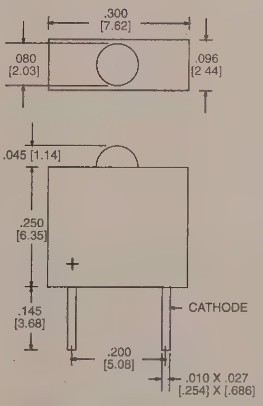

.300 [7.62]
080 [2.03]
.096 [2 44]
.045 [1.14]
.250 [6.35]
+
.145 [3.68]
CATHODE
.200 [5.08]
.010 X .027 [.254] X [.686]

FIGURE 25

2mm (Subminiature) Quad - 555 SERIES

Incorporates a 2mm LED in a right angle package in red, green or yellow. Integral resistors are available for a wide variety of voltages compatible with our 555 single series.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
555-4001	RIGHT	RED	1.6	20	0.6	26
555-4003	RIGHT	RED	5	6	1.2	26
555-4007	RIGHT	RED	5	3	0.6	26
555-4301	RIGHT	GREEN	2.4	20	1	26
555-4303	RIGHT	GREEN	5	4.7	0.5	26
555-4401	RIGHT	YELLOW	2.2	20	2	26
555-4403	RIGHT	YELLOW	5	4.7	0.6	26

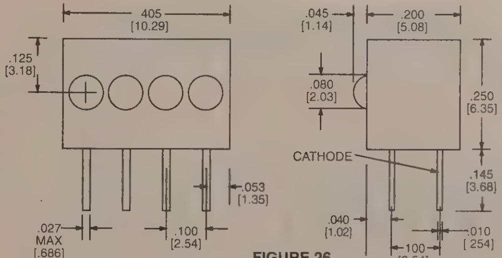

405 [10.29]
.045 [1.14]
.200 [5.08]
.125 [3.18]
.080 [2.03]
.250 [6.35]
CATHODE
.053 [1.35]
.145 [3.68]
.027 MAX [.686]
.100 [2.54]
.040 [1.02]
100 [2.54]
.010 [254]

FIGURE 26

ALL INDICATIONS ARE DIALIGHT

DIALIGHT 1913 Atlantic Avenue, Manasquan, NJ 08736 (908) 223-9400 Fax: (908) 223-8788

(CBI®) CIRCUIT BOARD INDICATORS

3mm Single - 551 SERIES

High luminous intensity solid state light source available in red, green or yellow standard and super efficient LEDs; some with integral resistors. Right angle housing offers ease of assembly compatible with Quad 551 series.

PART NO.	VIEW	COLOR	VF	mA	MCD	DIM A	FIG.
551-0207	RIGHT	GREEN	2.1	10	16	1.05	30
551-0307	RIGHT	YELLOW	2.1	10	6.3	1.05	30
551-0407	RIGHT	RED	2	10	10	1.05	30
551-0507	RIGHT	RED	5	13	8.0	.095	30
551-1107	RIGHT	RED	1.8	2	1.8	.095	30
551-1207	RIGHT	YELLOW	1.9	2	1.6	.095	30
551-1307	RIGHT	GREEN	1.8	2	1.6	.095	30

3mm Quad - 551 SERIES

Four high luminous intensity solid state light sources in a single package available in red, green, and yellow standard and super efficient LEDs; some with integral resistors compatible w/single 551.

PART NO.	VIEW	COLOR	VF	mA	MCD	DIM A	FIG.
551-0207-004	RIGHT	GREEN	2.1	10	16	1.05	31
551-0307-004	RIGHT	YELLOW	2.1	10	6.3	1.05	31
551-0407-004	RIGHT	RED	1.2	10	10	1.05	31
551-0507-004	RIGHT	RED	5	13	8.0	.095	31

3mm Bilevel - 553 SERIES

Bi-level solid state light source available in red, green or yellow with or without integral resistors. Available in standard and super efficient versions, the bilevel design conserves PC board space and right angle housing offers ease of assembly; leads are pretrimmed.

PART NO.	VIEW	COLOR*	VF	mA	MCD	DIM A	FIG.
553-0111	RIGHT	RED/RED	2.0	10	10	.113	32
553-0122	RIGHT	GRN/GRN	2.1	10	16	.113	32
553-0211	RIGHT	RED/RED	1.8	2	1.8	.103	32
553-0222	RIGHT	GRN/GRN	1.8	2	1.6	.103	32
553-0311	RIGHT	RED/RED	5	13	8.0	.103	32

* TOP/BOTTOM POSITION

3mm Trilevel - 564 SERIES

NEW - Tri-level solid state state light source available in red, green or yellow with or without intergal resistors. Available in standard and super efficient versions, the unique trilevel design conserves PC board space and right angle housing offers ease of assembly; leads are pretrimmed.

PART NO.	VIEW	COLOR*	VF	mA	MCD	FIG.
564-0100-111	RIGHT	RD/RD/RD	2.5	10	2.5	33
564-0100-222	RIGHT	GR/GR/GR	2.3	10	2.0	33
564-0100-132	RIGHT	RD/YL/GR	2.5/2.2/2.3	10	2.5/3.0/2.0	33
564-0200-111	RIGHT	RD/RD/RD	1.8	2	1.8	33
564-0200-222	RIGHT	GR/GR/GR	1.8	2	1.6	33
564-0200-132	RIGHT	RD/YL/GR	1.8/1.9/1.8	2	1.8/1.6/1.6	33
564-0300-111	RIGHT	RD/RD/RD	5	13	8	33

* TOP/MIDDLE/BOTTOM POSITION

2mm X 5mm Rectangular-566 SERIES

Rectangular right angle CBIs available in high efficiency red, green, yellow and 3 leaded bi-color. Unique snap-in retention feature allows for positive placement on PC board prior to wave soldering.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
566-0207	RIGHT	GREEN	2.3	20	4	34
566-0307	RIGHT	YELLOW	2.2	20	3.5	34
566-0407	RIGHT	RED	2.2	20	3.5	34
556-3507	RIGHT	R/G	2.1/2.3	10	1.75/2.0	35

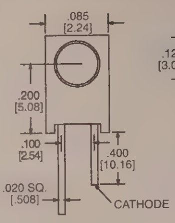

.085
[2.24]
.200
[5.08]
.100
[2.54]
.400
[10.16]
.020 SQ.
[.508]
CATHODE

FIGURE 30

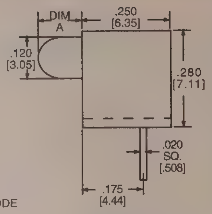

DIM
A
.250
[6.35]
.120
[3.05]
.280
[7.11]
.020
SQ.
[.508]
.175
[4.44]

FIGURE 30-A
Common to single & quad

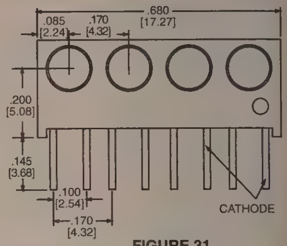

.085
[2.24]
.170
[4.32]
.680
[17.27]
.200
[5.08]
.145
[3.68]
.100
[2.54]
.170
[4.32]
CATHODE

FIGURE 31

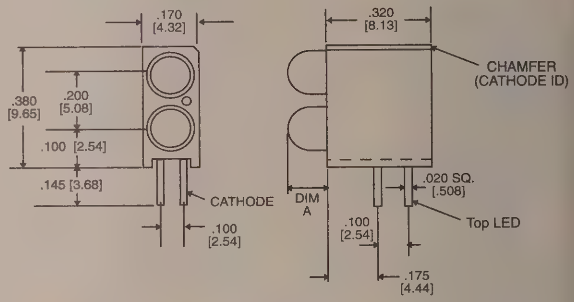

.170
[4.32]
.380
[9.65]
.200
[5.08]
.100 [2.54]
.145 [3.68]
CATHODE
.100
[2.54]
.320
[8.13]
CHAMFER
(CATHODE ID)
DIM
A
.020 SQ.
[.508]
.100
[2.54]
Top LED
.175
[4.44]

FIGURE 32

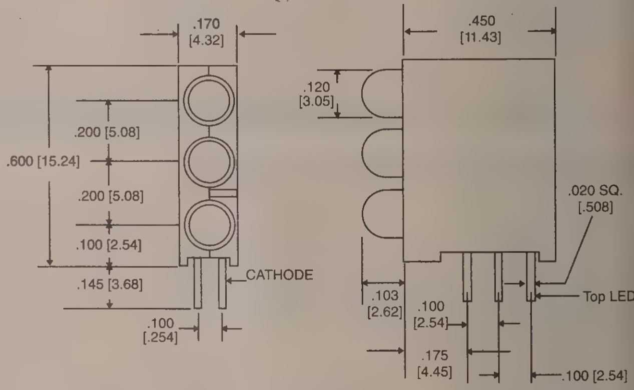

.170
[4.32]
.600 [15.24]
.200 [5.08]
.200 [5.08]
.100 [2.54]
.145 [3.68]
CATHODE
.100
[.254]
.450
[11.43]
.120
[3.05]
.020 SQ.
[.508]
.103
[2.62]
.100
[2.54]
Top LED
.175
[4.45]
.100 [2.54]

FIGURE 33

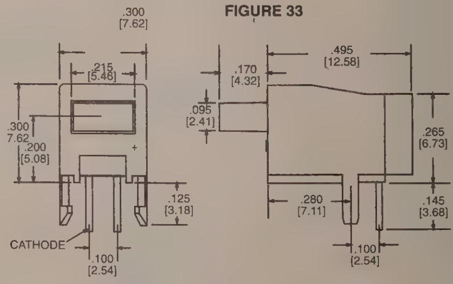

.300
[7.62]
.215
[5.46]
.300
7.62
.200
[5.08]
+
.125
[3.18]
CATHODE
.100
[2.54]
.170
[4.32]
.495
[12.58]
.095
[2.41]
.265
[6.73]
.280
[7.11]
.145
[3.68]
.100
[2.54]

FIGURE 34

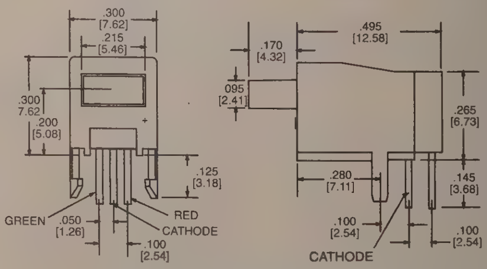

.300
[7.62]
.215
[5.46]
.300
7.62
.200
[5.08]
+
.125
[3.18]
GREEN
.050
[1.26]
RED
CATHODE
.100
[2.54]
.170
[4.32]
.495
[12.58]
095
[2.41]
.265
[6.73]
.280
[7.11]
.145
[3.68]
.100
[2.54]
.100
[2.54]
CATHODE

FIGURE 35

ALL INDICATIONS ARE DIALIGHT

DIALIGHT 1913 Atlantic Avenue, Manasquan, NJ 08736 (908) 223-9400 Fax: (908) 223-8788

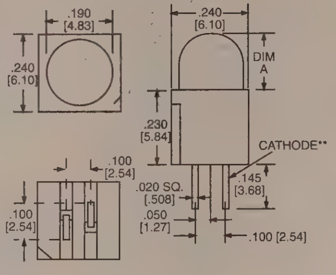
Dialight's circuit board indicators (CBI) offer you a variety of different LEDs assembled in either right angle or top view packages; all products are manufactured in our state of the art facility in Roxboro, NC.

(CBI®) CIRCUIT BOARD INDICATORS

5mm Single - 550 SERIES

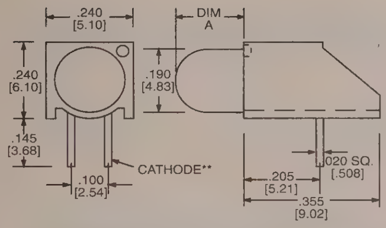
High luminous intensity solid state light source available in red, green, or yellow and 2 & 3 leaded bi-color, standard, high and super efficient LEDs; some with integral resistors. Right angle housing offers ease of assembly and pretrimmed leads; compatible with Dual or Quad 550 Series.

PART NO.	VIEW	COLOR	VF	mA	MCD	DIM A	FIG.
550-0204	TOP	GREEN	2.3	20	3.2	.130	17
550-0205	RIGHT	GREEN	2.3	20	3.2	.130	18
550-0207	RIGHT	GREEN	2.3	20	3.2	.130	19
550-0304	TOP	YELLOW	2.3	20	3.2	.130	17
550-0305	RIGHT	YELLOW	2.3	20	3.2	.130	18
550-0307	RIGHT	YELLOW	2.3	20	3.2	.130	19
550-0404	TOP	RED	1.7	20	2.0	.130	17
550-0405	RIGHT	RED	1.7	20	2.0	.130	18
550-0407	RIGHT	RED	1.7	20	2.0	.130	19
550-0504	TOP	RED	5	13	3.0	.187	17
550-0505	RIGHT	RED	5	13	3.0	.187	18
550-0507	RIGHT	RED	5	13	3.0	.187	19
550-1107	RIGHT	RED	1.8	2	2.0	.187	19
550-1207	RIGHT	YELLOW	1.9	2	1.8	.187	19
550-1307	RIGHT	GREEN	1.8	2	1.8	.187	19
550-2205	RIGHT	GREEN	2.2	10	10	.187	18
550-2207	RIGHT	GREEN	2.2	10	10	.187	19
550-2305	RIGHT	YELLOW	2.2	10	10	.187	18
550-2307	RIGHT	YELLOW	2.2	10	10	.187	19
550-2405	RIGHT	RED	2.2	10	10	.187	18
550-2407	RIGHT	RED	2.2	10	10	.187	19
550-3007	RIGHT	R/G	1.75/2	10	8.0	.187	19
550-3505	RIGHT	R/G	2.1/2.3	10	5/8	.217	20
550-3605	RIGHT	Y/G	2.0	10	4/6	.217	20



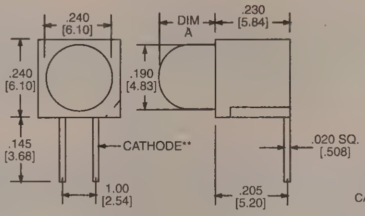
.190 [4.83]
.240 [6.10]
.240 [6.10]
DIM A
.230 [5.84]
CATHODE**
.100 [2.54]
.020 SQ. [.508]
.145 [3.68]
.050 [1.27]
.100 [2.54]
.100 [2.54]

FIGURE 17



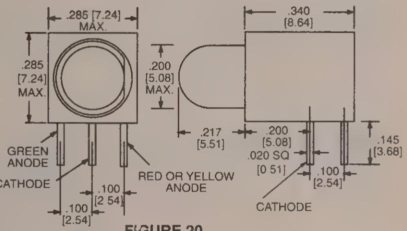
.240 [5.10]
DIM A
.240 [6.10]
.190 [4.83]
.145 [3.68]
CATHODE**
.100 [2.54]
.020 SQ. [.508]
.205 [5.21]
.355 [9.02]

FIGURE 19



.240 [6.10]
DIM A
.230 [5.84]
.240 [6.10]
.190 [4.83]
.145 [3.68]
CATHODE**
.020 SQ. [.508]
1.00 [2.54]
.205 [5.20]

FIGURE 18



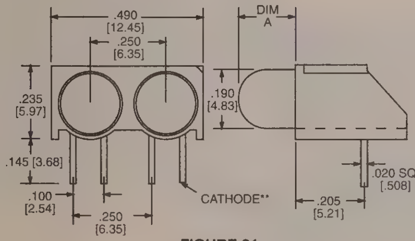
.285 [7.24] MAX.
.340 [8.64]
.285 [7.24] MAX.
.200 [5.08] MAX.
GREEN ANODE
CATHODE
.217 [5.51]
.200 [5.08]
.020 SQ [0 51]
.145 [3.68]
.100 [2 54]
.100 [2.54]
RED OR YELLOW ANODE
.100 [2.54]
CATHODE

FIGURE 20

5mm Dual - 550 SERIES

High luminous intensity solid state light source available in red, green or yellow some with integral resistors can be ordered with same variety of LEDs as in Single 550 Series. Right angle housing offers ease of assembly and pretrimmed leads; compatible with Single or Quad 550 Series.

PART NO.	VIEW	COLOR	VF	mA	MCD	DIM A	FIG.
550-0207-002	RIGHT	GREEN	2.3	20	3.2	.130	21
550-0307-002	RIGHT	YELLOW	2.3	20	3.2	.130	21
550-0407-002	RIGHT	RED	1.7	20	2.0	.130	21
550-0507-002	RIGHT	RED	5	13	3.0	.187	21



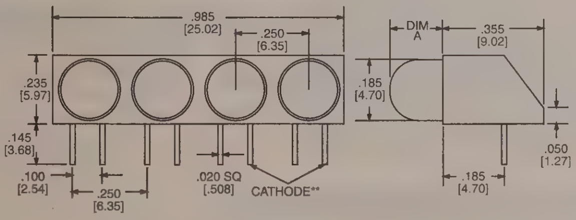
.490 [12.45]
.250 [6.35]
DIM A
.235 [5.97]
.190 [4.83]
.145 [3.68]
.020 SQ. [.508]
CATHODE**
.100 [2.54]
.250 [6.35]
.205 [5.21]

FIGURE 21

5mm Quad - 550 SERIES

Four high luminous intensity solid state light source in a single package available in red, green or yellow; some with integral resistors. Can be ordered with same variety of LEDs as in Single 550 Series. Right angle housing offers ease of assembly and pretrimmed leads compatible with Single or Dual 550 Series.

PART NO.	VIEW	COLOR	VF	mA	MCD	DIM A	FIG.
550-0206-004	RIGHT	GREEN	2.3	20	3.2	.130	22
550-0306-004	RIGHT	YELLOW	2.3	20	3.2	.130	22
550-0406-004	RIGHT	RED	1.7	20	2.0	.130	22
550-0506-004	RIGHT	RED	5	13	3.0	.187	22
550-3006-004	RIGHT	R/G	1.75/2	10	8	.187	22



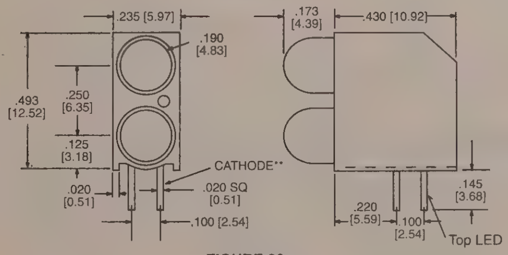
.985 [25.02]
.250 [6.35]
DIM A
.355 [9.02]
.235 [5.97]
.185 [4.70]
.145 [3.68]
.050 [1.27]
.100 [2.54]
.250 [6.35]
.020 SQ [.508]
CATHODE**
.185 [4.70]

FIGURE 22

5mm Bilevel - 552 SERIES

Bi-level solid state light source available in red, green or yellow with or without integral resistors, also available in high and super efficient versions. The bi-level design conserves PC board space and right angle housing offers ease of assembly, leads are pretrimmed.

PART NO.	VIEW	COLOR	VF	mA	MCD	FIG.
552-0211	RIGHT	R/R	2.2	10	10	23
552-0222	RIGHT	G/G	2.2	10	6.3	23
552-0311	RIGHT	R/R	5	13	3.0	23
552-0911	RIGHT	R/R	1.8	2	2.0	23
552-0922	RIGHT	G/G	1.8	2	1.8	23



.235 [5.97]
.173 [4.39]
.430 [10.92]
.190 [4.83]
.493 [12.52]
.250 [6.35]
.125 [3.18]
CATHODE**
.020 [0.51]
.020 SQ [0.51]
.100 [2.54]
.145 [3.68]
.220 [5.59]
.100 [2.54]
Top LED

FIGURE 23

**NOTE: CATHODE IS RED FOR 2 LEADED BICOLOR PARTS

ALL INDICATIONS ARE DIALIGHT

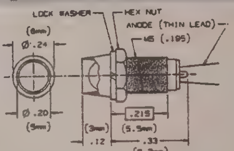
DIALIGHT 1913 Atlantic Avenue, Manasquan, NJ 08736 (908) 223-9400 Fax: (908) 223-8788

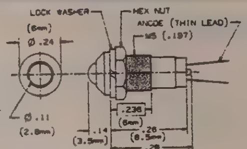
Part numbers for red lens only, amber & green also available. They are also listed for 2V or 6V operation. Other voltages are available. Internal current limiting resistor can be furnished on request.

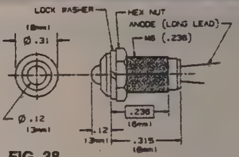
LED PMI (PANEL MOUNT INDICATORS)

605 SERIES for 5mm mounting hole

PART NO.	COLOR	VF	mA	mcd*	FIG.
605-1111-110	RED	2	10	1.2	37
605-2111-110	RED	2	10	1.2	36

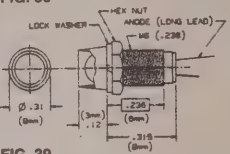

LOCK WASHER
HEX NUT
ANODE (THIN LEAD)
(6mm)
Ø.24
M5 (.195)
Ø.20
(5mm)
.219
(5.5mm)
(3mm)
.12
.33
(8.3mm)
FIG. 36

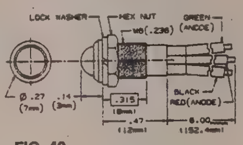

LOCK WASHER
HEX NUT
ANODE (THIN LEAD)
(6mm)
Ø.24
M5 (.197)
Ø.11
(2.8mm)
.236
(6mm)
.14
(3.5mm)
.26
(6.5mm)
.28
(7.1mm)
FIG. 37

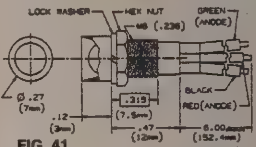

LOCK WASHER
HEX NUT
ANODE (LONG LEAD)
(8mm)
Ø.31
M8 (.236)
Ø.12
(3mm)
.236
(6mm)
.12
(3mm)
.315
(8mm)
FIG. 38

606 SERIES for 6mm mounting hole

606-1111-110	RED	2	5	2.4	38
606-2111-110	RED	2	5	2.4	39
606-1415-110	R/G	2	5/20	.6/1.0	40
606-2415-110	R/G	2	5/20	.6/1.0	41

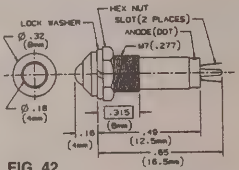

LOCK WASHER
HEX NUT
ANODE (LONG LEAD)
M8 (.236)
Ø.31
(8mm)
(3mm)
.12
.236
(6mm)
.315
(8mm)
FIG. 39

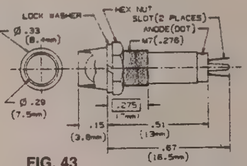

LOCK WASHER
HEX NUT
M8(.236)
GREEN (ANODE)
Ø.27
(7mm)
.14
(3mm)
.315
(8mm)
BLACK
RED(ANODE)
.47
(12mm)
6.00
(152.4mm)
FIG. 40

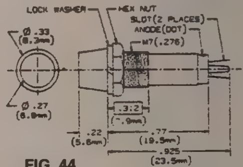

LOCK WASHER
HEX NUT
M8 (.236)
GREEN (ANODE)
Ø.27
(7mm)
.12
(3mm)
.315
(7.5mm)
BLACK
RED(ANODE)
.47
(12mm)
6.00
(152.4mm)
FIG. 41

607 SERIES for 7mm mounting hole

607-1112-110	RED	2	15	8.0	42
607-2112-110	RED	2	15	8.0	43
607-3132-120	RED	6	15	8.0	44

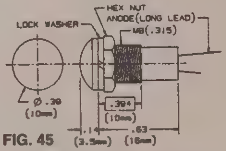

HEX NUT
SLOT(2 PLACES)
ANODE (DOT)
LOCK WASHER
Ø.32
(8mm)
M7(.277)
Ø.18
(4mm)
.315
(8mm)
.16
(4mm)
.49
(12.5mm)
.65
(16.5mm)
FIG. 42

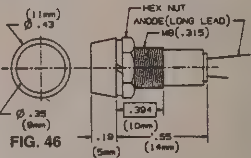

LOCK WASHER
HEX NUT
SLOT(2 PLACES)
ANODE(DOT)
M7(.276)
Ø.33
(8.4mm)
Ø.29
(7.5mm)
.275
(7mm)
.15
(3.8mm)
.51
(13mm)
.67
(16.5mm)
FIG. 43


LOCK WASHER
HEX NUT
SLOT(2 PLACES)
ANODE(DOT)
M7(.276)
Ø.33
(8.3mm)
Ø.27
(6.8mm)
.312
(7.9mm)
.22
(5.6mm)
.77
(19.5mm)
.925
(23.5mm)
FIG. 44

608 SERIES for 8mm mounting hole

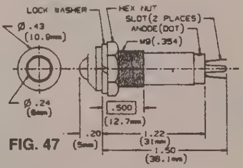
608-1131-110	RED	2	15	20	45
608-3131-110	RED	2	15	20	46

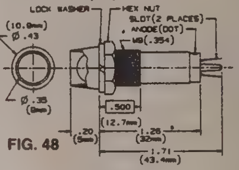

HEX NUT
ANODE(LONG LEAD)
LOCK WASHER
M8(.315)
Ø.39
(10mm)
.394
(10mm)
.14
(3.5mm)
.63
(16mm)
FIG. 45


(11mm)
Ø.43
HEX NUT
ANODE(LONG LEAD)
M8(.315)
Ø.35
(9mm)
.394
(10mm)
.19
(5mm)
.55
(14mm)
FIG. 46

609 SERIES for 9mm mounting hole

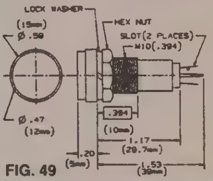
609-1112-110	RED	6	15	20	47
609-2112-110	RED	6	15	20	48

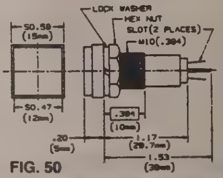

LOCK WASHER
HEX NUT
SLOT(2 PLACES)
ANODE(DOT)
M9(.354)
Ø.43
(10.9mm)
Ø.24
(6mm)
.500
(12.7mm)
.20
(5mm)
1.22
(31mm)
1.50
(38.1mm)
FIG. 47


LOCK WASHER
HEX NUT
SLOT(2 PLACES)
ANODE(DOT)
M9(.354)
(10.9mm)
Ø.43
Ø.35
(9mm)
.500
(12.7mm)
.20
(5mm)
1.26
(32mm)
1.71
(43.4mm)
FIG. 48

610 SERIES for 10mm mounting hole

610-3132-120	RED	6	10	250	49
610-4232-120	RED	6	10	250	50


LOCK WASHER
(15mm)
Ø.59
HEX NUT
SLOT(2 PLACES)
M10(.394)
Ø.47
(12mm)
.394
(10mm)
1.17
(29.7mm)
.20
(5mm)
1.53
(39mm)
FIG. 49

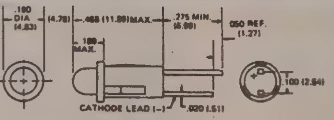

50.59
(15mm)
LOCK WASHER
HEX NUT
SLOT(2 PLACES)
M10(.394)
50.47
(12mm)
.394
(10mm)
.20
(5mm)
1.17
(29.7mm)
1.53
(39mm)
FIG. 50

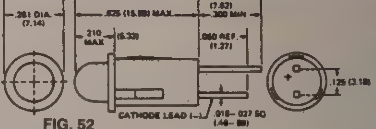
SNAP-IN LED PMI (PANEL MOUNT INDICATORS)

558 SERIES for .156" mounting hole

558-0101-001	RED	2	10	10	51

Mounting hole - .155 (394) to .158 (4.01) Diameter

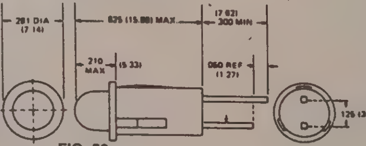

.180 DIA (4.83)
(4.78)
.468 (11.88) MAX
.275 MIN. (6.99)
050 REF. (1.27)
.188 MAX.
.100 (2.54)
CATHODE LEAD (–)
.020 (.51)
FIG. 51

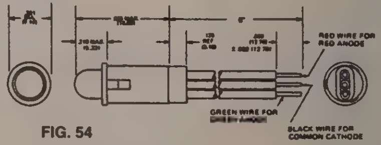

.281 DIA (7.14)
.625 (15.88) MAX
(7.62) .300 MIN
.210 MAX
(5.33)
050 REF (1.27)
.125 (3.18)
CATHODE LEAD (–)
.018–.027 SQ (.46–.69)
FIG. 52

559 SERIES for .250" mounting hole

559-0101-001	RED	2	5	2.7	52
559-3001-001	R/G	2.3	20	6	53
559-3501-003	R/G	2.1	10	6	54
559-4101-001	RED	1.9	5	.45	55
559-5101-001	RED	2.1	20	30	52

Mounting hole - .249 (6.32) to (6.40) diameter


.281 DIA (7.14)
.625 (15.88) MAX
(7.62) .300 MIN
.210 MAX
(5.33)
050 REF (1.27)
.125 (3.18)
FIG. 53


RED WIRE FOR RED ANODE
GREEN WIRE FOR
BLACK WIRE FOR COMMON CATHODE
FIG. 54

608 SERIES for 8mm mounting hole

608-1132-220	RED	6	15	20	56
608-2132-220	RED	6	15	20	57

* mcd intensity of LED
Figures 44,45,46 & 49-57 have polycarbonate housing. all others are chrome plated brass.

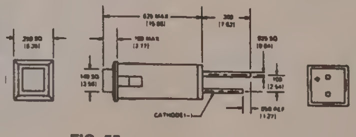
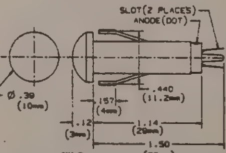
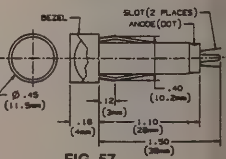


FIG. 55


SLOT(2 PLACES)
ANODE(DOT)
Ø.39
(10mm)
.157
(4mm)
.440
(11.2mm)
.12
(3mm)
1.14
(29mm)
1.50
(38mm)
FIG. 56


BEZEL
SLOT(2 PLACES)
ANODE(DOT)
Ø.45
(11.5mm)
.12
(3mm)
.40
(10.2mm)
.16
(4mm)
1.10
(28mm)
1.50
(38mm)
FIG. 57

ALL INDICATIONS ARE DIALIGHT

DIALIGHT

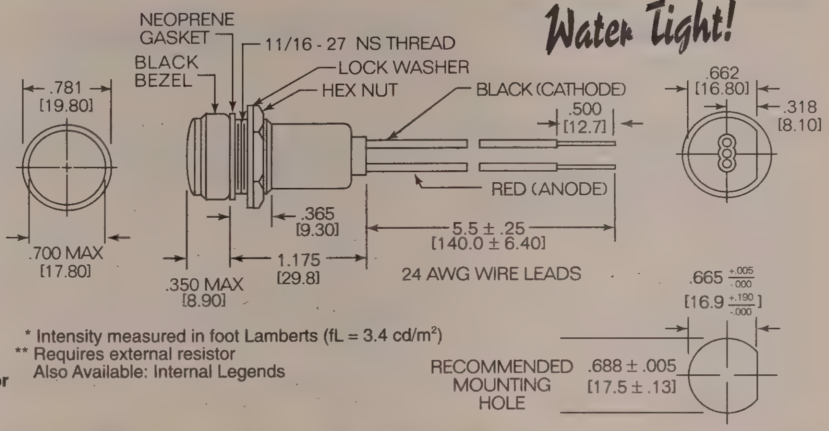
1913 Atlantic Avenue, Manasquan, NJ 08736 (908) 223-9400 Fax: (908) 223-8788

New! 557 SERIES FOR 11/16" MOUNTING HOLE

Housing Material:
Polycarbonate with Black Aluminum Bezel

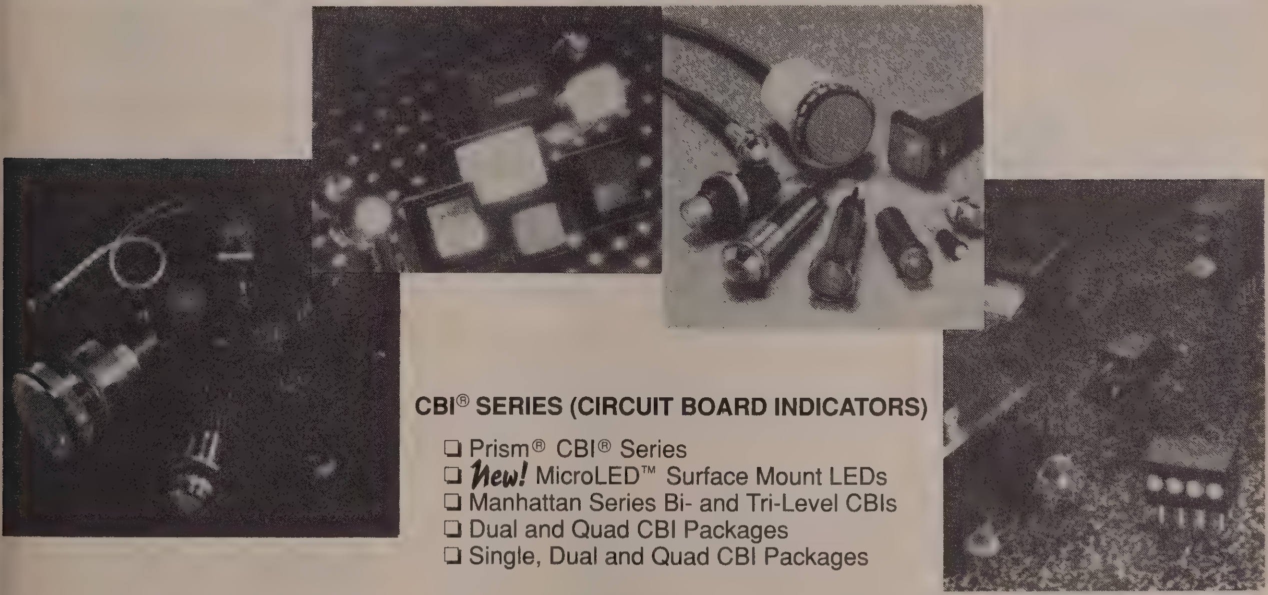
PART NUMBER	COLOR	λ(nm)	VF	mA	fL*
557-1101-203	R	650	4.3**	40	100
557-1201-203	G	565	4.3**	50	150
557-1301-203	Y	585	4.3**	50	100
557-1501-203	R	660	4.3**	40	1000
557-1402-203†	R | G	635/565	5	80	200/100
557-1103-203	R	650	12	20	100
557-1203-203	G	565	12	25	150
557-1303-203	Y	585	12	25	100
557-1505-203	R	660	24	20	1000
557-1104-203	R	650	28	20	100
557-1204-203	G	565	28	25	150
557-1304-203	Y	585	28	25	100

† Bi color has 3 leads: Red for Red Anode, Green for Green Anode, Black for Common Cathode


Water Tight!
NEOPRENE GASKET
BLACK BEZEL
11/16 - 27 NS THREAD
LOCK WASHER
HEX NUT
BLACK (CATHODE)
RED (ANODE)
.781 [19.80]
.700 MAX [17.80]
.350 MAX [8.90]
1.175 [29.8]
.365 [9.30]
5.5 ± .25 [140.0 ± 6.40]
.500 [12.7]
24 AWG WIRE LEADS
.662 [16.80]
.318 [8.10]
.665 +.005/-.000 [16.9 +.190/-.000]
RECOMMENDED MOUNTING HOLE
.688 ± .005 [17.5 ± .13]

* Intensity measured in foot Lamberts (fL = 3.4 cd/m^2)
** Requires external resistor
Also Available: Internal Legends

FROM INCANDESCENT TO LED.
FROM PANEL MOUNT TO SURFACE MOUNT.
DIALIGHT HAS THE SOLUTIONS.



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- ☐ Prism® CBI® Series
- ☐ *New!* MicroLED™ Surface Mount LEDs
- ☐ Manhattan Series Bi- and Tri-Level CBIs
- ☐ Dual and Quad CBI Packages
- ☐ Single, Dual and Quad CBI Packages

LED PANEL MOUNT INDICATORS

- ☐ 5-10mm mounting diameter
- ☐ High luminous intensity
- ☐ Low Voltage and current
- ☐ Variety of lens styles
- ☐ Available in both snap-in and hex nut mounting configurations
- ☐ *New!* High-tech LED 11/16 "Super-bright" design

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- ☐ Complete range

Displays

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- ☐ BCD Drives
- ☐ Bezeled Assembly Kits

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- ☐ Largest Selection
- ☐ UL/CSA/MIL Approved, QPL Listed
- ☐ MIL-Qualified NVIS Compatible Press-To-Test and Edge Lighting Products
- ☐ MIL-Qualified Secure Lighting Indicator Products

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- ☐ Single and Dual Lamp Configurations
- ☐ Custom Legends Available
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- ☐ Variety of Shapes, Sizes and Color Combinations

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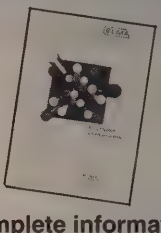


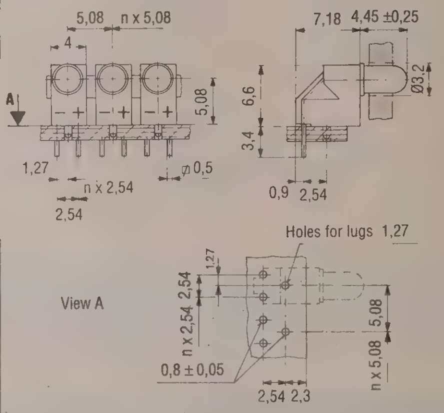
For complete information write or call for our *free* catalog today!

All ELMA products are available off-the-shelf and REASONABLY PRICED

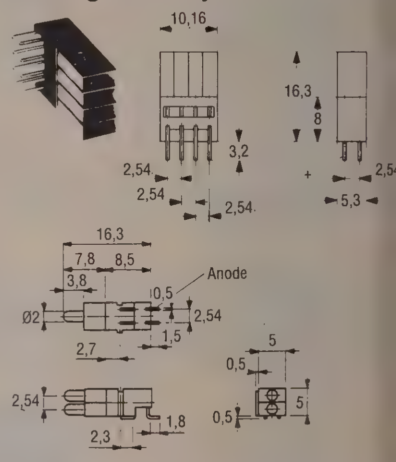
All of our LEDS are available off the shelf for immediate delivery and include:

- 2mm LED arrays
- 3mm LED arrays
- 5mm LED arrays
- High effeciency LEDs
- High output LEDs
- Dual high arrays
- Triple high arrays
- Quadruple high arrays
- Scale LEDs
- LED arrays with test jacks
- LED arrays with integral dip switch
- Bargraph arrays
- Rectangular arrays
- Straight and right angle arrays
- Surface mount LED arrays
- Much more… please call for catalog.

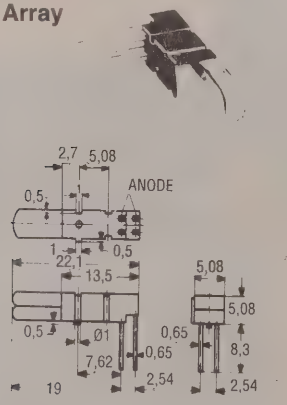
3mm Single High Array


5,08
n x 5,08
4
A
5,08
1,27
n x 2,54
2,54
ø 0,5
7,18
4,45 ±0,25
6,6
3,4
Ø3,2
0,9
2,54
Holes for lugs 1,27
View A
1,27
n x 2,54 2,54
5,08
n x 5,08
0,8 ± 0,05
2,54 2,3

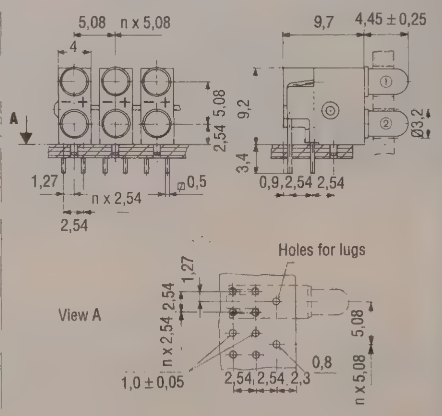
Rectangular Array


10,16
16,3
8
3,2
2,54
2,54
2,54
5,3
16,3
7,8
8,5
3,8
Anode
0,5
Ø2
2,54
1,5
2,7
5
0,5
2,54
1,8
2,3
0,5
5

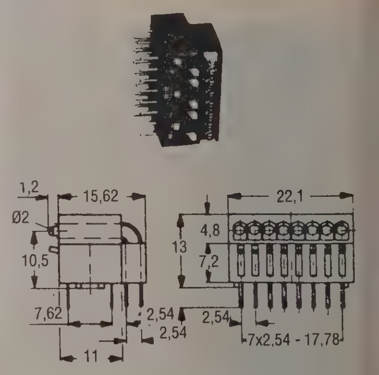
Scale Array


2,7
5,08
0,5
ANODE
1
0,5
22,1
13,5
5,08
5,08
0,5
Ø1
0,65
0,65
8,3
7,62
2,54
19
2,54

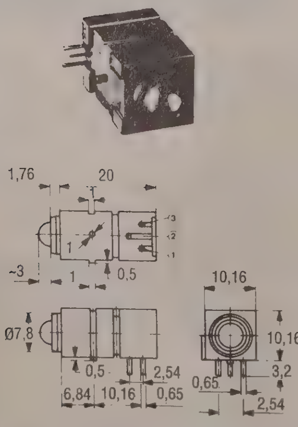
3mm Double High Array


5,08
n x 5,08
4
A
2,54
5,08
1,27
n x 2,54
ø0,5
2,54
9,7
4,45 ± 0,25
9,2
3,4
①
②
Ø3,2
0,9 2,54 2,54
Holes for lugs
View A
1,27
n x 2,54 2,54
1,0 ± 0,05
2,54 2,54 2,3
0,8
5,08
n x 5,08

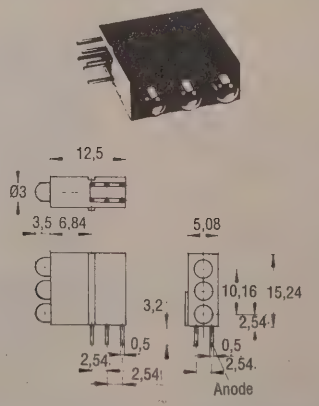
Dip Toggle with 2mm Array


1,2
15,62
Ø2
10,5
7,62
11
2,54
2,54
22,1
4,8
13
7,2
2,54
7x2,54 - 17,78

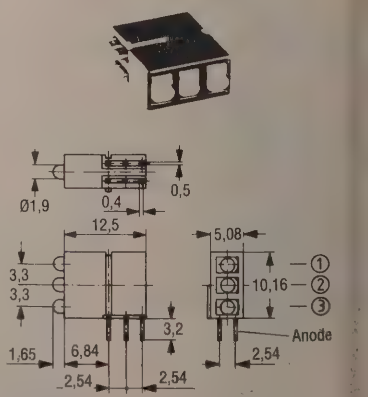
5mm


1,76
20
1
~3
1
0,5
Ø7,8
0,5
2,54
6,84
10,16
0,65
10,16
10,16
3,2
0,65
2,54

3mm Triple High Array


12,5
Ø3
3,5 6,84
5,08
3,2
10,16
15,24
2,54
0,5
2,54
2,54
0,5
2,54
Anode

2mm Triple High Array


Ø1,9
0,4
0,5
12,5
3,3
3,3
5,08
10,16
①
②
③
Anode
3,2
1,65
6,84
2,54
2,54
2,54

See Section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.), see Section 1400 (Cabinet Enclosures), see Section 5100 (Switches), see section 5150 (Keyboard & Keypads) for additional products.

ELtech

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Superior Performance for Wide Range of Applications

ELtech EL lamps provide the perfect blend of brightness, low power consumption, cool operation, versatility, thinness and product uniformity to make your designs really shine. They're ideal for LCDs; keypads; membrane switches; copier erase lamps; automotive, marine and other instrument panels; NVIS and other Mil-Spec lighting requirements; hand-held nstruments; and more.

■ *Performance comparison of EL plastic and foil lamps.*

	Relative Cost	Nominal Brightness*	Usable Life	Environmental Performance
FOIL	30-40% >Plastics	Green– 35 White– 21 Yellow– 10	10,000 to 20,000 Hours	1500 Hours or more
PLASTIC	30-40% <Foil	Green– 20 White– 10 Yellow– 8	8,000 to 10,000 Hours	200 Hours or more

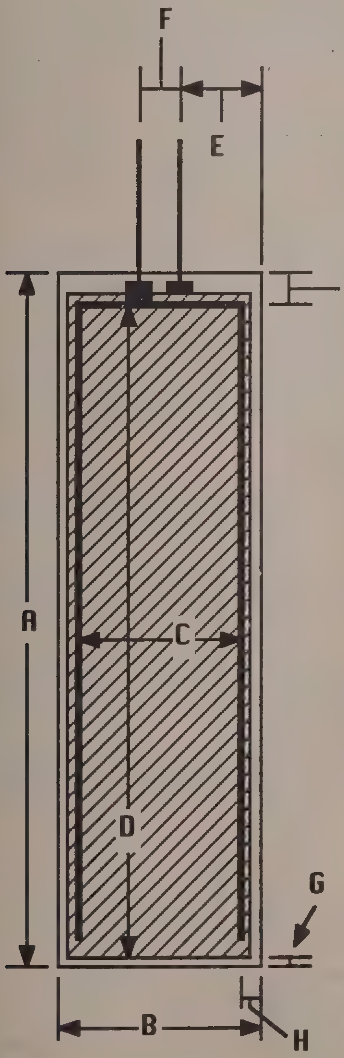
*Foil lamps when powered at 120 Volts, 400 Hertz. Plastic Lamps when powered at 230 Volts, 630 Hertz.

Single Source for All Your El Lamps

ELtech EL foil lamps provide high performance, long life (up to 20,000 hours or more), moisture resistance, superior brightness, low power operation, and are available in a range of colors. ELtech EL plastic lamps offer low cost, thinness, flexibility, extremely low power operation, and are also available in a range of colors.

The Last Word in LCD Backlighting

No other technology makes your LCDs look better, and ELtech has the most advanced EL lamps for your every LCD backlighting application. We have a broad range of EL lamps–available from stock–to provide higher output, longer life and more uniform brightness for your LCD designs.



ELtech	Dimensions									
Part Number	A	B	C(min.)	D (min.)	E (ref.)	F (ref.)	G (max.)	H (max.)	I (max.)	Bus Bar
10-0119	3.020	1.170	0.900	2.730	0.440	0.200	0.095	0.135	0.195	"U"
10-0161	2.100	0.900	0.745	1.835	0.350	0.200	0.105	0.105	0.195	"I"
10-0309	3.740	1.200	0.970	3.500	0.500	0.200	0.045	0.135	0.195	"U"
10-0360	3.805	0.900	0.670	3.540	0.350	0.200	0.070	0.135	0.195	"L"
10-0361	3.765	1.200	0.995	3.500	0.500	0.200	0.070	0.135	0.195	"L"
10-0362	4.680	1.100	0.895	4.410	0.450	0.200	0.070	0.135	0.195	"L"
10-0363	6.300	0.860	0.655	6.030	0.330	0.200	0.085	0.135	0.195	"L"
10-0423	2.090	0.900	0.760	1.850	0.250	0.200	0.070	0.135	0.195	"I"
10-0424	2.800	0.900	0.670	2.560	0.250	0.200	0.070	0.135	0.195	"L"
10-0425	2.800	1.200	0.970	2.560	0.400	0.200	0.070	0.135	0.195	"L"

▌*ELtech offers EL lamps for LCDs. A variety of sizes are available from stock.*

Ltech EL foil lamps can be manufactured with front and/or rear adhesive or secure positioning and mounting behind the LCD glass. PWB solderable ins are typically used for termination, but many different configurations re possible.

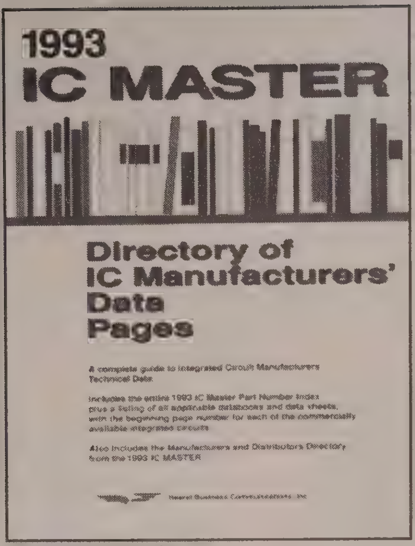
tandard colors include hi-bright green, white, yellow, blue or red, plus a ariety of custom colors. ELtech EL foil lamps can be successfully used in ransmissive or transflective LCD displays.

OTE: Eltech LCD Foil Lamps available from stock are supplied with front adhesive and are available in green or white.

ELtech

Electroluminescent Technologies Corporation
181 Gibraltar Road, Horsham, PA 19044

Telephone (215) 441-0404
Fax (215) 441-8299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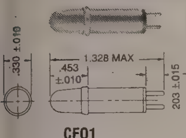
ELDEMA INDICATOR LITES

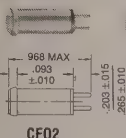
INCANDESCENT C-LITES CF SERIES

Eldema CF Series incandescent C-lites have an unbased lamp packaged inside the cartridge, with connections made to the two pins. The lamps used are the standard T-1-3/4 bulb size or smaller with ratings from 1.35 to 28 volts available. Lens colors in both clear and translucent shades are all standard. The short flat lens style cartridge–Cf03–conforms to MS18235.

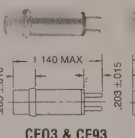
MATE WITH DH SERIES LAMPHOLDERS



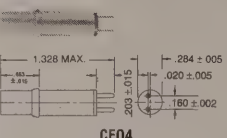
CF01
DOME LENS STYLE



CF02
FLUSH LENS STYLE



CF03 & CF93
SHORT FLAT LENS STYLE

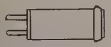
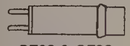


CF04
LONG FLAT LENS STYLE

ORDERING INFORMATION– To order Eldema incandescent C-lites refer to the table below and specify Style–Lens, Color–Cartridge, Finish–and Lamp Number.
EXAMPLE PART NUMBER: **CF03-RTS-2187**

CHOICE OF LENS SHAPE AND COLOR–The CF03, short flat lens, is the style used in most applications.The long flat lens–CF04– and the dome lens–CF01– are used where wide side visibility is important. The lens colors for CF incandescent C-Lites are usually the translucent shades except for the lower brilliance lamps which should be used with the clear colors. The translucent lens colors give an even, diffused light over the lens surface. The transparent lens color(WC-water clear) should be used with the lampholders and screw-on D Series lens caps.

LAMP SPECIFICATIONS–The lamp specifications shown are the lamp manufacturer's ratings and are based on average performance under laboratory conditions. The milli ampere ratings are nominal values with 10% tolerances at rated voltage operation.

SERIES CF STYLE	LENS COLOR	FINISH	LAMP			
			Number	Volts	MA	Life(hrs.)
 CF01 Dome  **CF02** Flush  **CF03 & CF93** Short Flat **CF04** Long Flat	Translucent AT-Amber BT-Blue GT-Green RT-Red WT-White YT-Yellow Clear AC-Amber BC-Blue CC-Cloudy GC-Green RC-Red WC-Water Clear YC-Yellow	S - Clear Anodize (Standard) B Black Anodize (Special)	1728*	1.35	60	5,000
			1738*	2.7	60	6,000
			2158*	3.0	15	10,000
			680	5.0	60	60,000
			1730	6.0	40	1,000
			2114	6.0	60	3,000
			1784	6.0	200	1,000
			2180	6.3	40	20,000
			2112	6.3	200	5,000
			2181	6.3	200	20,000
			1869*	10.0	14	100,000
			2107*	10.0	40	10,000
			2174	12.0	40	10,000
			1705	14.0	80	1,500
			2182	14.0	80	15,000
			4814*	14.0	17	50,000
			4818*	18.0	20	20,000
			2102	18.0	40	10,000
			1762	28.0	40	4,000
			2185	28.0	40	20,000
			2187	28.0	40	7,000

*These lamps should be used with the clear lens colors only because of their relatively lower light output.

TYPE CF93 - LENS STYLE

Now available - fluted lens cap for improved lite dispersion on low power lamps and elimination of "hot spots" on high power lamps.

Dimensionally same as **CF03** above.

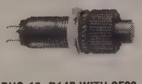
HOW TO SPECIFY

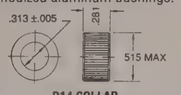
Standard		Fluted
CF03	becomes	**CF93**
CG03	becomes	**CG93**
CR03	becomes	**CR93**

D HOLDER ASSEMBLY

MATE WITH SINGLE LAMPHOLDERS

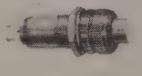
These lens caps and collars mate with the single lamp holders. The collars may be used with C-Lites that have colored lenses. The lens caps should be used with C-Lites with clear water (transparent) lenses. The lens caps are high temperature plastic with anodized aluminum bushings.

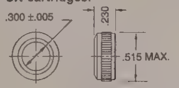

DHO-10 -D14B WITH CF03



D14 COLLAR

The **D14** knurled collar is designed for use on the **DHO** holder only. The collar securely retains the C-Lite cartridge. It may be used with any of the **CF**, **CG**, or **CR** cartridges.

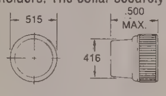

DHN-10B-D15B WITH CF03



D15 COLLAR

The **D15** is a new trim style collar for the **DHN** or **DHO** holders. The collar securely retains any of the **CF**, **CG**, or **CR** Series C-Lite cartridges.

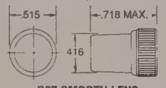
DHN- B-D06BRT



D06 SMOOTH LENS

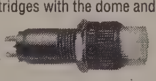
The **D06** lens caps rotate so lens marking may be aligned after installation. These caps mate with the **CF03**, **CG03**, **CR03**, and **CF24** style C-Lite. The **D06** conforms to LC32 per Mil-L-3661.

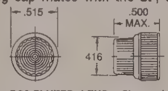
DHN -10B-D07BRC



D07 SMOOTH LENS

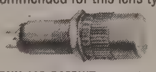
The **D07** lens will rotate to align lens marking. The long cap mates with the **CF**, **CG**, and **CR** cartridges with the dome and long flat shapes.

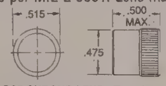

DHO-30B-D09WC



D09 FLUTED LENS Clear colors only

The **D09** fluted lens caps mate with **CF03**, **CG03**, **CR03** and **CF24** style C-Lites. These caps are available in clear lens colors only. The **D09** conforms to LC30 per MIL-L-3661. Lens marking is not recommended for this lens type.


DHN-60B-D25BWT



D25 SHROUD LENS Translucent colors only

The **D25** is a full shroud lens with end on viewing only. The **D25** comes in translucent colors and mates with the **CF03** and **CF24** C-Lite incandescent cartridges.

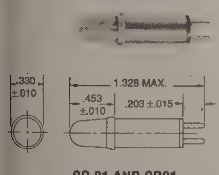
DHO-10B Holder only with CF03 C-Lite for Flush Panel Mounting

Holder	Lens Cap	O.A.L	Max. Panel
DHO or DHN	D06 or D09	1.573 Max.	1/4"
DHO or DHN	D07	1.781 Max.	1/4"
DHO	D14 or D15	1.281 Max.	3/16"
DHN	D15	1.296 Max.	1/4"
DHO or DHN	D25	1.573 Max.	1/4"
DHO	None	1.203 Max.	9/32"

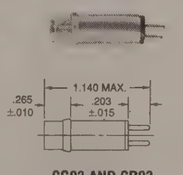
NEON C-LITES CR SERIES - NEON LAMP WITH BUILT-IN RESISTOR / CG SERIES - NEON LAMP ONLY

Eldema neon C-Lites come in two basic types–CG Series with the neon lamp built into the cartridge but requiring an external resistor–CR Series, with the lamp and current limiting resistor built into the cartridge. Neon C-Lites only come in clear (transparent) lens colors due to their low light output–note neons are not effective with blue or green lenses. The water clear lens color should be specified when the neon C-Lite is used with a DH lampholder and lens cap. The CR01 conforms to MS18236 and the CR04 to MS18237

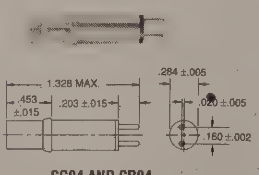
MATE WITH DH SERIES LAMPHOLDERS



CG 01 AND CR01
DOME LENS STYLE



CG93 AND CR93
CG03 AND CR03
SHORT FLAT LENS STYLE



CG04 AND CR04
LONG FLAT LENS STYLE

ORDERING INFORMATION–To order Eldema neon C-Lites refer to the table at right and specify the Style–Lens, Color–Cartridge, Finish and Lamp or Lamp/Resistor Number.
EXAMPLE PART NUMBER: **CG03-RCS-N120**
CR03-WCS-N117

CHOICE OF LAMP–High brightness lamps offer the best indication and require 110 Volts AC or 150 Volts DC for their operation–the current is less than 1.5 ma with a 33K resistor in series with the lamp.

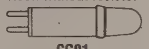
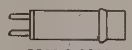
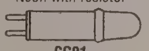
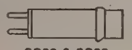
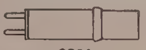
The standard brightness lamps require less than 0.6 ma current and operate on 90 Volts DC or 65 Volts AC with a 100K resistor in series with the lamp.

The circuit component lamps are comparable to the standard brightness lamps–selected for the firing voltages listed.

RECOMMENDED RESISTOR VALUES–The lower the resistor value, the greater the light output, but the life rating decreases. The standard life ratings are the best compromise for most applications. Listed below are the approximate life ratings for operation on 110-125 Volts AC and the recommended resistor.

HIGH BRIGHTNESS LAMPS
Standard life–25,000 hours–33K, Medium life–3,000 hours–22K
STANDARD BRIGHTNESS LAMPS
Standard life–15,000 hours–100K, Medium life–5,000 hours–56K
Long Life–25,000 hours–150K

The last digit in the lamp/resistor number designates the resistor value as follows: (CG type)–none; (CR type) 1-22K, 3-33K, 4-56K, 7-100K, 8-150K. Other resistor values on special order.

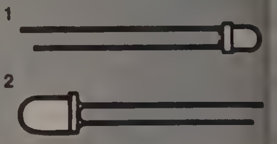
CG SERIES STYLE	LENS COLORS	FINISH	LAMP NUMBER
Neon without resistor  **CG01** Dome  **CG93 & CG03** Short Flat **CG04** Long Flat	Clear Colors Only AC - Amber CC - Cloudy RC - Red WC - Water Clear YC - Yellow Cloudy Clear (CC) is the shade of white most suitable for neon lamps	S - Clear Anodize (Standard) B - Black Anodize (Special)	STANDARD NEON LAMPS N110 - Standard brightness N120 - High Brightness SPECIAL COMPONENT LAMPS (Available in CG01 and CG04 only) N210* - Firing Voltage 72±8 Volts DC N220* - Firing Voltage 72±4 Volts DC N230* - Firing Voltage 80 Volts DC Maximum
CR SERIES STYLE	**LENS COLORS**	**FINISH**	**LAMP/RESISTOR NUMBER**
Neon with resistor  **CG01** Dome  **CG93 & CG03** Short Flat  **CG04** Long Flat	Same as Above	Same as Above	STANDARD NEON LAMPS N114 - Standard brightness Medium Life (56K) N117 - High Brightness Standard Life (100K) N118 - Standard Brightness Long Life (150K) N121 - High Brightness Medium Life (22K) N123 - High Brightness Standard Life (33K)

* The special circuit component lamps are longer than the indicator type lamps and require the long CG01 and CG04 lens shape. These lamps are available with a built-in resistor in the long CN Series cartridges.

FOR MORE INFORMATION PLEASE CONSULT FACTORY. SEE OUR PAGE IN SECTION 2750

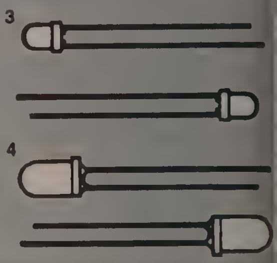
Super Bright Green LEDs: T-1 and T-1¾

	LED No.	Size	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
GREEN	E166	T-1	Clear	200mcd	300mcd	30°	2.2V	2.5V	565nm	1
GREEN	E167	T-1¾	Clear	100mcd	200mcd	30°	2.2V	2.5V	565nm	2
GREEN	E168	T-1¾	Clear	200mcd	300mcd	30°	2.2V	2.5V	565nm	2



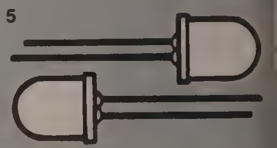
Ultra Bright Red LEDs: T-1 and T-1¾

	LED No.	Size	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E169	T-1	Clear	300mcd	500mcd	30°	1.85V	2.5V	660nm	3
RED	E170	T-1	Clear	500mcd	700mcd	30°	1.85V	2.5V	660nm	3
RED	E171	T-1	Clear	700mcd	1000mcd	30°	1.8V	2.5V	660nm	3
RED	E160	T-1¾	Clear	300mcd	500mcd	40°	1.8V	2.2V	660nm	4
RED	E161	T-1¾	Clear	500mcd	1000mcd	40°	1.8V	2.2V	660nm	4
RED	E163	T-1¾	Clear	1500mcd	2000mcd	40°	1.8V	2.2V	660nm	4
RED	E164	T-1¾	Clear	2000mcd	3000mcd	40°	1.8V	2.2V	660nm	4



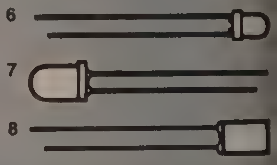
Jumbo LEDs: T-3¼. T-10mm (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E176	Diffused	12.5mcd	40.0mcd	100°	2.0V	2.5V	625nm	5
YELLOW	E177	Diffused	8.0mcd	40.0mcd	100°	2.1V	2.5V	590nm	5
GREEN	E178	Diffused	8.0mcd	40.0mcd	100	2.2V	2.5V	565nm	5



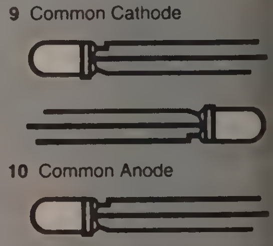
Blue LEDs: T-1, T-1¾ and Rectangular

	LED No.	Size	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
BLUE	E172	T-1	Clear	[illegible]	14.0mcd	30°	3.0V	3.2V	470nm	6
BLUE	E173	T-1	Diffused	4mcd	1.0mcd	60°	3.0V	3.2V	470nm	6
BLUE	E174	T-1¾	Diffused	4mcd	1.0mcd	60°	3.0V	3.2V	470nm	7
BLUE	E175	Rect.	Diffused	4mcd	1.0mcd	120	3.0V	3.2V	470nm	8



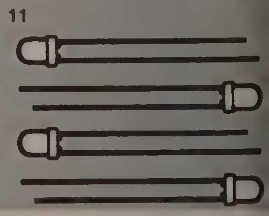
T-1¾ Bi-Color LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED & GREEN	E201	Milky White	12.5mcd 12.5mcd	40.0mcd 40.0mcd	100 100	2.0V 2.2V	2.5V 2.5V	625nm 565nm	9 9
RED & GREEN	E204	Milky White	12.5mcd 12.5mcd	40.0mcd 40.0mcd	100 100	2.0V 2.2V	2.5V 2.5V	625nm 565nm	10 10
RED & YELLOW	[illegible]	Milky White	8.0mcd 8.0mcd	20.0mcd 20.0mcd	100 100	2.0V 2.1V	2.5V 2.5V	625nm 590nm	9 9
GREEN & YELLOW	[illegible]	Milky White	8.0mcd 8.0mcd	20.0mcd 20.0mcd	100 100	2.2V 2.1V	2.5V 2.5V	565nm 590nm	9 9



T-1 Bi-Color LEDs (Two Leads)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED & GREEN	E207	Milky White	5mcd 5mcd	12.5mcd 12.5mcd	100° 100°	2.0V 2.2V	2.5V 2.5V	625nm 565nm	11
RED & YELLOW	E208	Milky White	5mcd 5mcd	12.5mcd 12.5mcd	100° 100	2.0V 2.1V	2.5V 2.5V	625nm 590nm	11
GREEN & YELLOW	E209	Milky White	5mcd 5mcd	12.5mcd 12.5mcd	100° 100	2.2V 2.1V	2.5V 2.5V	565nm 590nm	11



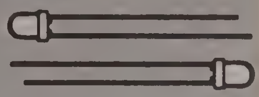
Gilway
Technical Lamp

Please request Engineering Catalog 166
800 West Cummings Park, Woburn, Massachusetts 0180
Telephone us directly: 617 935-4442
Fax: 617 938-5867

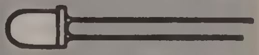
T-1 and T-1¾ Infrared LEDs: 940nm, 880nm

	IRLED No.	Size	Lens	Radient Intensity at 100mA Minimum	Typical	Viewing Angle	Forward Voltage at 100mA Typical	Maximum	Peak Wave Length at 100mA	Drawing
Infrared	E21	T-1	Clear	6mW	**10mW**	25°	1.3V	1.7V	940nm	1
Infrared	E22	T-1	Trans. Blue	21mW	**35mW**	26°	1.3V	1.7V	880nm	1
Infrared	E23	T-1¾	Clear	6mW	**10mW**	25°	1.3V	1.7V	940nm	2
Infrared	E24	T-1¾	Trans. Blue	21mW	**35mW**	26°	1.3V	1.7V	880nm	2

1



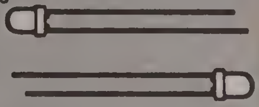
2



Phototransistors

Photo-transistor No.	Size	Light current I_L		Dark current I_D	Collector to Emitter Sustaining Voltage V_{CE}	Emitter to Collector Breakdown Voltage BV_{ECO}	Collector to Emitter Saturation Voltage V_{CE} (sat)	Drawing
		V_{CE}=5V H=20mW/cm²		H=0 V_{CE}=15	I_C=100µA H=0	I_E=100µA H=0	I_C=0.5mA H=20mW/cm²	
		Minimum	Typical	Maximum	Minimum	Minimum	Typical	
D40	T-1	1.0mA	20.0mA	100nA	30.0V	5.0V	0.4V	3
D41	T-1¾	1.0mA	20.0mA	100nA	30.0V	5.0V	0.4V	4

3



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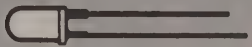
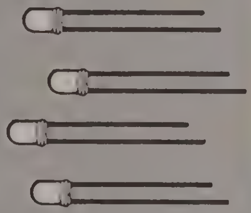


T-1 Visible LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Typical	Viewing Angle	Forward Voltage at 20mA Typical	Maximum	Peak Wave Length at 20mA	Drawing
RED	E100	Clear	90mcd	**200mcd**	32°	2.1V	3.0V	650nm	5
ORANGE	E102	Clear	90mcd	**200mcd**	32°	2.1V	3.0V	610nm	5
YELLOW	E104	Clear	90mcd	**200mcd**	32°	2.2V	3.0V	585nm	5
GREEN	E106	Clear	90mcd	**200mcd**	32°	2.2V	3.0V	563nm	5
RED	E112	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	650nm	5
ORANGE	E113	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	610nm	5
YELLOW	E114	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	585nm	5
GREEN	E116	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	563nm	5

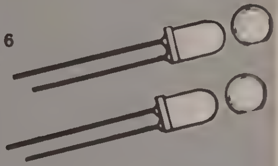
5



T-1¾ Diffused LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Typical	Viewing Angle	Forward Voltage at 20mA Typical	Maximum	Peak Wave Length at 20mA	Drawing
RED	E118	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	650nm	6
ORANGE	E119	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	610nm	6
YELLOW	E120	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	585nm	6
GREEN	E121	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	563nm	6

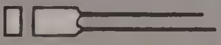
6



Rectangular and Square LEDs

	LED No.	Lens	Luminous Intensity at 10mA Min.	Typical	Max.	Forward Voltage at 10mA Typical	Maximum	Peak Wave Length at 10mA	Drawing
RED	E122	Diffused	40mcd	**.80mcd**	—	2.0V	3.0V	650nm	7
ORANGE	E123	Diffused	40mcd	**.80mcd**	—	2.0V	3.0V	610nm	7
YELLOW	E124	Diffused	40mcd	**.80mcd**	—	2.1V	3.0V	585nm	7
GREEN	E125	Diffused	40mcd	**1.0mcd**	—	2.1V	3.0V	562nm	7
RED	E126	Diffused	40mcd	**1.0mcd**	—	2.0V	3.0V	650nm	8
ORANGE	E127	Diffused	40mcd	**1.0mcd**	—	2.0V	3.0V	610nm	8
YELLOW	E128	Diffused	40mcd	**1.0mcd**	—	2.1V	3.0V	585nm	8
GREEN	E129	Diffused	40mcd	**1.0mcd**	—	2.1V	3.0V	562nm	8

7



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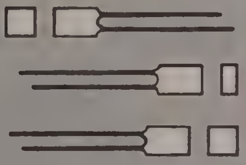

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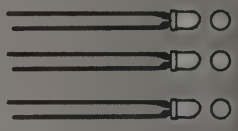
T-1 Low Current LEDs (2mA)

	LED No.	Lens	Luminous Intensity at 2mA Minimum	Luminous Intensity at 2mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E28	Diffused	8.0mcd	**20.0mcd**	120°	1.85V	2.50V	660nm	1
RED	E30	Diffused	0.8mcd	**2.00mcd**	120°	2.00V	2.50V	625nm	1
YELLOW	E31	Diffused	0.8mcd	**2.00mcd**	120°	2.10V	2.50V	590nm	1
GREEN	E32	Diffused	0.8mcd	**2.00mcd**	120°	2.20V	2.50V	565nm	1

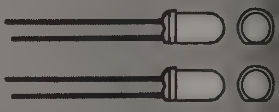
1



T-1¾ Low Current LEDs (2mA)

	LED No.	Lens	Luminous Intensity at 2mA Minimum	Luminous Intensity at 2mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E29	Diffused	8.0mcd	**12.50mcd**	120°	1.85V	2.50V	660nm	2
RED	E33	Diffused	0.8mcd	**2.00mcd**	120°	2.00V	2.50V	625nm	2
YELLOW	E34	Diffused	0.8mcd	**2.00mcd**	120°	2.10V	2.50V	590nm	2
GREEN	E35	Diffused	0.8mcd	**2.00mcd**	120°	2.20V	2.50V	565nm	2

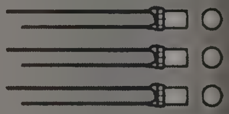
2



T-1 Wide Angle LEDs

	LED No.	Lens	Luminous Intensity at 10mA Minimum	Luminous Intensity at 10mA Typical	Viewing Angle	Forward Voltage at 10mA Typical	Forward Voltage at 10mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E136	Transparent	6mcd	**1.6mcd**	140°	2.0V	3.0V	650nm	3
YELLOW	E137	Transparent	9mcd	**2.5mcd**	140°	2.1V	3.0V	585nm	3
GREEN	E138	Transparent	1.4mcd	**4.0mcd**	140°	2.1V	3.0V	563nm	3

3



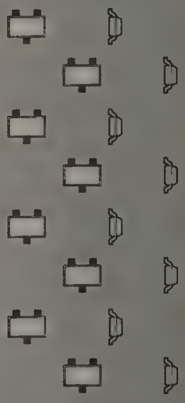
Surface Mount LEDs, SOT-23 Package

	LED No.	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E40	1.0mcd	**3.5mcd**	80°	2.1V	2.8V	635nm	4
YELLOW	E41	1.0mcd	**3.0mcd**	80°	2.1V	2.8V	585nm	4
GREEN	E42	1.0mcd	**3.0mcd**	80°	2.1V	2.8V	565nm	4

Surface Mount Bi-Color LEDs, SOT-23 Package

	LED No.	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Terminals	Drawing
RED & GREEN	E43	1mcd 1mcd	**3mcd** **3mcd**	80° 80°	2.1V 2.2V	2.8V 2.5V	635nm 565nm	1. Red Cathode 2. Grn Cathode 3. Anode	4
RED & YELLOW	E44	1mcd 1mcd	**3mcd** **3mcd**	80° 80°	2.1V 2.2V	2.8V 2.5V	635nm 585nm	1. Red Cathode 2. Ylw. Cathode 3. Anode	4
GREEN & YELLOW	E45	1mcd 1mcd	**3mcd** **3mcd**	80° 80°	2.1V 2.2V	2.8V 2.5V	565nm 585nm	1. Ylw. Cathode 2. Grn. Cathode 3. Anode	4

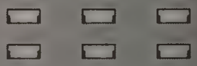
4



Surface Mount LEDs, Ceramic Package

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Dwg
ULTRA BRIGHT RED	E60	Translucent	50mcd	**80mcd**	90°	1.85V	2.5V	660nm	5
HIGH EFFICIENCY RED	E61	Translucent	12.5mcd	**20mcd**	90°	2.0V	2.5V	625nm	5
YELLOW	E62	Translucent	5mcd	**20mcd**	90°	2.1V	2.5V	590nm	5
GREEN	E63	Translucent	12.5mcd	**20mcd**	90°	2.2V	2.5V	565nm	5

5



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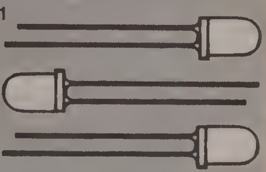
T-1³/₄ Flashing LEDs

	LED No.	Lens	Foward DC Voltage Min.	Foward DC Voltage Max.	Foward Current (mA) Min.	Foward Current (mA) Typ.	Foward Current (mA) Max.	Luminous Intensity at 9.0 VDC Typical	Viewing Angle	Freq. (Hz)	Peak Wave Length	Dwg
RED	E157	Diffused	3.5	13.0	38	56	70	**70.0mcd**	120°	2.5	660nm	1
RED	E159	Diffused	3.5	13.0	38	56	70	**12.5mcd**	120°	2.5	625nm	1
YELLOW	E160	Diffused	3.5	13.0	38	56	70	**12.5mcd**	120°	2.5	595nm	1
GREEN	E161	Diffused	3.5	13.0	38	56	70	**8.0mcd**	120°	2.5	565nm	1

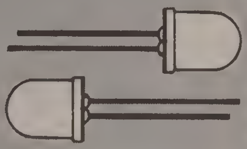
1



Large T-3¹/₄ Flashing LEDs

	LED No.	Lens	Foward DC Voltage Min.	Foward DC Voltage Max.	Foward Current (mA) Min.	Foward Current (mA) Typ.	Foward Current (mA) Max.	Luminous Intensity at 9.0 VDC Typical	Viewing Angle	Freq. (Hz)	Peak Wave Length	Dwg
RED	E162	Diffused	3.5	13.0	38	56	70	**120.0mcd**	140°	2.5	660nm	2
YELLOW	E163	Diffused	3.5	13.0	38	56	70	**12.5mcd**	140°	2.5	595nm	2
GREEN	E164	Diffused	3.5	13.0	38	56	70	**8.0mcd**	140°	2.5	565nm	2

2



Spacers for T-1, T-1³/₄, Right Angle, Square & Rectangular LEDs

Spacer No.	Length	Material	Drawing
SP3T	3 mm (.118)	Black PVC	3
SP4T	4 mm (.157)	Black PVC	3
SP5T	5 mm (.197)	Black PVC	3
SP6T	6 mm (.236)	Black PVC	3
SP7T	7 mm (.276)	Black PVC	3
SP9T	9 mm (.354)	Black PVC	3
SP12T	12 mm (.472)	Black PVC	3
SP15T	15 mm (.590)	Black PVC	3

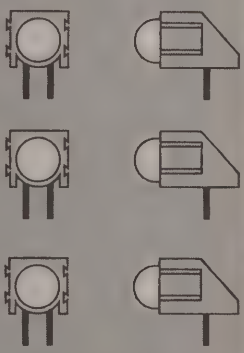
Spacer numbers ending in "T" provide a tight fit on the LED leads.

3

The Attachables, Right Angle LEDs

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Dwg
HIGH EFFICIENCY RED	EA18	Diffused	5mcd	**12.5mcd**	120°	2.0V	2.5V	625nm	4
ULTRA BRIGHT RED	EA22	Diffused	90mcd	**100mcd**	120°	1.85V	2.5V	660nm	4
ULTRA BRIGHT RED	EA23	Diffused	110mcd	**200mcd**	120°	1.85V	2.5V	660nm	4
ULTRA BRIGHT RED	EA26	Clear	510mcd	**1000mcd**	30°	1.85V	2.5V	660nm	4
ULTRA BRIGHT RED	EA27	Clear	1000mcd	**2000mcd**	30°	1.85V	2.5V	660nm	4
YELLOW	EA20	Diffused	5mcd	**12.5mcd**	120°	2.1V	2.5V	590nm	4
GREEN	EA21	Diffused	2mcd	**12.5mcd**	120°	2.2V	2.5V	565nm	4
GREEN	EA25	Diffused	50mcd	**60mcd**	120°	2.2V	2.5V	565nm	4

4



The Attachables, Right Angle LEDs: Bi-Color

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED & GREEN	EA28	Milky White	5mcd 5mcd	**12.5mcd** **12.5mcd**	120° 120°	2.0V 2.2V	2.5V 2.5V	625nm 565nm	5
RED & YELLOW	EA29	Milky White	5mcd 5mcd	**12.5mcd** **12.5mcd**	120° 120°	2.0V 2.1V	2.5V 2.5V	625nm 590nm	5
GREEN & YELLOW	EA30	Milky White	5mcd 5mcd	**12.5mcd** **12.5mcd**	120° 120°	2.2V 2.2V	2.5V 2.5V	565nm 590nm	5

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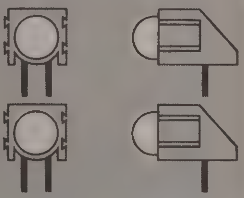

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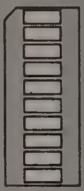
LED Bargraph, 10 Segment

	LED No.	Lens	Luminous Intensity at 10mA Minimum	Luminous Intensity at 10mA Typical	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
HIGH EFFICIENCY RED	E1011	Diffused	900µcd	2200µcd	2.0V	2.5V	625nm	1
ULTRA BRIGHT RED	E1015	Diffused	2200µcd	9000µcd	1.85V	2.5V	660nm	1
YELLOW	E1012	Diffused	900µcd	2200µcd	2.1V	2.5V	590nm	1
GREEN	E1013	Diffused	900µcd	2200µcd	2.2V	2.5V	565nm	1

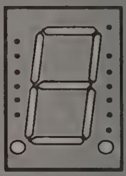
1



LED Numeric Displays

	LED No.	Luminous Intensity at 10mA Minimum	Luminous Intensity at 10mA Typical	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Leads	Drawing
HIGH EFFICIENCY RED	E710	900µcd	2200µcd	2.0V	2.5V	625nm	Common Anode	2
GREEN	E711	900µcd	2200µcd	2.2V	2.5	565nm	Common Anode	2

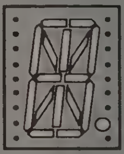
2



LED Alphanumeric Displays

	LED No.	Luminous Intensity at 10mA Minimum	Luminous Intensity at 10mA Typical	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Leads	Drawing
HIGH EFFICIENCY RED	E1610	900µcd	2200µcd	2.0V	2.5V	625nm	Common Anode	3
GREEN	E1611	900µcd	2200µcd	2.2V	2.5	565nm	Common Anode	3

3



LED Modulite (Recommended for LCD Backlighting)

	LED No.	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Dimensions L1	L2	L3	H1	Drawing
RED	[illegible]	7.5mcd	12.5mcd	4.5V	5.5V	635nm	52	47	49.5	19	4
GREEN	[illegible]	6.0mcd	11.0mcd	4.5V	5.5V	565nm	52	47	49.5	19	4
RED	[illegible]	7.5mcd	12.5mcd	4.5V	5.5V	635nm	78	73	75.5	30	4
GREEN	[illegible]	6.0mcd	11.0mcd	4.5V	5.5V	565nm	78	73	75.5	30	4

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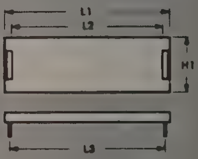

Neon Glow Lamps (Standard Brightness)

Lamp No.	Color Off	Color On	Circuit Voltage	Breakdown V Maximum AC	DC	Current mA	Series Resistor 115V	220V	Average Life (hours)	mcd	Drawing
N514	Clear	Orange	90-115/220	65	90	3	150KΩ	480KΩ	15,000	2.2	5
N515	Clear	Orange	90-115/220	65	90	3	150KΩ	480KΩ	20,000	2.2	6
N516	Clear	Orange	90-115/220	65	90	3	150KΩ	480KΩ	25,000	2.2	7

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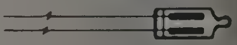

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Neon Glow Lamps (High Brightness)

Lamp No.	Color Off	Color On	Circuit Voltage	Breakdown V Maximum AC	DC	Current mA	Series Resistor 115V	220V	Average Life (hours)	mcd	Drawing
N517	Clear	Red	90-115/220	95	135	1.0	47KΩ	150KΩ	15,000	3.8	8
N518	Clear	Red	90-115/220	95	135	1.0	47KΩ	150KΩ	15,000	3.8	5
N519	Clear	Red	90-115/220	95	135	1.2	47KΩ	150KΩ	20,000	3.8	6
N520	Clear	Red	90-115/220	95	135	1.2	47KΩ	150KΩ	25,000	3.8	7

7

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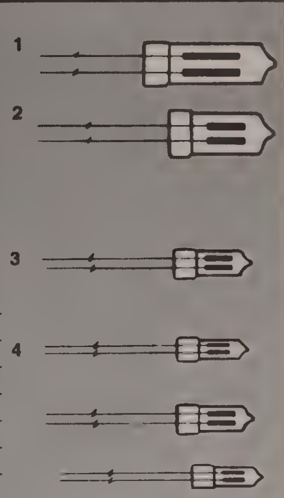
Neon Glow Lamps (Maximum Brightness)

Lamp No.	Color Off	Color On	Circuit Voltage	Breakdown V Maximum	Current mA	Series Resistor 115V	Series Resistor 220V	Average Life (hours)	mcd	Drawing
N512	Clear	Red	90-115/220	85	5.0	8.2KΩ	33KΩ	10,000	40.0	1
N501	Clear	Red	90-115/220	85	1.1	33KΩ	150KΩ	20,000	8.0	2
N502	Clear	Red	85-115/220	65	.9	47KΩ	180KΩ	20,000	4.0	3
N503	Clear	Red	85-115/220	75	1.4	33KΩ	120KΩ	20,000	4.0	4

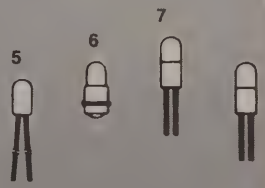


Fluorescent Glow Lamps (Green, Yellow, Blue)

Lamp No.	Color Off	Color On	Circuit Voltage	Breakdown V Maximum	Current mA	Series Resistor 115V	Series Resistor 220V	Average Life (hours)	mcd	Drawing
N504	White	Green	90-115/220	80	.8	51KΩ	200KΩ	20,000	4.0	2
N505	White	Green	90-115/220	80	1.4	33KΩ	120KΩ	20,000	6.0	2
N506	White	Green	90-115/220	80	6	75KΩ	220KΩ	20,000	1.1	3
N507	White	Green	90-115/220	80	.6	75KΩ	270KΩ	20,000	.8	4
N508	White	Yellow	90-115/220	80	8	51KΩ	200KΩ	20,000	4.0	2
N509	White	Yellow	90-115/220	80	1.4	33KΩ	120KΩ	20,000	6.0	2
N510	White	Blue	90-115/220	80	8	51KΩ	200KΩ	20,000	1 5	2
N511	White	Blue	90-115/220	80	1.4	33KΩ	120KΩ	20,000	3.2	2

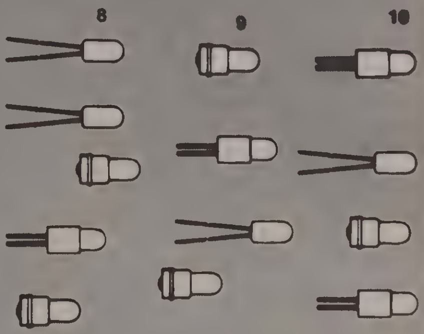
T-³/₄ Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 5	Flanged 6	Bi-Pin 7
5.0	.060	05	100,000	6833	8913	7114
5.0	060	15	3,000	6153	6183	7115
5.0	.075	09	25,000	7133	8828	7116
5.0	115	.15	40,000	7153	8270	7118
5.0	.115	20	5,000	7102	7123	7119
12.0	.060	.15	16,000	L51	L52	L53
14.0	.050	.13	16,000	L54	L55	L56
28.0	.024	.15	16,000	L57	L58	L59



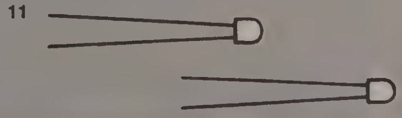
T-1 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 8	Flanged 9	Bi-Pin 10
5 0	021	.034	10,000	6022	8022	7022
5.0	.060	.15	5,000	6150	6180	7265
5 0	075	.09	25,000	713	714	7714
5 0	.115	.15	40,000	715	718	7715
5.0	.115	20	5,000	7213	7236	7267
5.0	.125	.22	5,000	7216	7239	7268
5.0	.145	.16	10,000	8096	7251	7269
10.0	.027	10	10,000	7218	7240	8095
12.0	.060	15	16,000	7219	32	8097
14.0	.065	.15	16,000	8111	8112	8098
18 0	.026	.15	16,000	7220	7241	8099
28 0	.024	.15	16,000	6838	6839	7839



T-1 Subminiature Short Type Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 11
5 0	06	.05	100,000	6832AS15
5 0	075	.09	40,000	7132AS15
5.0	.115	15	40,000	7152AS15
28.0	.024	15	16,000	7009



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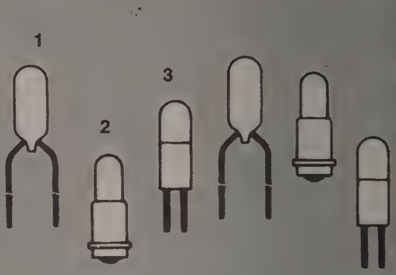
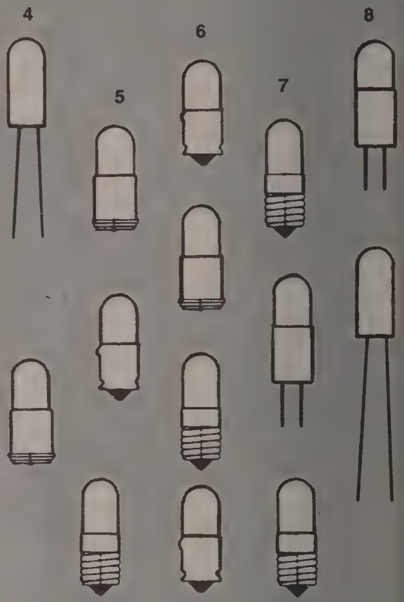
T-1¹/4 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
2.5	40	.55	30	8655	8656	7307
3.0	19	.25	350	324	8637	7637
5.0	06	03	100,000	580	3582	7580
5.0	.06	05	100,000	583	3585	7583
5.0	.115	.15	40,000	515	3518	7515
6.0	.06	13	3,000	2114	8541	7309
6.0	.20	63	1,000	634	8628	7628
6.3	.20	55	5,000	8610	8551	7310
14.0	.08	50	1,000	8640	8646	7646
28.0	04	32	1,000	8627	8632	7632



T-1³/4 Subminiature Lamps

Volts	Amps	M.S.C.P	Hours	Wire 4	Flanged 5	Grooved 6	Screw 7	Bi-Pin 8
3.0	.03	02	1,800	2156	7329	7343	7314	7358
5.0	.06	15	5,000	3151	3150	3152	3153	3149
5.0	.115	15	40,000	2203	7335	7348	7319	7362
5.0	.19	.45	1,000	8784	7334	7350	7317	7363
6.0	.04	03	10,000	1730	345	8705	342	7945
6.0	.20	60	1,000	1784	328	337	1768	7328
6.0	22	63	3,000	1784L	7337	337L	1768L	7365
6.3	04	02	50,000	2180	380	7351	7320	7380
6.3	20	40	50,000	2181	381	379	378	7381
6.3	20	55	3,000	2112	349	398	7323	7349
10.0	014	002	10,000	1869	344	709	8691	7344
10.0	04	08	5,000	2107	367	397	389	7367
11.0	022	03	10,000	8946	7338	7353	7325	7369
12.0	04	12	10,000	2174	394	7354	7326	7394
14.0	08	30	50,000	2182	382	386	8362	7382
14.0	08	50	750	1705	330	336	373	7330
14.0	.100	50	10,000	2162	8918	393	8162	7373
18.0	.04	15	10,000	2102	370	346	8536	7370
22.0	04	30	2,000	8425	459	457	8437	7459
28.0	04	20	50,000	2185	385	7355	8384	7374
28.0	04	30	25,000	2187	387	388	399	7387
28.0	04	34	7,000	1764	327	334	335	7327
28.0	065	.65	5,000	8361	7341	7356	8369	7376

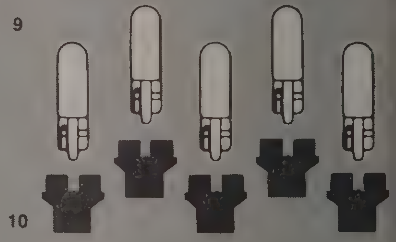


T-5mm Wedge Base Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	Filament Type	Base Type	Drawing
86	6.3	.200	40	50,000	C-2F	Wedge	9
73	14.0	080	30	25,000	C-2F	Wedge	9
74	14.0	100	.70	500	C-2F	Wedge	9
35	28.0	040	30	7,000	C-2F	Wedge	9
17	28.0	065	.65	5,000	C-2F	Wedge	9

T-5mm Wedge Base Holders

Holder No.	Lamp Type	Lamp Base Type	Drawing
H710	T-5mm	Wedge Base	10



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T-10mm Wedge Base Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	Filament Type	Base Type	Drawing
159	6.3	.150	.38	5,000	C-2V	Wedge	1
259	6.3	.250	.50	5,000	C-2V	Wedge	1
555	6.3	.250	90	3,000	C-2R	Wedge	1
161	14.0	.090	1.00	1,500	C-2F	Wedge	1
194	14.0	.270	2.00	1,500	C-2F	Wedge	1

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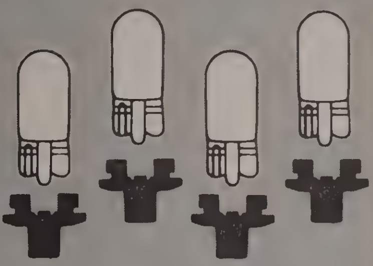

T-10mm Wedge Base Holders

Holder No.	Lamp Type	Lamp BaseType	Drawing
H711	T-10mm	Wedge Base	2

Focused Lens-End Lamps

Lamp No.	Volts	Amps	Lux	Color Temp. (° Kelvin)	Hours	Vacuum or Gas	Filament Type	Base Type	Drawing
L1005	2.5	.350	1,200	2,170	30,000	V	C-6	Brass	3
L1005A	2.5	.350	1,550	2,170	30,000	V	C-6	Brass	3
L1026A	2.5	.350	2,000	2,250	10,000	V	C-2R	Brass	3
L1023	2.5	.350	2,100	2,240	15,000	V	C-6	Brass	3
L4038	2.5	350	2,100	2,250	10,000	V	C-6	Cartridge	4
L4040	3.5	.370	4,000	2,550	1,000	V	C-2R	Cartridge	5
L1006	3.5	.450	1,600	2,230	30,000	G	C-6	Brass	3
L1024	3.5	560	3,800	2,490	5,000	G	C-6	Brass	3
L1024A	3.5	.560	3,800	2,490	5,000	G	C-6	Brass	3
L1021	3.5	.600	12,000	2,930	100	Krypton	C-6	Brass	3
L1007	5.0	.160	800	2,300	15,000	V	C-2R	Brass	3
L1025	5.0	.240	1,200	2,450	10,000	V	C-2R	Brass	3
L8006	5.0	.775	7,000	2,370	30,000	G	C-6	½-20UNF-2A	6
L8008	5.0	.725	12,000	2,400	10,000	G	C-6	½-20UNF-2A	6

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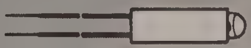

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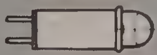

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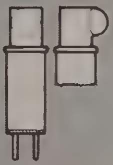

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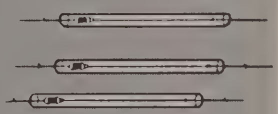
Line Filament Lamps

Lamp No.	Volts	Amps	Watts	Hours	Vacuum or Gas	Filament Type	Filament Length, L1	L2	Dimensions MOL	D Max	Drawing
L9050	3.0	.360	1.10	2,000	V	S-8	16±1	9±.5	36	3.5	7
L9001	4.5	.360	1.65	2,000	V	S-8	23±1	9±.5	43	3.5	7
L9013	6.0	.370	2.22	1,500	V	S-8	30±1	9±.5	50	3.5	7
L9003	12.0	.320	3.60	2,000	V	S-8	75±1	9±.5	92	3.5	7
L9014	12.0	.370	4.45	1,500	V	S-8	60±1	9±.5	77	3.5	7
L9028	12.0	.760	9.00	2,500	V	S-8	100±1	9±.5	121	3.5	7



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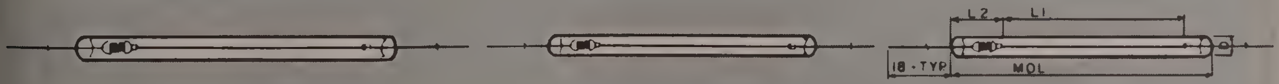

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Lens-End Halogen Lamps

Lamp No.	Volts	Amps	Lux	Color Temp. (Kelvin)	Hours	Filament Type	Base Type	Drawing
L1030	3.5	1.200	18,100	2,560	150	C-6	¼" Sleeve	1
L1041	5.0	1.432	30,000	2,900	3,000	C-6	¼" Sleeve	1
L1051	6.0	1.92	75,000	3,000	500	C-6	⁷⁄₈" 24 UNF-2A	2

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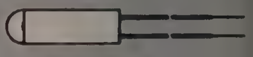

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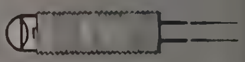

Clear-End Halogen Lamps

Lamp No.	Volts	Amps	Lumens	Color Temp. (Kelvin)	Hours	Filament Type	Base Type	Drawing
L1031	3.5	1.200	40	[illegible]	150	C-6	¼" Sleeve	3
L1040	5.0	1.430	70	[illegible]	3,000	C-6	¼" Sleeve	3
L1050	6.0	1.930	170	[illegible]	500	C-6	⁷⁄₈" 24 UNF-2A	4

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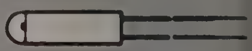

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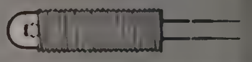

Halogen Lamps with Miniature Bayonet Base

Lamp No.	Volts	Watts	Lumens	Color Temp. Degrees Kelvin	Life In Hours	Filament Type	Dimensions D	MOL	LCL	Base Type	Drawing
L6412	6.0	10	130	2,850	3,000	C-6	9.0	38	15.5	Ba9s	5
L6410	12.0	10	170	2,600	3,000	C-6	9.0	38	15.5	Ba9s	5
L6411	12.0	15	210	2,900	1,000	C-6	9.0	38	15.5	Ba9s	5

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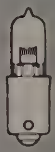

Quartz Halogen Lamps with Flat C-Bar-6 Filaments

Lamp No.	Volts	Watts	Lumens	Color Temp. Degrees Kelvin	Life In Hours	Filament Type	Dimensions D	MOL	LCL	Base Type	Drawing
L7415	6.0	20	400	3,200	50	C-Bar-6	8.0	30.0	19.5	G-4	6
L7416	6.0	20	340	2,900	2,000	C-Bar-6	8.0	30.0	19.5	G-4	6
[illegible]	12.0	30	1200	3,500	2,900	C-Bar 6	11.0	44.0	30.0	GY6.35	6

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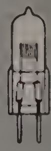

Quartz Halogen Lamps

Lamp No.	Volts	Watts	Lumens	Color Temp. (Kelvin)	Hours	Filament Type	D	Dimensions MOL	LCL	Base Type	Drawing
[illegible]	6.0	10	200	3,200	100	C-6	8.5	30.0	19.5 ± .25	G-4	7
L6402	6.0	10	150	2,900	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	7
L7396	6.0	20	420	3,200	100	C-6	8.5	30.0	19.5 ± .25	G-4	7
L7394	6.0	20	350	3,000	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	7
L7401	12.0	20	420	3,150	250	C-6	8.5	30.0	19.5 ± .25	G-4	7
[illegible]	12.0	20	350	3,000	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	7
[illegible]	12.0	50	900	3,000	2,500	C-6	12.0	44.0	30.0 ± .25	GY6.35	8
[illegible]	12.0	100	2,400	3,000	2,000	C-Bar	11.0	44.0	30.0 ± .25	GY6.35	8
L7407	12.0	100	3,000	3,400	50	C-Bar	11.0	44.0	30.0 ± .25	G6.35	8
L6405	24.0	150	4,700	3,400	50	C-Bar	13.5	58.0	32.0 ± .50	G6.35	8
[illegible]	24.0	250	[illegible]	3,000	2,000	C-Bar	15.0	58.0	37.0	GY6.35	8
L6404	120	20	350	3,000	2,000	C-6	11.0	55.0	30.3 ± .25	Snaplock	9
[illegible]	120	50	900	3,000	2,500	C-6	12.0	60.0	33.3 ± .25	Snaplock	9
[illegible]	120	100	2,400	3,000	2,000	C-Bar	11.0	60.0	33.3 ± .25	Snaplock	9
[illegible]	120	35	500	3,000	2,000	C-8	12.0	42.0	28.5 ± .25	GY6.35	10
L7410	120	35	650	3,000	3,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	10
L7411	120	50	900	3,000	3,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	10
L9110	120	150	2,400	2,900	1,500	C-8	12.0	78.0	-	R7s	11
L9011	120.0	150	3,000	2,900	2,000	C-8	9.4	114.2	—	R7s	11
L9012	120.0	250	4,000	2,900	2,000	C-8	9.4	114.2	—	R7s	11

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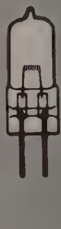

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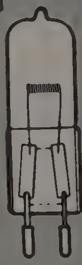

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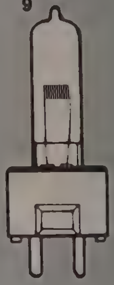

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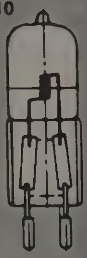

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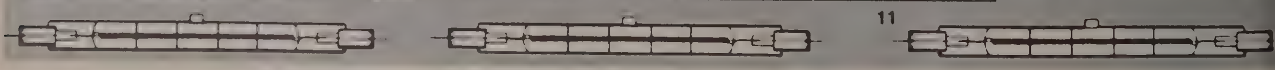

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Quartz Halogen Projection Lamps

Lamp No.	Volts	Watts	Lumens	Color Temp. Degrees Kelvin	Life In Hours	Filament Type	Dimensions D	MOL	LCL	Base Type	Drawing
L7418	24	250	6750	3,250	300	C-Bar-6	14.5	57	33	GY6.35	1
L7419	36	400	14000	3,400	50	C-Bar-6	18.0	60	36	GY6.35	1
L7420	36	400	9500	3,200	300	C-Bar-6	18.0	60	36	GY6.35	1
L7421	120	100	1900	3,000	200	CC-6	13.5	50	30	GY6.35	1
L7422	120	150	3300	3,050	200	CC-6	13.5	50	30	GY6.35	1
L7423	120	250	5750	3,100	300	CC-6	16.0	50	33	GY6.35	1

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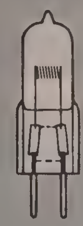

Halogen Lamps for Machine Vision Illumination

Lamp No.	Volts	Watts	Color Temp. Degrees Kelvin	Life In Hours	Filament Type	Beam Angle	Dimensions MD	MOL	Base Type	Drawing
L518	6.0	10	2925	2000	C-6	+/-11	35.5	35.0	GZ4	2
L519	12.0	20	2925	2000	C-6	+/-11	35.5	35.0	GZ4	2
L520	12.0	42	3050	4000	C-6	+/-12	50.7	45.0	GX5.3	2
L521	12.0	50	3050	4000	C-6	+/-13	50.7	45.0	GX5.3	2
L522	12.0	65	3050	4000	C-6	+/-13	50.7	45.0	GX5.3	2
L523	12.0	75	3050	4000	C-6	+/-14	50.7	45.0	GX5.3	2

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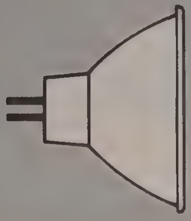

Halogen Lamp Holders

Holder No.	Halogen Lamp Base Types	Drawing
H9901	G-4, GZ4, MR-11	3
H9941	G-4, GZ4, MR-11	4
H997	G-4	5
H912	GY6.35, G6.35, MR-16	4
H701	GY6.35, G6.35, MR-16	6
H910	G6.35	7
H881	G6.35, GZ6.35	11
H9971	GY9.5, *Snaplock*	8
H705	GZ6.35, MR-16	9
H706	GX5.3, MR-16	9
H867	GY5.3, MR-16	9
H989	GX5.3, MR-16	4
H9431	R7s	10

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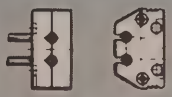

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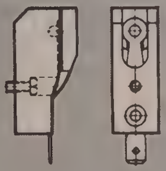

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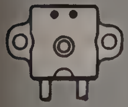

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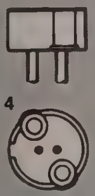

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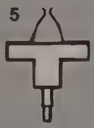

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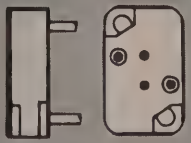

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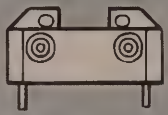

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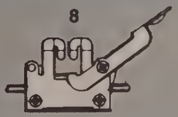

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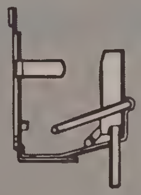


Please request Engineering Catalog 166
800 West Cummings Park, Woburn, Massachusetts 01801
Telephone us directly: 617 935-4442
Fax: 617 938-5867

Gilway
Technical Lamp

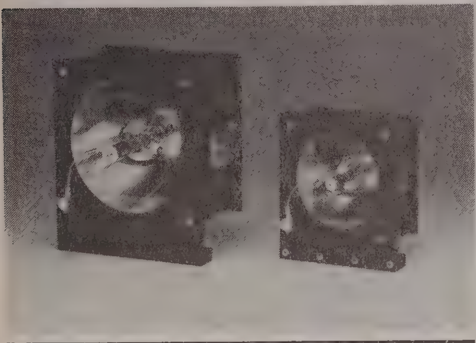
HAMAMATSU

Main Office / U.S.A.: 360 Foothill Road, PO Box 6910
Brightwater, NJ 08807-0910 • 908-231-0960 • FAX: 908-231-1539
1-800-430-0404

▼ XENON LAMPS ▼ LAMPS ▼ MERCURY-XENON LAMPS ▼

▼ See our DETECTOR PAGES in Section 3700 — Vol. B ▼

XENON MODULE


Xex Lamp with Ellipse Mirror

Our highly-integrated compact Xenon Flash Module helps speed your design to production. Containing a stable xenon flash lamp, power supply and trigger socket in a compact package, the module eliminates costs of design and production for the OEM engineer. Useful in many applications, including SO_2 analyzers, color analyzers, high-speed camera lightings, stroboscopes, phototypesetting and photomask light sources.

Lamp	Xe Lamps	75W/150W
	Hg-Xe Lamps	75W/100W/150W/200W
Elliptical Mirror		for 365nm/for 254nm/for Visible /Al coated

SUPER-QUIET XENOX LAMPS- CONTINUOUS MODE
...Plus... MERCURY-XENON ADD ADITIONAL PARTS

at 25°C

Type No.	Power Consumption (W)	Arc Length (mm)	Window Material	Spectral Distribution (nm)	Lamp Current (Adc)	Lamp Voltage (Vdc)	Output Stability (after 20 min.)		Life	
							Drift Max. (%/h)	Fluctuation Max. (%p-p)	Guaranteed Ⓐ (h)	Average (h)
Super-Quiet Mercury-Xenon Lamps										
L2421	50	1.0	Fused Silica	185 to 2000	3.5±0.5	14	±0.5	±1.0	500	1000
L2481	75	1.0	Fused Silica	185 to 2000	5.5±0.5	14	±0.5	±1.0	500	1000
L2481-01										
L2481-02										
L2422	100	1.3	Fused Silica	185 to 2000	5.5±0.5	18	±0.5	±1.0	500	1000
L2422-01										
L2422-02										
L2482	150	1.7	Fused Silica	185 to 2000	7.5±0.5	20	±0.5	±1.0	1000	2000
L2423	200	2.0	Fused Silica	185 to 2000	8.0±0.5	23	±0.5	±1.0	1000	2500
L2423-01										
L2570			Ozone-free Silica	220 to 2000						
L2570-01										
L2483	350	2.5	Fused Silica	185 to 2000	14.0±1.0	25	±0.5	±1.0	500	1000
L2424	500	3.0	Fused Silica	185 to 2000	20.0±1.0	25	±0.5	±1.0	500	1000
Super-Quiet Xenon Lamps-Contiuous Mode										
L2173	35	1.0	Fused Silica	185 to 2000	3.5±0.5	11	±0.5	1.0	1000	2000
L2193			Ozone-free Silica	220 to 2000						
L2174	75	1.3	Fused Silica	185 to 2000	5.4±0.5	15	±0.5	1.0	1000	2000
L2174-01										
L2174-02										
L2194			Ozone-free Silica	220 to 2000						
L2194-01										
L2194-02										
L2175	150	2.5	Fused Silica	185 to 2000	7.5±0.5	20	±0.5	1.0	1000	2500
L2195			Ozone-free Silica	220 to 2000						
L2273		2.0 (GS)	Fused Silica	185 to 2000	8.5±0.5	18	±0.5	1.0	1500	3000
L2274			Ozone-free Silica	220 to 2000						
L2479	300	3.0	Fused Silica	185 to 2000	15.0±1.0	20	±0.5	1.0	1000	2000
L2480			Ozone-free Silica	220 to 2000						

Ⓐ The life end is defined as the time when the radiant intensity falls to 50% of its initial value or when the output fluctuation exceeds ±1%p-p.

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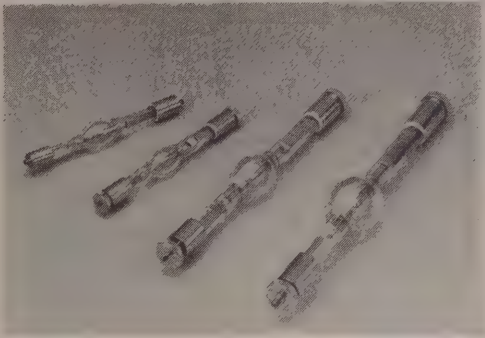
SUPER-QUIET XENOX LAMPS- CONTINUOUS MODE ...*Plus*... MERCURY-XENON ADD ADITIONAL PARTS

Super-Quiet Xenon Flash



Super-Quiet Xenon Lamps-Continuous Mode

at 25°C

Type No.	Arc Size (mm)	Window Material	Spectral Distribution (nm)	Supply Voltage (Vdc)	Trigger Voltage (kV)	Max Average Power (W)	Max. Power Energy per Flash (J/Flash)	Repetition Rate Max. (Hz)	Output Stability Ⓐ Jitter Ⓑ (hs)	Output Stability Ⓐ Output Fluctuation Type (%)	Ⓐ Life Min. (# of Flashes)
Super-Quiet Xenon Flash Lamps (22mm Diameter Types)											
L2467 *	8.0 x 1.5	Synthetic Silica	160 to 2000	700 to 1000	5 to 7	10	0.10	100	200	3.0	1×10^9
L2468 *		UV Glass	185 to 2000								
L2469		Borosilicate	240 to 2000								
L2415 *	3.0 x 1.5	Synthetic Silica	160 to 2000	700 to 1000	5 to 7	10	0.10	100	200	3.0	1×10^9
L2416 *		UV Glass	185 to 2000								
L2417 *		Borosilicate	240 to 2000								
L2439	1.5 x 1.5	Synthetic Silica	160 to 2000	700 to 1000	5 to 7	10	0.10	100	200	3.0	1×10^9
L2440		UV Glass	185 to 2000								
L2441		Borosilicate	240 to 2000								

Ⓐ Measured with power supply voltage of 1 kV, main supply of 0.1 uF and 100 Hz repetition rate.

Ⓑ Variation in delay from input of flash signal (trigger signal) to peak flash value (varies depending on main voltage value.)

XENON FLASH LAMP POWER SUPPLY
MODEL C5398
INPUT 12Vdc 0.75A Max.
OUTPUT 600Vdc 6W Max.
HAMAMATSU MADE IN JAPAN

Xe Flash Lamp Module

COMPACT, EASY HANDLING

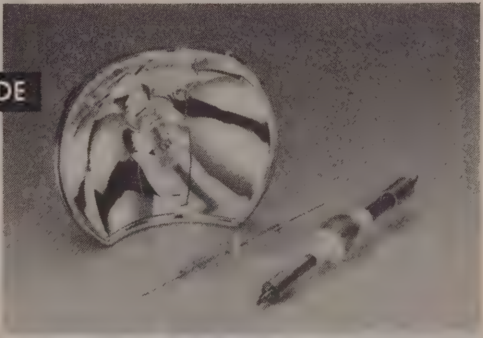
This module consists of a high stability xenon flash lamp, power supply and trigger socket in a compact module. It reduces troublesome wiring steps when designing. The xenon flash lamp employed for the module features high stability, long life and low thermal dissipation. Useful in a wide variety of applications

Type No.	5W Type	10W Type
Output voltage range (Vdc)	480 to 720	300 to 1000
Maximum repetition frequency (Hz)	100	200
Standard built-in capacitor (µF)	0.1	0.1

METAL HALIDE

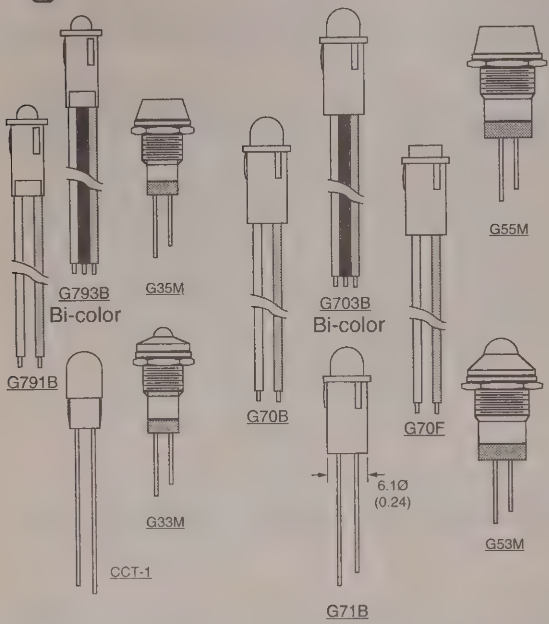
A bright source for white light, our short arc metal halide lamp has four times the luminous efficiency of xenon or halogen lamps. With excellent color balance, it's perfect for liquid crystal projectors and fiber applications.

Lamp Variation	Luminous Efficiency	Color Temp.	Life
• 150W:L4342	76 (lm/W)	7000 (k)	2500 (HR)
• 575W:L5431	85 (lm/W)	6000 (k)	1000 (HR)

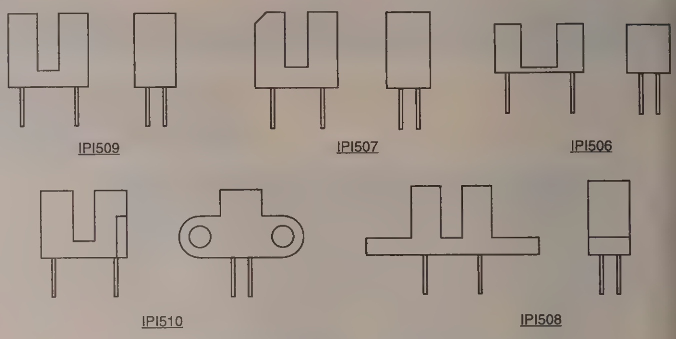


Metal Halide Lamp

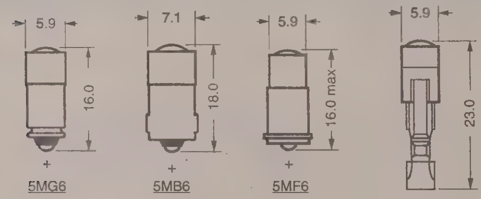
IDEA, Inc.
1300-B Pioneer Street, Brea, CA 92621-3728


G791B
G793B
Bi-color
G35M
G33M
CCT-1
G70B
G703B
Bi-color
G71B
6.1Ø
(0.24)
G70F
G55M
G53M

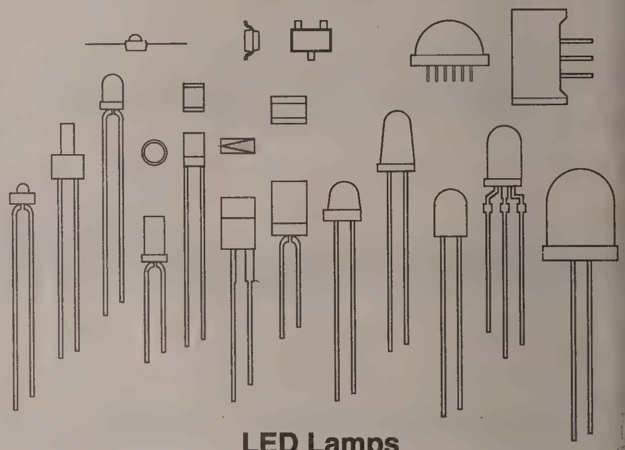
T-1 & T-1-3/4 Panel Mount LED Indicators


IPI509
IPI507
IPI506
IPI510
IPI508

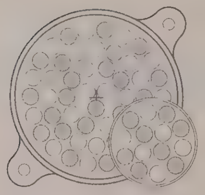
IREDs & Photo-interrupters


5.9
16.0
+
5MG6
7.1
18.0
+
5MB6
5.9
16.0 max
+
5MF6
5.9
23.0
5TS6

Based Lamps

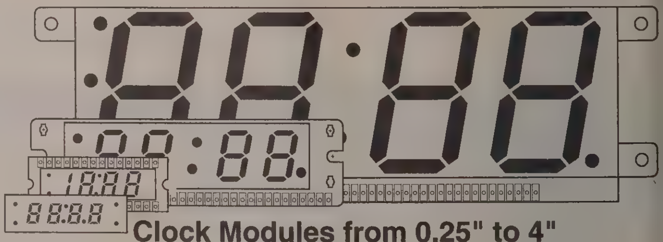


LED Lamps



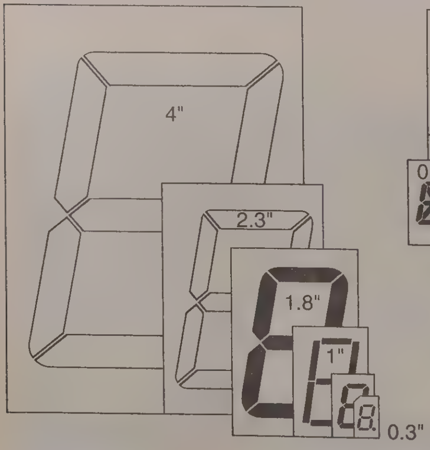
Cluster Lamps

1-800-LED-IDEA
is
your link to LED selection,
service, delivery, and
quality.

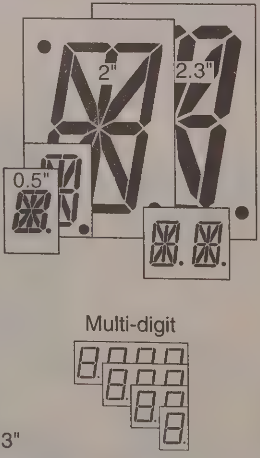

88:88
88:88
18:88
88.8.8

Clock Modules from 0.25" to 4"

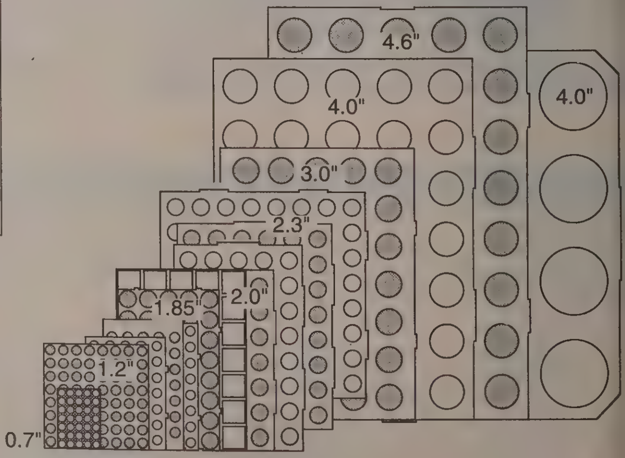
0.3" to 4" 7-Segs



0.5" to 2.3" Alphanumerics

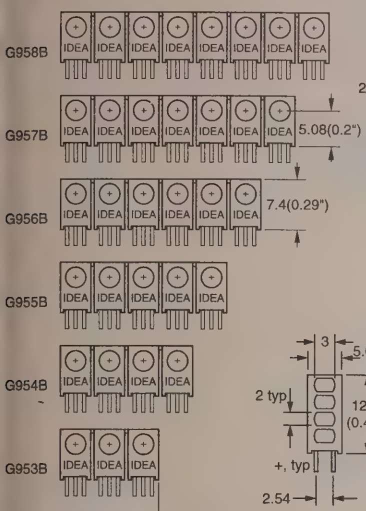

2"
2.3"
0.5"
Multi-digit

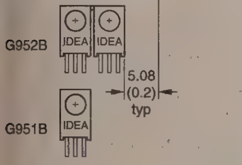
0.7" to 4.6" Dot Matrices

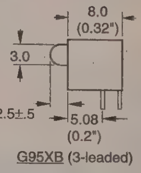

4.6"
4.0"
4.0"
3.0"
2.3"
2.0"
1.85"
1.2"
0.7"

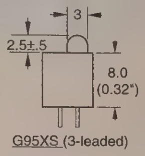
Tel: (310)697-4332 Fax: (310)690-1352

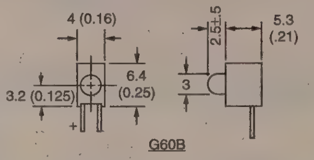
idea

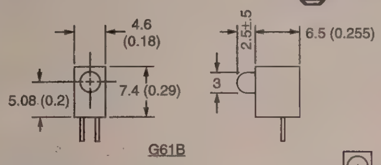

G958B
G957B
G956B
G955B
G954B
G953B
IDEA
5.08(0.2")
7.4(0.29")

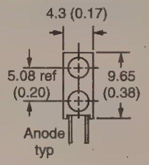

G952B
G951B
IDEA
5.08
(0.2)
typ

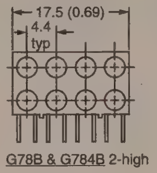

8.0
(0.32")
3.0
2.5±.5
5.08
(0.2")
G95XB (3-leaded)

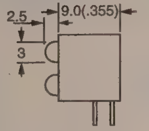

3
2.5±.5
8.0
(0.32")
G95XS (3-leaded)

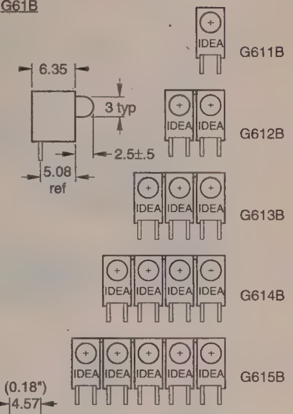

4 (0.16)
6.4
(0.25)
3.2 (0.125)
+
2.5±.5
5.3
(.21)
3
G60B

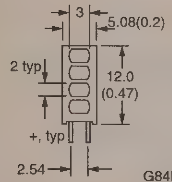

4.6
(0.18)
7.4 (0.29)
5.08 (0.2)
2.5±.5
6.5 (0.255)
3
G61B

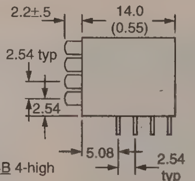

4.3 (0.17)
5.08 ref
(0.20)
9.65
(0.38)
Anode
typ

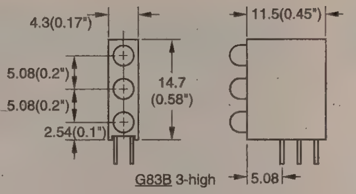

17.5 (0.69)
4.4
typ
G78B & G784B 2-high

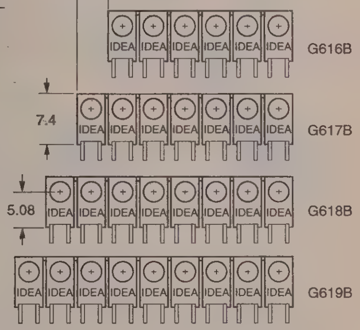



6.35
3 typ
2.5±.5
5.08
ref
G611B
G612B
G613B
G614B
G615B
IDEA
(0.18")
4.57

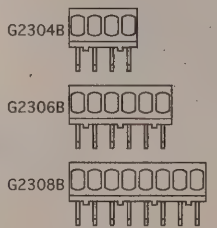

3
5.08(0.2)
2 typ
12.0
(0.47)
+, typ
2.54

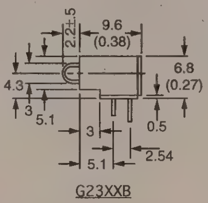

2.2±.5
14.0
(0.55)
2.54 typ
2.54
5.08
2.54
typ
G84B 4-high

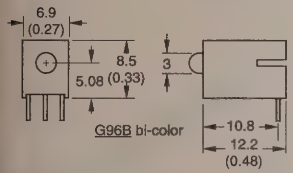

4.3(0.17")
5.08(0.2")
5.08(0.2")
2.54(0.1")
14.7
(0.58")
G83B 3-high
11.5(0.45")
5.08

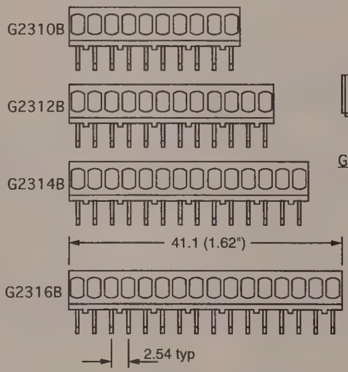

G616B
G617B
G618B
G619B
IDEA
7.4
5.08

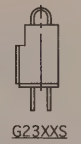
Call us for that better IDEA indicator.

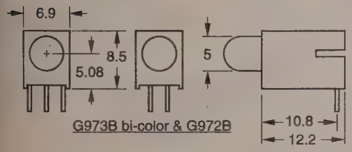

G2304B
G2306B
G2308B

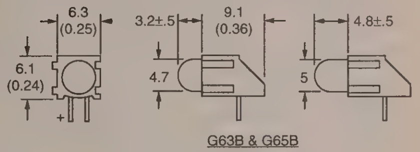

2.2±.5
9.6
(0.38)
6.8
(0.27)
4.3
3
5.1
3
0.5
5.1
2.54
G23XXB

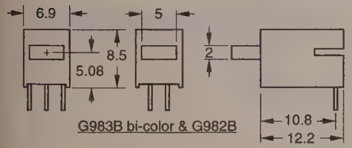

6.9
(0.27)
8.5
5.08 (0.33)
3
10.8
12.2
(0.48)
G96B bi-color


G2310B
G2312B
G2314B
41.1 (1.62")
G2316B
2.54 typ

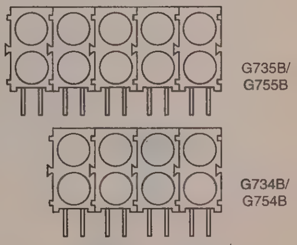


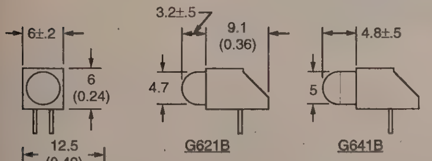

6.9
8.5
5.08
5
10.8
12.2
G973B bi-color & G972B

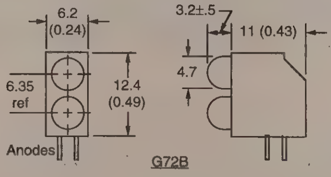

6.3
(0.25)
6.1
(0.24)
+
3.2±.5
9.1
(0.36)
4.7
4.8±.5
5
G63B & G65B

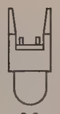

6.9
5
8.5
5.08
2
10.8
12.2
G983B bi-color & G982B

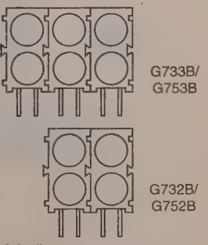
The first 0.1" pitch indicator for direct or right angle view with upto 16 pos.

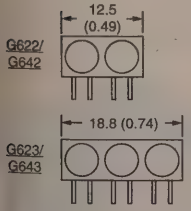

G735B/
G755B
G734B/
G754B

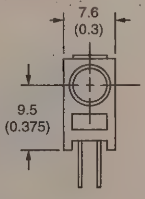

6±.2
6
(0.24)
3.2±.5
9.1
(0.36)
4.7
G621B
4.8±.5
5
G641B

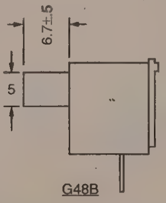

6.2
(0.24)
6.35
ref
12.4
(0.49)
Anodes
3.2±.5
11 (0.43)
4.7
G72B

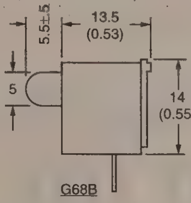


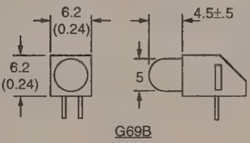

G733B/
G753B
G732B/
G752B

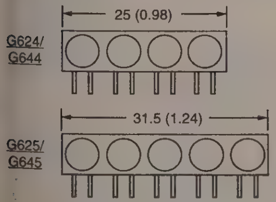

12.5
(0.49)
G622/
G642
18.8 (0.74)
G623/
G643

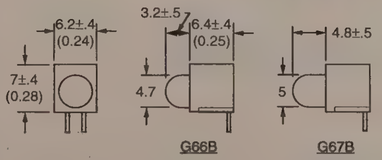

7.6
(0.3)
9.5
(0.375)

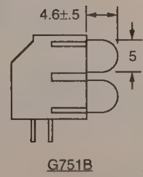


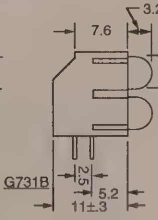

5.5±.5
13.5
(0.53)
5
14
(0.55)
G68B

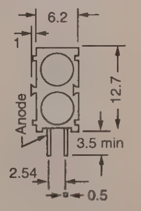

6.2
(0.24)
6.2
(0.24)
4.5±.5
5
G69B


25 (0.98)
G624/
G644
31.5 (1.24)
G625/
G645

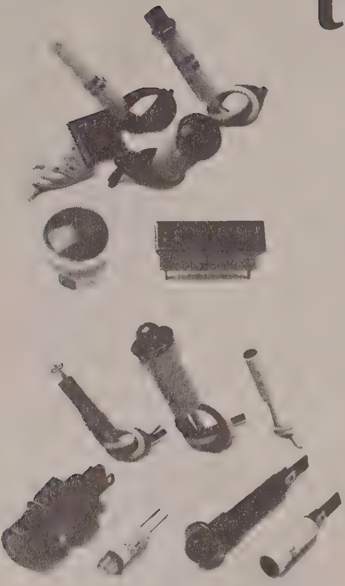

6.2±.4
(0.24)
7±.4
(0.28)
3.2±.5
6.4±.4
(0.25)
4.7
G66B
4.8±.5
5
G67B




3.2±.5
7.6
4.7
G731B
2.5
5.2
11±.3


6.2
1
12.7
Anode
3.5 min
2.54
0.5

No one gives you more ways to see the light.

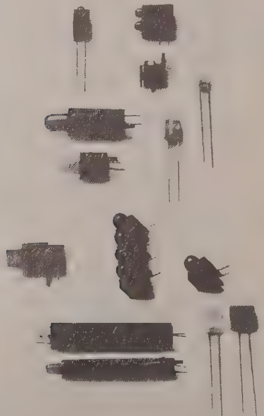


Neon and Incandescent Panel Indicator Lights.

When it comes to line voltage applications, our rugged neon lamps are designed to outlast the equipment they're used in. Available in unique packaging, colors and voltages, they offer you a wide range of options. IDI Incandescent Panel Indicator Lights are ideally suited for low-voltage applications which require higher light output. These incandescent indicators have replaceable lamps and are extremely cost effective. A wide variety of lens shapes and colors add to their versatility.

LED Panel Indicator Lights.

Featuring quick, snap-in panel mounting, wide angle visibility and attractive appearance, IDI LED Panel Indicator Lights are available in both SUPER BRITE and ULTRA BRITE configurations.



PC Board Mount LEDs.

IDI PC board mount LED's are a dream come true for design engineers because they do away with a host of problems. IDI PC board assemblies saves manufactu ing cost by installing quickly, assuring proper spacing and insulation, and at the same time provide uniform and secure mounting. Available in a wide variety of colors, voltages and brightness levels.

A Wide Range of SMT LEDs Now Available.

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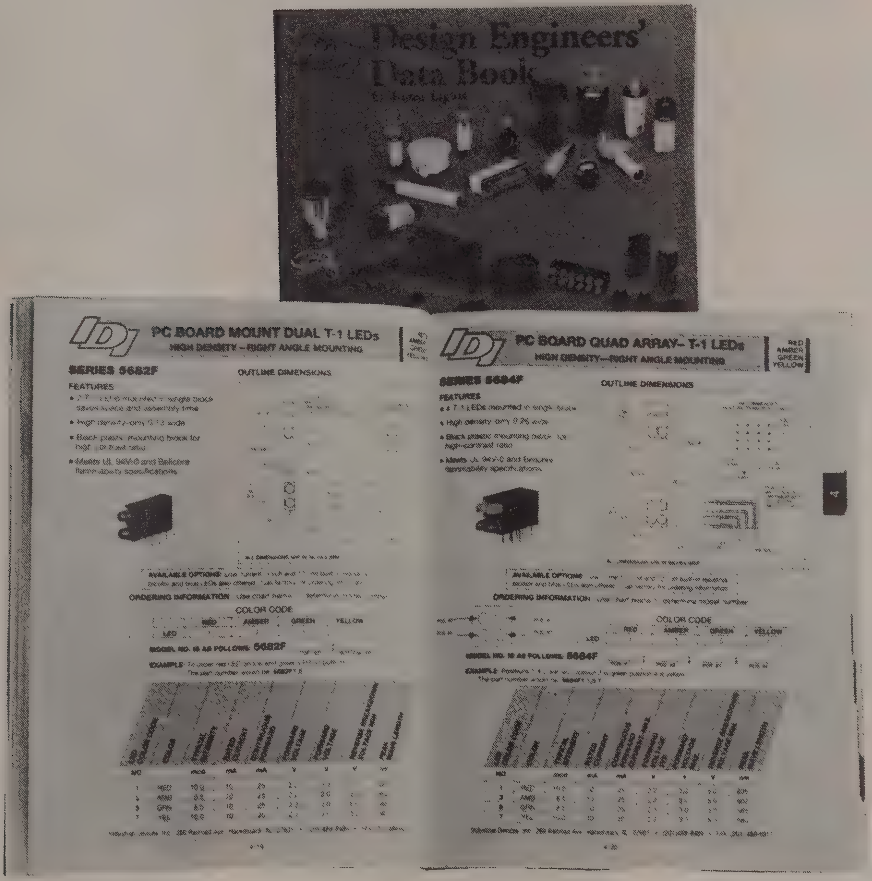
260 Railroad Avenue, Hackensack, NJ 07601
Phone: (201) 489-8989 FAX: (201) 489-6911

Presenting over 50,000 bright ideas from IDI.



Design Engineers' Data Book

PC BOARD MOUNT DUAL T-1 LEDs
HIGH DENSITY—RIGHT ANGLE MOUNTING

SERIES 5682F

FEATURES

OUTLINE DIMENSIONS

AVAILABLE OPTIONS

ORDERING INFORMATION

COLOR CODE

RED AMBER GREEN YELLOW

MODEL NO. IS AS FOLLOWS: 5682F

EXAMPLE

PC BOARD QUAD ARRAY- T-1 LEDs
HIGH DENSITY—RIGHT ANGLE MOUNTING

SERIES 5684F

FEATURES

OUTLINE DIMENSIONS

AVAILABLE OPTIONS

ORDERING INFORMATION

COLOR CODE

RED AMBER GREEN YELLOW

MODEL NO. IS AS FOLLOWS: 5684F

EXAMPLE

Where can you find the world's largest, most complete selection of "off the shelf" indicator lights in every shape, size and configuration imaginable? It's easy. Just do some light reading in IDI's all-new Data Book.

IDI has been supplying millions of incandescent, neon & LED indicator lights to designers and manufacturers for use in a wide array of panels and printed circuit boards. From simple LED solid state lamps to custom designed modules.

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JKL: The Industry's Most Comprehensive Source For Lamps & Lighting Accessories

JKL Components Corporation is at the forefront of new product innovation, providing thoughtfully-engineered solutions to the changing needs of the dynamic industries it serves.

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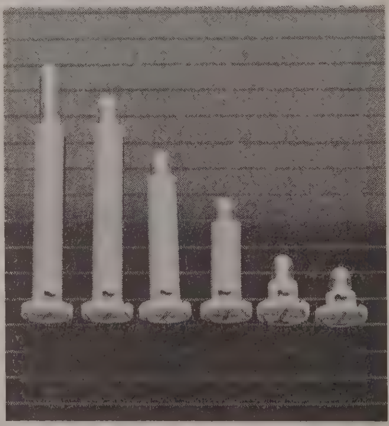
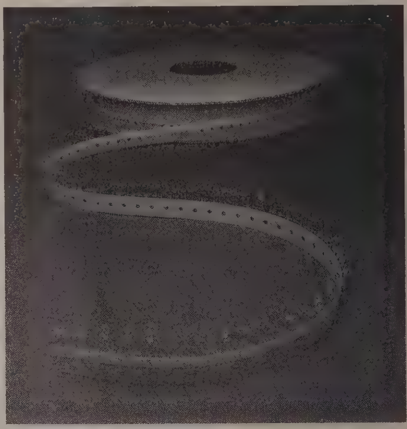
WORLD'S SMALLEST FLUORESCENT LAMP

Only .250″ (6.5mm) in diameter, and available in 2″, 4″ and 8″ standard lengths, this unique line is offered in a variety of colors, and provides a minimum of 20,000 hours operating life. A new, narrow spectrum RBG series is also available, as well as the Ultra-Violet Line in diameters as small as 3/8″ (9.5mm).



JKL NEO-WEDGE™ PCB LAMP SYSTEM

This patented design allows direct mounting of lamp assemblies to a PC board with a quarter turn twist, reducing labor costs and eliminating all secondary assembly operations. It is also available in a double-contact version for single sided boards that assures electrical contact whether lamp is pointing top or bottom, as well as a new gas filled line *guaranteed* for 2500 hours lamp life.



HIGH PRODUCTION TAPE & REEL LAMPS

This revolutionary concept permits utilization of leaded lamps with automatic insertion equipment, providing a practical and cost-effective solution to the problems of manual lamp insertion in what is otherwise an automatic operation. Available in high volume quantities on special order, to exacting customer specifications. Compatible with most auto-insertion systems. Consult factory.

STANDARD JKL LIGHTING PRODUCTS

- Miniature Fluorescent Lamps
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- Neon Glow Lamps
- Sub-Miniature Indicator Lamps
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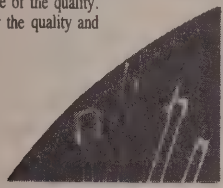
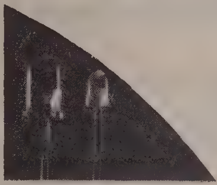
Popular models are supplied from stock

With over 12 years in this field, you can be assured of our product quality at all times. In fact, major firms worldwide use our products because of the quality. Get in touch with us for the quality and price you demand.

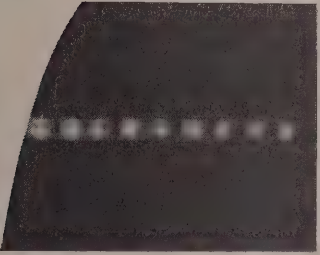


- Photo transistor infrared diodes

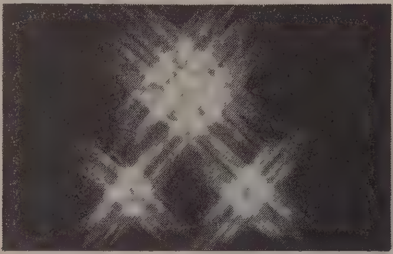
- Hi-super bright lamps 400 to 4,000 mcd



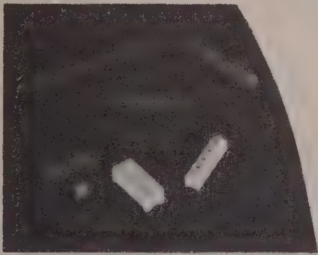
- Blue LEDs



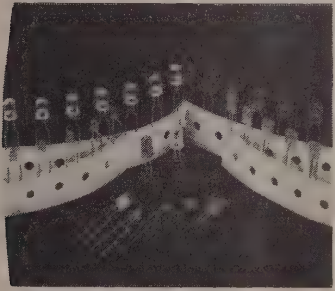
- Light sources



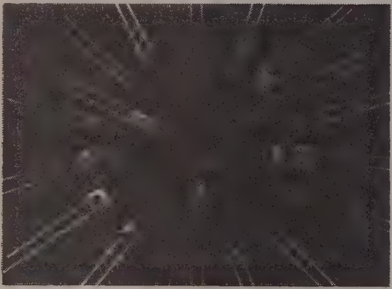
- LED clusters, big lamps



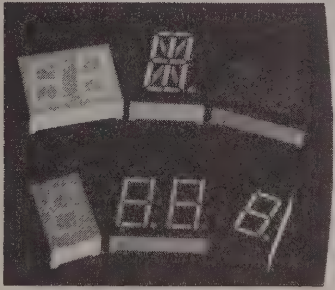
- Bar graph arrays



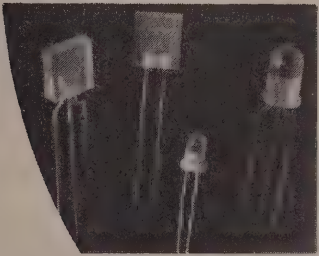
- Tape and reel packed LEDs



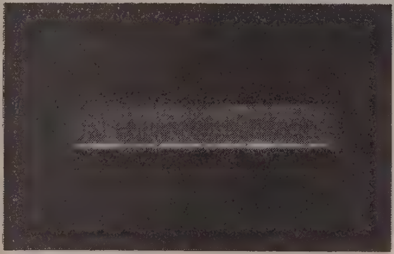
- Over 2,000 types of standard & special lamps



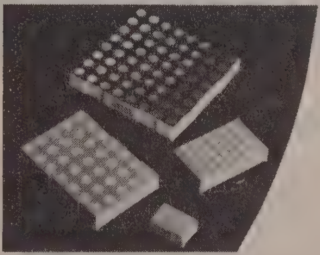
- Low current, numeric & alphanumeric displays



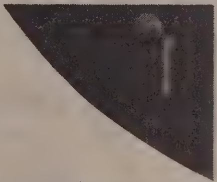
- Bi/Tri color LEDs in all packages



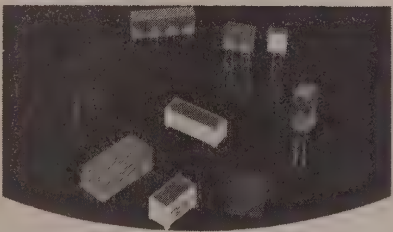
- Backlights for LCD



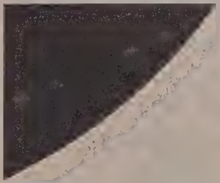
- 1-color, bi/tri color dot matrix



- LEDs with holders
- LEDs with long leads



- Light bars



- Surface mount LEDs

Kingbright USA Corp.

225 BREA CANYON RD., CITY OF INDUSTRY, CA 91789
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celest EL™

Advanced Technology EL Lamp System

We've Given Electroluminescent Lighting a Whole New Look

A combination of new EL (electroluminescent) Thick Film technology, industry experience and drive circuit capabilities allows Leading Edge Industries to now offer EL to engineers who might not have considered it in the past.

Leading Edge Industries has developed a totally new EL product utilizing the most advanced materials and production techniques in the industry today.

Construction

Leading Edge Industries (electroluminescent lamps) are all polymer based with a multilayer construction. In Manufacturing, a chemical process renders the EL Phosphor used in the construction of EL Lamps chemically inert and pacified in the presence of water molecules. Our EL Lamp System has high moisture and humidity resistance without Aclar packaging and is 30% more power efficient than other EL products.

Leading Edge Industries also manufactures EL Lamps packaged in Aclar for applications where overall thickness is not a concern. These lamps range in thinness from 0.013" to 0.019". Leading Edge Industries' EL Lamps require no peripheral bus bar.

Lamp Characteristics

♦ Operating Voltage Range	24 - 250 Vrms
♦ Recommended Voltage Range	50 - 180 Vrms
♦ Operating Frequency Range	Up to 5,000 Hz
♦ Recommended Frequency Range	50 to 1,000 Hz
♦ Lamp Brightness @ 115V, 400 Hz:	
Standard	20 ft. - L
High Performance	35 ft. - L
♦ Dynamic Capacitance	0.003 µf per in²
♦ Current Phase Angle	78 leading
♦ Power Consumption @ 115V, 400 Hz	20 mW per in²
♦ Useful Life	Up to 100,000 hours

CELEST EL™

The CELEST EL™ Lamp System is Leading Edge Industries' new extra thin Electroluminescent Lamp. This material features:

- High moisture and humidity resistance without Aclar packaging
- Longer Life
- Design Light up to within .025" from all edges and internal cutouts
- Overal thickness: .008" to .012"
- Increased design flexibility
- Innovative termination techniques

For a complete brochure, pricing information, or engineering support, call us Toll Free at:

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LEADING **EDGE**
INDUSTRIES, INC.

11578 Encore Circle • Minnetonka, MN 55343
Tel: (612) 936-7744 • Fax: (612) 936-9194

Lamp Options and Specifications

Highly Flexible, All Polymer - Leading Edge Industries' lamps are all polymer, and durability is enhanced since all materials have the same coefficient of expansion.

Thinness From .008 Inches - Leading Edge Industries' lamps are approximately one half the thickness of other lamps available today.

Layers Selectively Deposited - Leading Edge Industries can selectively deposit phosphors and other critical layers providing flexibility of design, selectivity of light emission, and minimization of power consumption.

Multiple Colors - Leading Edge Industries can produce different colors within an individual lamp.

Independently Addressable Segments - Leading Edge Industries can independently address and illuminate different locations within a lamp without utilizing adjacent space. Therefore, configurations within a lamp are limitless.

Wide Range of Termination Techniques - Any location on a lamp can be terminated without having to consider proximity to connection points and uses termination techniques compatible with membrane switches and LCDs.

Uniform Light Output Without Bus Bars - Leading Edge Industries' transparent conductive layer is more conductive than that of competing products. This eliminates the need for bus bars allowing for larger illuminated areas as well as larger edge seals.

Wide Range of Operating Frequencies - Leading Edge Industries' lamps can operate at up to 5,000 Hz without irregularities while maintaining uniform light output over the entire lit area.

Efficiency - Leading Edge Industries' lamps are generally 30% more power efficient than all other standard EL products.

Variety of Applications - Leading Edge Industries' lamps have an infinite variety of applications. Examples include:

A. Membrane switches for medical, industrial, automotive, computer, marine, and consumer electronics.
B. Any type of backlighting including LCDs.
C. Ornamental lighting for automotive and marine applications.
D. Emergency egress lighting (aisle and EXIT marking).

Price and Availability - Leading Edge Industries' proprietary manufacturing techniques will result in more reliable and consistent leadtimes at competitive prices.

Prototype Leadtime - We will evaluate your requirements and generate your prototypes promptly, for a minimal cost.

Soft Tool Option Progam

Stop paying for unnecessary dies on short run and prototype orders. To maintain our position at the leading edge of electroluminescent lamp technology, Leading Edge Industries is now able to provide prototype and short run orders without the use of costly tools.

Here are some of the advantages of our Soft Tool program:

- ♦ Eliminates die costs
- ♦ Allows design changes without tool rebuilding
- ♦ Soft Tool parts manufactured with the same care and quality as hard tooled parts
- ♦ Once the design is finalized and larger volumes are required the same CAD program will be used to manufacture the necessary dies.

Discount Tooling Offer

TOOLING DISCOUNT FOR *FIRST* PRODUCTION ORDER

- ♦ Reduce or eliminate your tooling costs.
- ♦ Tooling consists of art, screens and steel rule dies.
- ♦ Discount percentage is determined by the dollar amount of your production order.
- ♦ Multiply your piece price by the quantity ordered to calculate your discount.

Amount	Discount
$2500.00 to $5000.00	25% Discount
$5001.00 to $7500.00	50% Discount
$7501.00 to $10,000.00	75% Discount
$10,000.00 and over	100% Discount

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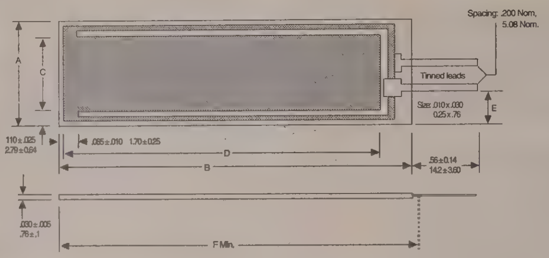
OUR LAMPS SET THE STANDARD.
For over twenty years, our EL lamps have met or exceeded rigid military standards, providing solid-state durability and reliability under extreme physical and environmental conditions. That kind of unsurpassed performance carries through in every one of our EL lamps, so you know your product's lighting will work every time and everywhere.

NO OTHER INVERTER DOES SO MUCH IN SO LITTLE SPACE.
Our System II DC-AC inverters are half the size of other inverters, and up to twice as efficient. They are easily customized to provide the exact combination of lamp brightness, life and current draw to meet your specs, with the capability of driving up to 70 square inches on a single inverter. They are ideal where space is limited, as in hand-held instruments, or for any application with special power and size requirements.

Our System I inverters, suitable for most EL applications, are performance matched for lamp output and size. These inverters, like the System II, compensate for lamp aging and are our most economical. They are available for immediate off-the-shelf delivery.

CHALLENGE US WITH YOUR APPLICATION TODAY.
Call us with your space and power limits, your desired initial brightness and brightness over time requirements, and we can design an EL lamp-inverter system perfect for your needs. Let LLS put its 20 years of experience in the field of electroluminescent technology to work for you.



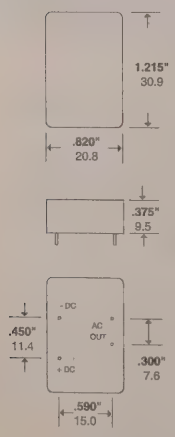
STOCK PARTS

Part Number	Package Size AxB	Lit Size CxD	Lit Area
30431-x	.90 x 2.115 (22.9 x 53.7)	.76 x 1.85 (19.3 x 47.0)	1.41 (907.1)
30432-x	.90 x 2.8825 (23.0 x 71.7)	.67 x 2.56 (17.0 x 65.0)	1.72 (1105.0)
30433-x	1.20 x 2.825 (30.6 x 71.7)	.97 x 2.56 (24.6 x 65.0)	2.48 (1599.0)
30434-x	1.50 x 3.785 (38.2 x 96.1)	1.27 x 3.52 (32.3 x 89.4)	4.47 (2887.6)
30554-x	.90 x 3.805 (23.0 x 96.6)	.67 x 3.54 (17.0 x 89.9)	2.37 (1528.3)
30555-x	1.20 x 3.765 (30.6 x 95.6)	.97 x 3.50 (24.6 x 88.9)	3.40 (2186.9)
30097-x	1.10 x 4.68 (27.9 x 118.9)	.865 x 4.41 (22.0 x 112.0)	3.81 (2464.0)
30743-x	.86 x 6.30 (21.8 x 160.0)	.63 x 6.03 (16.0 x 153.2)	3.79 (2451.2)

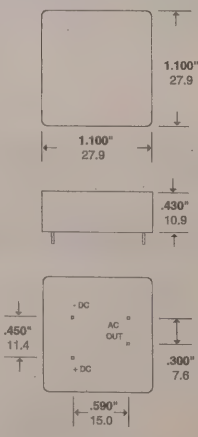
TOLERANCES:	A	+.010 inches	.26 mm
		-.005 inches	.13 mm
	B	± .040 inches	1.02 mm
	C	± .015 inches	.38 mm
	D	± .015 inches	.38 mm
	E	± .025 inches	.64 mm

- Lights are stocked in green and white, except 30097 and 30743 which are available in green.
- All stock lights come with front adhesive.
- Standard operating parameters 115V, 400 Hz.
- Special size/shapes available.
- Long-life phosphors available.
- Special colors available.
- Drive parameters may vary.

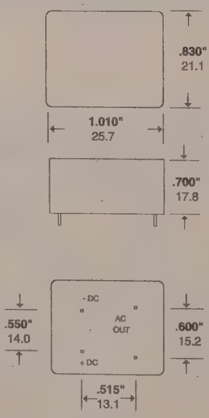
100 Series
1-10 in^2
6.5-65 cm^2



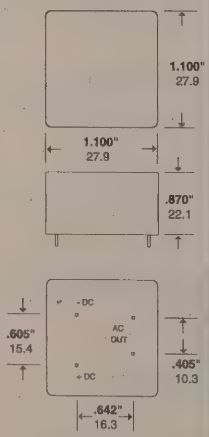
300 Series
6-30 in^2
40-190 cm^2



500 Series
10-50 in^2
65-230 cm^2



700 Series
20-70 in^2
130-450 cm^2

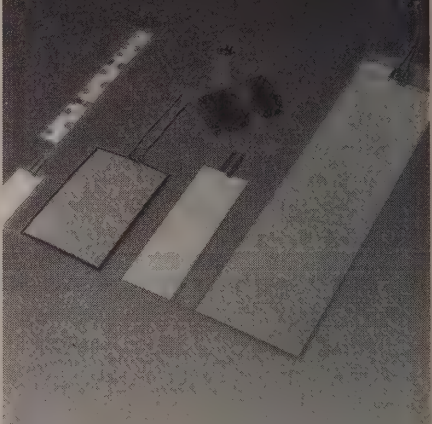


- Low Harmonic Distortion
- High Efficiency (35-50%)
- Wide Range of DC Input Voltages
- No Load Protection
- Reverse Polarity Protection at Rated Input
- Input Voltage Variation Allowed - 40% to +10%
- Operation and Storage Environment:
- Temperature -30°C to 70°C
- Humidity 95% RH Max.

Dimensions:
All tolerances +/- 0.020" (0.5 mm)
Case Size Edge to Edge
Pins:
Location Center to Center
Length 0.140" (3.5mm) Min.
Size Square 0.025" x 0.025" (0.6x0.6 mm)
Hole Size for PC Board Mount:
Square Pins ø 0.055" (1.4 mm) Min.

EL Lamps & Inverters

IF YOU'RE LOOKING FOR A LIGHT, WE HAVE A MATCH.



As the country's only manufacturer of both electroluminescent (EL) lamps and DC-AC inverters, we provide a one-stop source for your lighting needs. With our unique, in-depth knowledge of the performance of, and the relationship between lamps and inverters, we can create a lighting system that meets your precise specifications, while maximizing lamp performance.

ONLY AVAILABLE FROM THE PEOPLE WHO WROTE THE BOOK ON ELECTROLUMINESCENT TECHNOLOGY.

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LUMINESCENT
SYSTEMS INC.
SETTING THE STANDARD
A SUBSIDIARY OF LOCTITE CORP.
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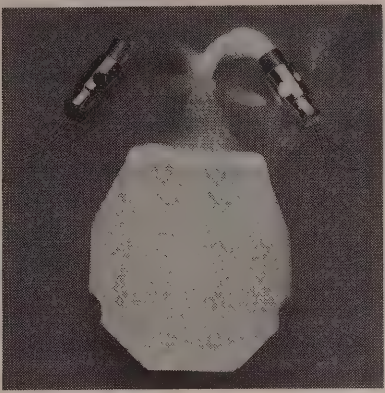
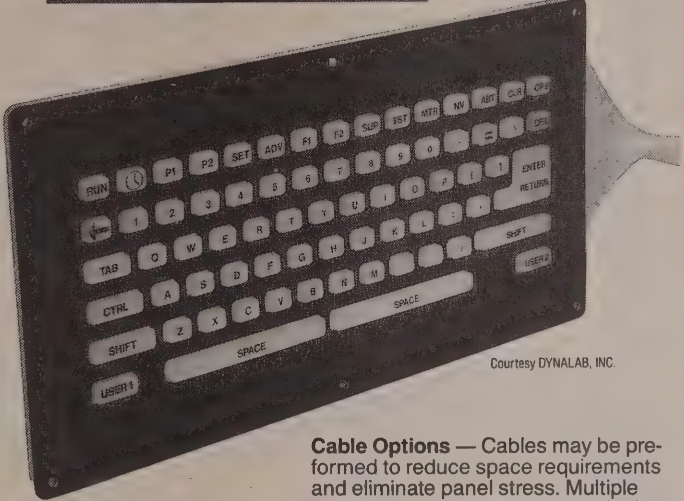
LUMITEX®
Woven Fiber-Optic Backlighting for

- ■ LCD's ■ Membrane switches
- ■ Rubber keypads ■ Control panels



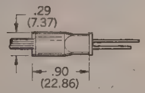
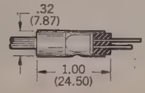
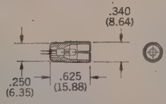
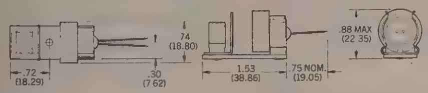
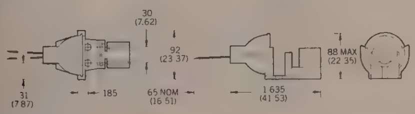
Norand Corporation
RT5910 Mobile Radio Terminal
Screen Size Options:
8 Lines X 40 Characters
up to
25 Lines X 80 Characters.

Courtesy NORAND INC.

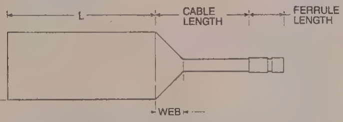

RUN
P1
P2
SET
ADV
F1
F2
SUP
TST
MTR
NV
ABT
CLR
CP
TAB
CTRL
SHIFT
USER 1
SPACE
SPACE
ENTER
RETURN
SHIFT
USER 2

Courtesy DYNALAB, INC.

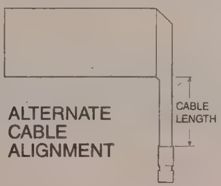
Lumitex technology provides
■ Long life ■ Low power consumption ■ High intensity
■ Uniform light emissions ■ Heat/EMI free

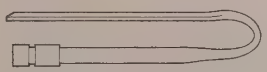
SOURCE TYPE	LAMP PART NO.	LAMP TYPE	POWER	LIFE/ HOURS
CUFF  .29 (7.37) .90 (22.86)				
LED  .32 (7.87) 1.00 (24.50)	LUMITEX 165	Red	2.2VDC, 25mA	50,000
	LUMITEX 172	Green	1.7VDC, 20mA	50,000
	LUMITEX 156	Yellow	2.2VDC 20mA	50,000
DC-2  .340 (8.64) .250 (6.35) .625 (15.88)	DC2-20mA	Incandescent	5V, 20mA	10,000
	DC2-60mA	Incandescent	5V, 60mA	25,000
	DC2-115mA	Incandescent	5V,115mA	40,000
BB-1  .72 (18.29) 74 (18.80) .30 (7 62) 1.53 (38.86) .75 NOM. (19.05) .88 MAX (22 35)	BB1-1.5	Incandescent	12V, 1.5 Watts	15,000
	BB1-2.5	Gas Filled	5V, 2.5 Watts	5,000
	BB1-4.22	Gas Filled	4.5V, 4.5 Watts	17,000
	BB1-4.85	Halogen	5V, 4.85 Watts	15,000
BB-2  30 (7.62) 92 (23 37) 88 MAX (22 35) 31 (7 87) 185 65 NOM (16 51) 1 635 (41 53)	BB2-1.5	Incandescent	12V, 1.5 Watts	15,000
	BB2-2.5	Gas Filled	5V, 2.5 Watts	5,000
	BB2-4.22	Gas Filled	4.5V, 4.5 Watts	17,000
	BB2-4.85	Halogen	5V, 4.85 Watts	15,000

Cable Options — Cables may be preformed to reduce space requirements and eliminate panel stress. Multiple panels may be connected to a single source in control panels or automotive applications.


L
CABLE LENGTH
FERRULE LENGTH
W
WEB

WEB dimension usually 1/2 panel width.


ALTERNATE CABLE ALIGNMENT
CABLE LENGTH



Minimum bend radius of fiber is 0.062."
Actual cable bend radius may be greater.

MATERIALS
Fiber Core — Polymethyl Methacrylate
Fiber Cladding — Fluoropolymer
Weft — Acrylic Monofilament
Temperature Range —
-50°C to +85°C

For a complete catalog or technical assistance call 1-800-969-5483

Lumitex,® Inc.
Creators of Woven Light
8443 Dow Circle
Strongsville, OH 44136

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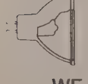
THE HIGHEST QUALITY MINIATURE LIGHTING PRODUCTS AT REASONABLE COSTS

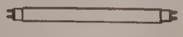
MINIATURE AND SUBMINIATURE INCANDESCENT LAMPS
FROM 1.35V TO 120V MADE TO ANSI SPECIFICATIONS.

MINIATURE LAMPS

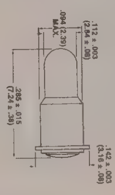
Lamp No.	Volts	Amps	MSCP	Bulb
PR2	2.38	.50	.80	B-3½
PR3	3.57	.50	1.50	B-3½
PR4	2.33	.27	.40	B-3½
PR5	2.35	.35	.45	B-3½
PR6	2.47	.38	.45	B-3½
44	6.30	.25	.90	T-3¼
45	3.20	.35	.50	T-3¼
46	6.30	.25	.90	T-3¼
47	6.30	.15	.52	T-3¼
48	2.00	.06	.04	T-3¼
49	2.00	.06	.04	T-3¼
50	7.50	.22	1.00	G-3½
51	7.50	.22	1.00	G-3½
52	14.40	.10	.75	G-3½
53	14.40	.12	1.00	G-3½
159	6.30	.15	3.80	T-3¼
194	14.00	.27	2.00	T-3¼
219	6.30	.25	.50	G-3½
222	2.25	.25	. . .	GTL-3
313	28.00	.17	.35	T-3¼
313G	28.00	.17	.35	T-3¼
313R	28.00	.17	.35	T-3¼
755	6.30	.15	.33	T-3¼
756	14.00	.08	.31	T-3¼
73	14.00	.08	.30	T-1¾
74	14.00	.08	.30	T-1¾
84	6.30	.04	.03	T-1¾
85	28.00	.04	.30	T-1¾
86	6.30	.20	.40	T-1¾
89	13.00	.58	6.00	G-6
90	13.00	.58	6.00	G-6
93	12.80	1.04	15.00	S-8
97	13.50	.69	4.00	G-6
97A	13.50	.69	. . .	G-6
112	1.20	.22	. . .	G-6
1141	12.80	1.44	21.00	S-8
1156	12.80	2.10	32.00	S-8
1157	12.80	2.10	32.00	S-8
	14.00	.59	3.00	
1157A	12.80	2.10	32.00	S-8
	14.00	.59	3.00	
1146	12.00	.20	1.70	G-3½
1149	14.00	20	2.00	G-3½
1813	14.14	.10	.868	T-3¼
1815	14.00	.20	1.40	T-3¼
1819	28.00	.04	.34	T-3¼
1820	28.00	.10	1.60	T-3¼
1828	37.50	.05	.65	T-3¼
1829	28.00	.07	1.00	T-3¼
1835	55.00	.05	1.10	T-3¼
1847	6.30	.15	.38	T-3¼
1850	5.00	.09	.25	T-3¼
1855	6.30	.80	3.60	T-4½
1869	10.00	.014	.002	T-1¼
1891	14.00	.24	2.00	T-3¼
1892	14.40	.12	.75	T-3¼
1893	14.00	.33	2.00	T-3¼
129MB	120.00	.025	.36	T-2
129PS	120.00	.025	.36	T-2
129PSB	120.00	.025	.36	T-2

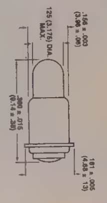
MR-16 AND MR-11 SERIES FOR DISPLAY, PROJECTION LIGHTING AND MINIATURE FLUORESCENTS.

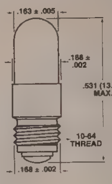


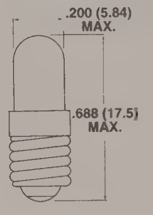


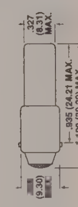
T-5 FLUORESCENT

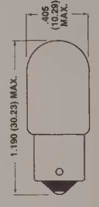

.094 (2.39) MAX.
.112 ± .003 (2.84 ± .08)
.285 ± .015 (7.24 ± .38)
.142 ± .003 (3.18 ± .08)

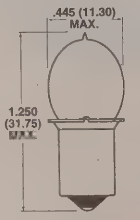

125 (3.175) DIA. MAX.
.156 ± .003 (3.96 ± .08)
.360 ± .015 (9.14 ± .38)
181 ± .005 (4.68 ± 13)

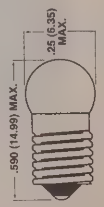

.163 ± .005
.188 ± .002
.531 (13.49) MAX.
10-64 THREAD
.168 ± .002

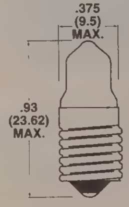

.200 (5.84) MAX.
.688 (17.5) MAX.

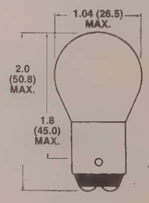

.327 (8.31) MAX.
.935 (24.21 MAX.
1.190 (30.22) MAX.
(9.30)

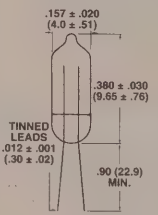

.405 (10.29) MAX.
1.190 (30.23) MAX.


.445 (11.30) MAX.
1.250 (31.75) MAX.


.25 (6.35) MAX.
.590 (14.99) MAX.


.375 (9.5) MAX.
.93 (23.62) MAX.


1.04 (26.5) MAX.
2.0 (50.8) MAX.
1.8 (45.0) MAX.


.157 ± .020 (4.0 ± .51)
.380 ± .030 (9.65 ± .76)
TINNED LEADS .012 ± .001 (.30 ± .02)
.90 (22.9) MIN.

SUB-MINIATURE BI-PIN LAMPS

Lamp No.	Volts	Amps	MSCP	Bulb
7327	28.00	.04	.34	T-1¾
7328	6.00	.20	.60	T-1¾
7330	14.00	.08	.50	T-1¾
7370	18.00	.04	.15	T-1¾
7376	28.00	.065	.65	T-1¾
7380	6.30	.04	.02	T-1¾
7381	6.30	.20	.40	T-1¾
7382	14.00	.08	.30	T-1¾
7387	28.00	.04	.30	T-1¾

GOV'T QPL AND FAA APPROVALS
ON AIRCRAFT LIGHTS.

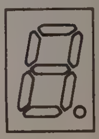
SUB-MINIATURE LAMPS

Lamp No.	Volts	Amps	MSCP	Bulb
327	28.00	.04	.34	T-1¾
327AS15	28.00	.04	.34	T-1¾
327 Red	28.00	.04	.34	T-1¾
328	6.00	.20	.60	T-1¾
328AS15	6.00	.20	.60	T-1¾
328 Red	6.00	.20	.60	T-1¾
330	14.00	.08	.50	T-1¾
330 Red	14.00	.08	.50	T-1¾
331	1.35	.06	.01	T-1¾
333	28.00	.04	.34	T-1¾
334	28.00	.04	.34	T-1¾
335	28.00	.04	.34	T-1¾
376	28.00	.06	.34	T-1¾
377	6.30	.075	.22	T-1¾
378	6.30	.20	.40	T-1¾
380	6.30	.04	.02	T-1¾
382	14.00	.08	.30	T-1¾
385	28.00	.04	.20	T-1¾
386	14.00	.08	.30	T-1¾
387	28.00	.04	.30	T-1¾
387AS15	28.00	.04	.30	T-1¾
680	5.00	.06	.03	T-1
682	5.00	.06	.03	T-1
683	5.00	.06	.05	T-1
683AS15	5.00	.06	.05	T-1
683 Red	5.00	.06	.05	T-1
685	5.00	.06	.05	T-1
713	5.00	.075	.09	T-1
714	5.00	.075	.09	T-1
715	5.00	.115	.15	T-1
715AS15	5.00	.115	.15	T-1
718	5.00	.115	.15	T-1
718AS15	5.00	.115	.15	T-1
1784	6.00	.20	.60	T-1¾
2124	2.50	.35	. . .	GTL-1¾
2162	14.00	.088	.10	T-1¾
6150	5.00	.06	.15	T-1
6832	5.00	.06	.05	T-1
6832AS15	5.00	.06	.05	T-1
6833	5.00	.06	.05	T-¾
6838	28.00	.024	.15	T-1
6838AS15	28.00	.024	.15	T-1
6838-S	28.00	.024	.15	T-1
6839	28.00	.024	.15	T-1
6839AS15	28.00	.024	.15	T-1

NEON LAMPS

Lamp No.	Volts	Amps	Watts
A1A	105-125	.50	1 17
A1B	105-125	.30	1 25
A1C	105-125	.80	1 25
A1G	105-125	.30	1 25
A1H	105-125	1.20	1 7
A2B(NE2V)	105-125	.70	1 12
A3C(NE2V)	105-125	.70	1 4
A9A(NE2E)	105-125	.70	1 12
B1A(NE51)	105-125	.30	1 25
B2A(NE51H)	105-125	1.20	1 7
C2A(NE2H)	105-125	1.90	1 4
C7A(NE2D)	105-125	.70	1 12
C9A(NE2J)	105-125	1.90	1 4

COMPLETE LINE OF LED'S AND LED DISPLAYS



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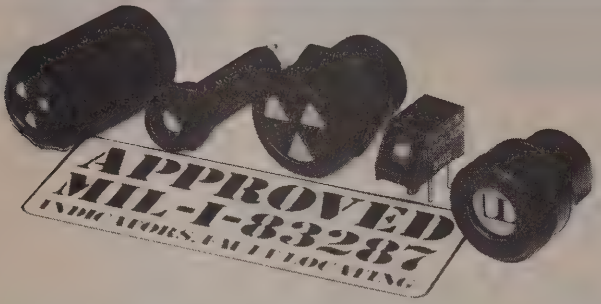
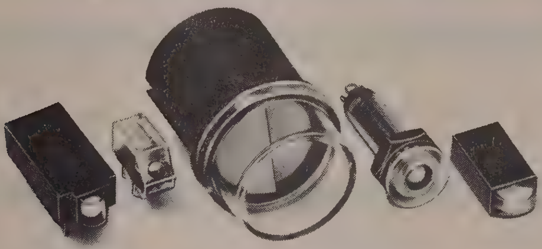
FOR COMPLETE PRODUCT LISTINGS AND SPECIFICATIONS, SEND FOR YOUR FREE CATALOG.

STATUS INDICATORS & DISPLAYS



Military - Avionics

- Electrical or Manual Reset
- Pulse Operated
- Latching Display
- High Visibility
- Environmental Seals
- TTL Operation
- SEM-E Module Mountings

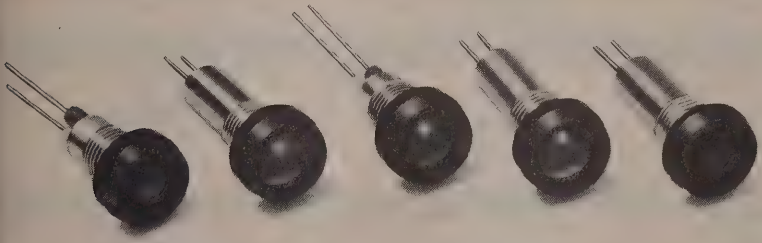


FAULT FINDERS for monitoring critical systems on computers, pipelines, generators, compressors, battery systems, and heavy equipment

Commercial Low-Power

- Low Cost
- Panel or Board Mount
- High Visibility
- Weather-Tight
- Wave Solderable

LED & INCANDESCENT INDICATORS

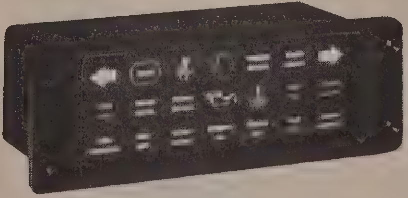


DESC 87019 & 85122, NVG & IR Secure, CECOM-SOW

- MIL Quality
- Environmental Seals
- Sunlight Viewable
- Ultra-Brite
- EMI-RFI Protection

VEHICLE DISPLAY PANELS

NVG AVIATION CAUTION PANEL
Meets military specifications:
MIL-L-85762
MIL-Q-9858
MIL-I-45208



ANNUNCIATOR LIGHT PANEL
Specifically designed for:
- automotive, truck and off-road vehicles
- heavy equipment
- marine and industrial applications

- Military
- Commercial
- LED
- Incandescent
- Sunlight Viewable
- Blackout
- IR Secure
- NVG Compatible
- EMI-RFI Protection

NON-VOLATILE

RUGGED

AIR & GROUND

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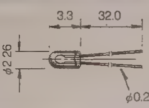
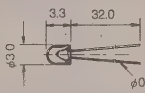
OSHINO

WIDE VARIETY SUB-MINIATURE INCANDESCENT LAMPS

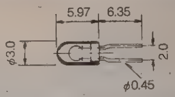
T-3/4 Short Wire Terminal


3.3
32.0
φ2.26
φ0.25

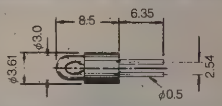
T-1 Short Wire Terminal


3.3
32.0
φ3.0
φ0.25

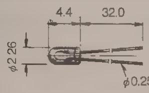
T-1 IBP-G


5.97
6.35
φ3.0
2.0
φ0.45

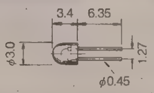
T-1 Bi-Pin, Type-E


8.5
6.35
φ3.0
φ3.61
2.54
φ0.5

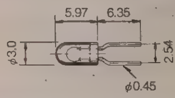
T-3/4 Wire Terminal


4.4
32.0
φ2.26
φ0.25

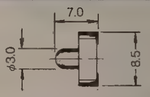
T-1 Short IBP-A


3.4
6.35
φ3.0
1.27
φ0.45

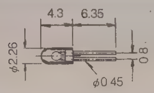
T-1 IBP-E


5.97
6.35
φ3.0
2.54
φ0.45

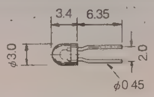
T-1 Surface Mount



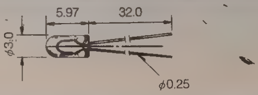
T-3/4 IBPS


4.3
6.35
φ2.26
0.8
φ0.45

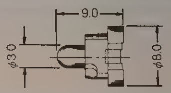
T-1 Short IBP-G


3.4
6.35
φ3.0
2.0
φ0.45

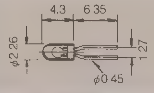
T-1 Wire Terminal


5.97
32.0
φ3.0
φ0.25

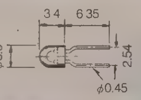
T-1 Neowedge



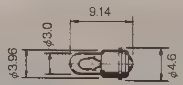
T-3/4 IBPS-A


4.3
6.35
φ2.26
1.27
φ0.45

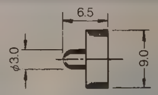
T-1 Short IBP-E


3.4
6.35
φ3.0
2.54
φ0.45

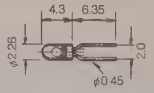
T-1 SMF


9.14
φ3.0
φ3.96
φ4.6

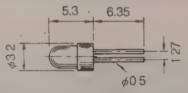
T-1 Grommet



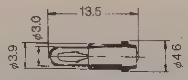
T-3/4 IBPS-G


4.3
6.35
φ2.26
2.0
φ0.45

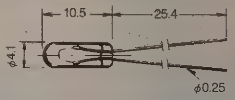
T-1 Short BPA


5.3
6.35
φ3.2
1.27
φ0.5

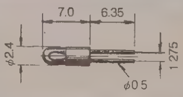
T-1 SMF French Norm


13.5
φ3.0
φ3.9
φ4.6

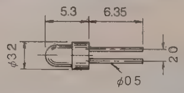
T-1 1/4 Wire Terminal


10.5
25.4
φ4.1
φ0.25

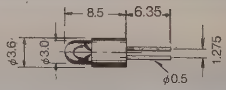
T-3/4 Bi-Pin


7.0
6.35
φ2.4
1.275
φ0.5

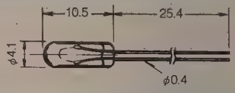
T-1 Short BPG


5.3
6.35
φ3.2
2.0
φ0.5

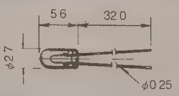
T-1 Bi-Pin Std.


8.5
6.35
φ3.6
φ3.0
1.275
φ0.5

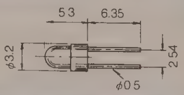
T-1 1/4 IBP


10.5
25.4
φ4.1
φ0.4

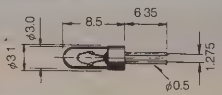
T-7/8 Wire Terminal


5.6
32.0
φ2.7
φ0.25

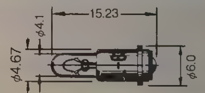
T-1 Short BPE


5.3
6.35
φ3.2
2.54
φ0.5

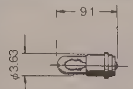
T-1 Bi-Pin, Type-A


8.5
6.35
φ3.0
φ3.1
1.275
φ0.5

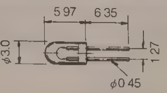
T-1 1/4 MF


15.23
φ4.1
φ4.67
φ6.0

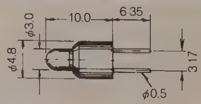
T-7/8 SMF



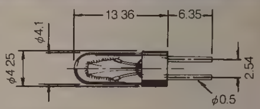
T-1 IBP-A


5.97
6.35
φ3.0
1.27
φ0.45

T-1 Bi-Pin, Type-C


10.0
6.35
φ3.0
φ4.8
3.17
φ0.5

T-1 1/4 Bi-Pin, Type-A


13.36
6.35
φ4.1
φ4.25
2.54
φ0.5

Unit in mm

OSHINO LAMPS LTD.
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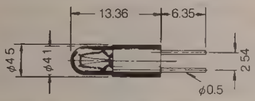
11555-A Coley River Circle, Fountain Valley, California 92708-4272
Tel: 714-545-5560 Facsimile: 714-545-6093 Telex: 678459 WAMCO INC FNVY

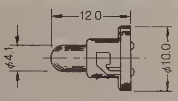
LAMPS

TYPICAL APPLICATIONS
AEROSPACE, AUTOMOTIVE TELECOMMUNICATION, etc.

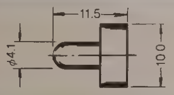
T-1 1/4 Bi-Pin, Type-E


13.36
6.35
φ4.5
φ4.1
2.54
φ0.5

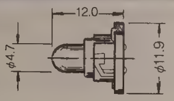
T-1 1/4 Neowedge


12.0
φ4.1
φ10.0

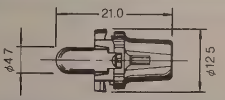
T-1 1/4 Grommet



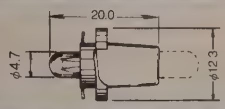
T-1 1/2 Neowedge


12.0
φ4.7
φ11.9

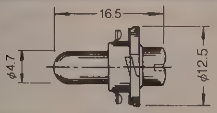
T-1 1/2 PBA


21.0
φ4.7
φ12.5

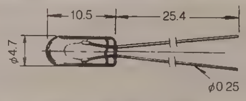
T-1 1/2 PBB


20.0
φ4.7
φ12.3

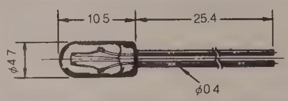
T-1 1/2 PBC


16.5
φ4.7
φ12.5

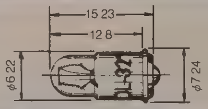
T-1 3/4 Wire Terminal


10.5
25.4
φ4.7
φ0.25

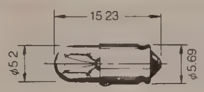
T-1 3/4 IBP


10.5
25.4
φ4.7
φ0.4

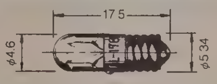
T-1 3/4 MF


15.23
12.8
φ6.22
φ7.24

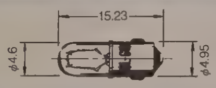
T-1 3/4 MG


15.23
φ5.2
φ5.69

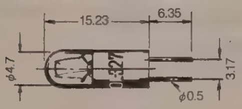
T-1 3/4 MS


17.5
φ4.6
φ5.34

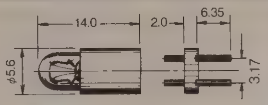
T-1 3/4 MB


15.23
φ4.6
φ4.95

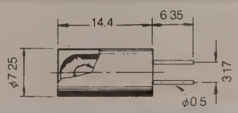
T-1 3/4 Bi-Pin


15.23
6.35
φ4.7
3.17
φ0.5

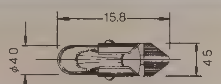
T-1 3/4 BPR


14.0
2.0
6.35
φ5.6
3.17

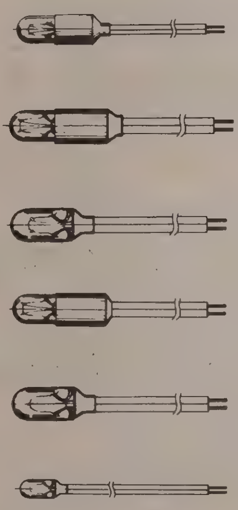
T-1 3/4 BPS


14.4
6.35
φ7.25
3.17
φ0.5

T-4.5 Telephone Slide

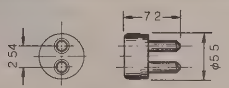


Insulated Wire Lead Lamps

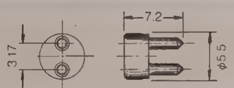


BI-PIN LAMP SOCKETS

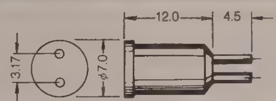
125-2E (for PCB)



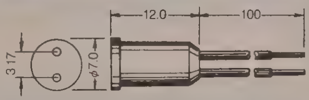
125-2P (for PCB)



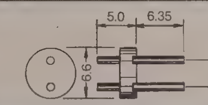
125-2B (for PCB & PANEL)


12.0
4.5
3.17
φ7.0

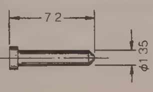
125-3A (for PANEL)


12.0
100
3.17
φ7.0

BPR (for PCB)


5.0
6.35
6.6
3.17

125-20 (for PCB)



Unit in mm

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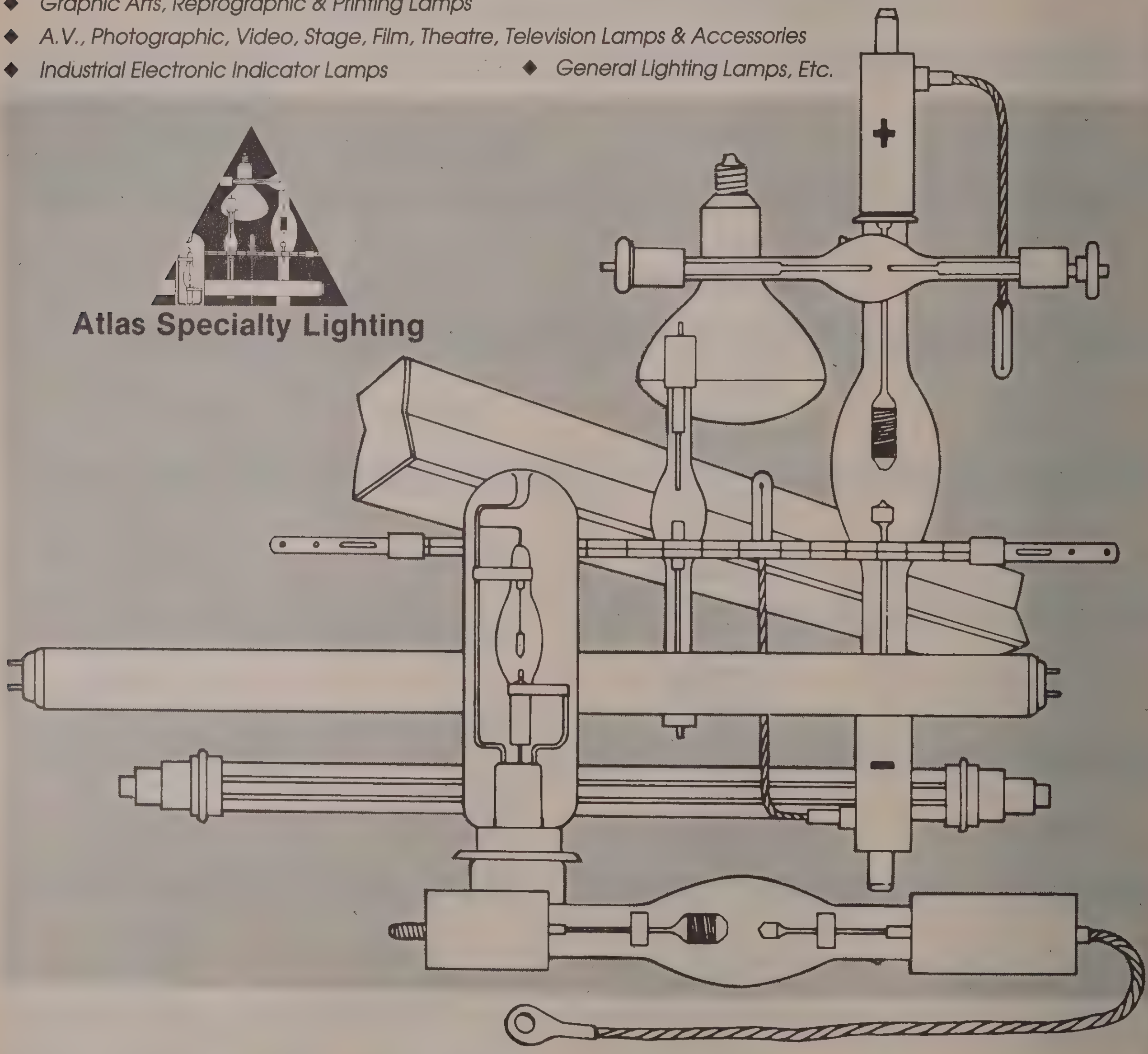

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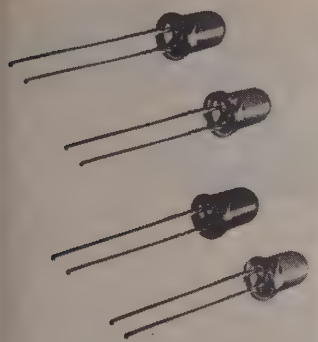

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500 SERIES T-1¾

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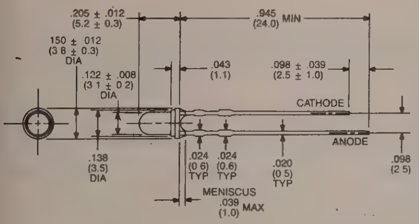
FEATURES

- IC COMPATIBLE
- 24° HALF INTENSITY ANGLE
- BINNED FOR BRIGHTNESS
- CHOICE OF COLORS
- TINNED LEADS

APPLICATIONS

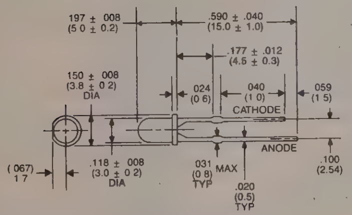
- BACKLIGHTED PANELS
- STATUS INDICATORS
- OVERLAYS
- ALPHANUMERIC DISPLAYS
- LIGHTED SWITCHES

T-1


.205 ± .012 (5.2 ± 0.3)
.945 (24.0) MIN
150 ± .012 (3.8 ± 0.3) DIA
.043 (1.1)
.098 ± .039 (2.5 ± 1.0)
.122 ± .008 (3.1 ± 0.2) DIA
CATHODE
ANODE
.138 (3.5) DIA
.024 (0.6) TYP
.024 (0.6) TYP
.020 (0.5) TYP
.098 (2.5)
MENISCUS .039 (1.0) MAX

PART NUMBER	LENS COLOR AND MATERIAL*	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A=25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE $V_F@I_F=20mA$		I_F=20mA TYP (nm)	I_F (mA)	P_D (mW)	V_R (VDC)
		TYP mcd	MIN mcd	TYP V	MAX V				
SA 343R	Red diffused	80@20mA	36@20mA	2.1	3.0	635	25	75	3
SA 343G	Green diffused	80@20mA	36@20mA	2.2	3.0	565	25	75	3
SA 343Y	Yellow diffused	80@20mA	36@20mA	2.2	3.0	585	25	75	3
SA 343E	Orange diffused	80@20mA	36@20mA	2.1	3.0	610	25	75	3
SA 344R	Red clear	200@20mA	56@20mA	2.1	3.0	635	25	75	3
SA 344G	Green clear	200@20mA	56@20mA	2.2	3.0	563	25	75	3
SA 344Y	Yellow clear	200@20mA	56@20mA	2.2	3.0	585	25	75	3
SA 344E	Orange clear	200@20mA	56@20mA	2.1	3.0	610	25	75	3

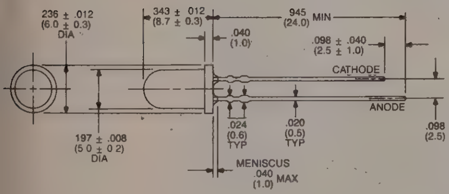
*Water clear available: see PART NUMBER DESIGNATION on back


197 ± .008 (5.0 ± 0.2)
.590 ± .040 (15.0 ± 1.0)
.177 ± .012 (4.5 ± 0.3)
150 ± .008 (3.8 ± 0.2) DIA
024 (0.6)
040 (1.0)
059 (1.5)
CATHODE
ANODE
(.067) 1.7
.118 ± .008 (3.0 ± 0.2) DIA
031 (0.8) TYP
MAX
.100 (2.54)
.020 (0.5) TYP

PART NUMBER	LENS COLOR AND MATERIAL	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A=25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE $V_F@I_F=20mA$		I_F=20mA TYP (nm)	I_F (mA)	P_D (mW)	V_R (VDC)
		TYP mcd	MIN mcd	TYP V	MAX V				
SA 353R	Red diffused	0.8@15mA	0.3@15mA	2.2	2.8	700	25	70	4
SA 353G	Green diffused	2.0@20mA	0.7@20mA	2.2	2.8	565	30	90	4
SA 353Y	Yellow diffused	4.0@20mA	1.4@20mA	2.2	2.8	590	30	90	4

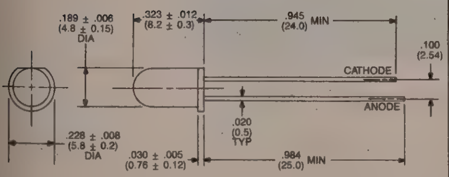
NOTE: OPERATING TEMPERATURE RANGE ON ALL LED's IS −25°C to +85°C.

T-1¾


236 ± .012 (6.0 ± 0.3) DIA
343 ± .012 (8.7 ± 0.3)
945 (24.0) MIN
.040 (1.0)
.098 ± .040 (2.5 ± 1.0)
CATHODE
ANODE
197 ± .008 (5.0 ± 0.2) DIA
.024 (0.6) TYP
.020 (0.5) TYP
.098 (2.5)
MENISCUS .040 (1.0) MAX

PART NUMBER	LENS COLOR AND MATERIAL*	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A=25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE $V_F@I_F=20mA$		I_F=20mA TYP (nm)	I_F (mA)	P_D (mW)	V_R (VDC)
		TYP mcd	MIN mcd	TYP V	MAX V				
SA 543R	Red diffused	100@20mA	40@20mA	2.1	3.0	635	25	75	3
SA 543G	Green diffused	100@20mA	40@20mA	2.2	3.0	565	25	75	3
SA 543Y	Yellow diffused	100@20mA	40@20mA	2.2	3.0	585	25	75	3
SA 543E	Orange diffused	100@20mA	40@20mA	2.1	3.0	610	25	75	3
SA 544R	Red clear	200@20mA	56@20mA	2.1	3.0	635	25	75	3
SA 544G	Green clear	200@20mA	56@20mA	2.2	3.0	563	25	75	3
SA 544Y	Yellow clear	200@20mA	56@20mA	2.2	3.0	585	25	75	3
SA 544E	Orange clear	200@20mA	56@20mA	2.1	3.0	610	25	75	3
SA 635R-5	Water clear	2000@20mA		1.8	2.6	665	30	70	3

*Water clear available: see PART NUMBER DESIGNATION on back


.189 ± .006 (4.8 ± 0.15) DIA
.323 ± .012 (8.2 ± 0.3)
.945 (24.0) MIN
.100 (2.54)
CATHODE
ANODE
.020 (0.5) TYP
.228 ± .008 (5.8 ± 0.2) DIA
.030 ± .005 (0.76 ± 0.12)
.984 (25.0) MIN

PART NUMBER	LENS COLOR AND MATERIAL	ELECTRO-OPTICAL CHARACTERISTICS				λP	MAX RATINGS (T_A=25°C)		
		LUMINOUS INTENSITY		FORWARD VOLTAGE $V_F@I_F=20mA$		I_F=20mA TYP (nm)	I_F (mA)	P_D (mW)	V_R (VDC)
		TYP mcd	MIN mcd	TYP V	MAX V				
SA 553R	Red diffused	9@20mA	4.5@20mA	2.1	2.7	630	30	81	4
SA 553G	Green diffused	3@20mA	1.5@20mA	2.1	2.7	565	30	81	4
SA 553Y	Yellow diffused	4@20mA	2@20mA	2.1	2.7	585	30	81	4
SA 554R	Red clear	40@10mA	56@ 20mA	2.1	2.7	630	30	81	4
SA 554G	Green clear	8@10mA	4@10mA	2.1	2.7	565	30	81	4
SA 554Y	Yellow clear	30@10mA	15@10mA	2.1	2.7	585	30	81	4

PART NUMBER DESIGNATION

SA ☐ ☐ ☐ ☐

Package Size
3 : T-1 ≈ 3mm
5 : T-1¾ ≈ 5mm

Package Style
4 : Extra Bright
5 : Std Bright

Diffusion
3 : Color diffused
4 : Color clear
*5 : Water clear

Color
R : Red
G : Green
Y : Yellow
E : Orange

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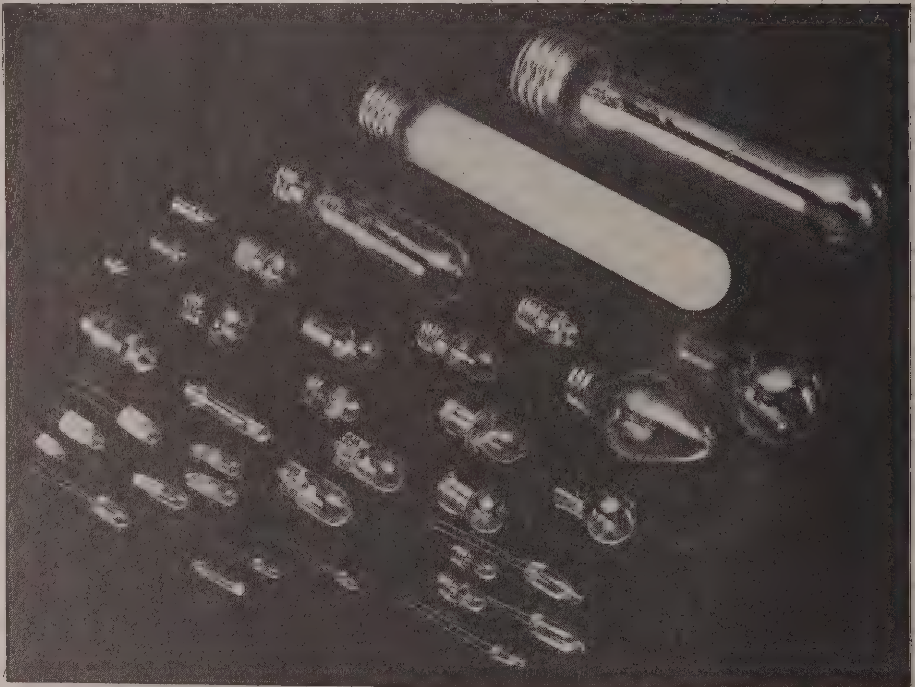

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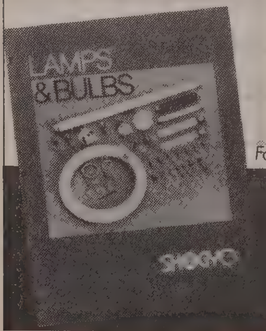
FAX 516-466-0922



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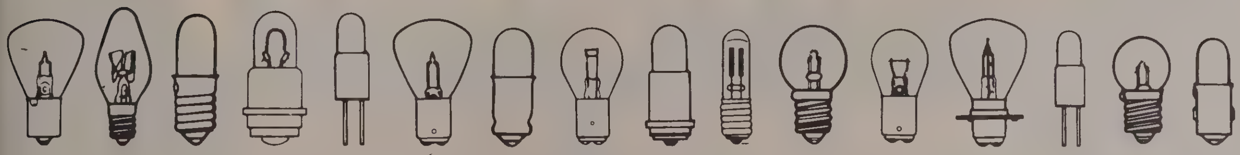

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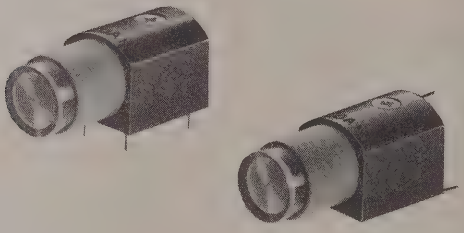

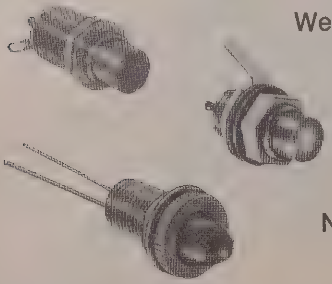

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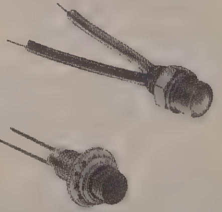

For the last 30 years The Sloan Company has been providing the finest indicator lights available.

For military applications, it's important to know that all of our material and processes meet or exceed military specs.

In the event that you don't see what you are looking for here, call us, you will find our staff most obliging. You will be pleasantly surprised to find how few you may have to order and how fast you can get them.

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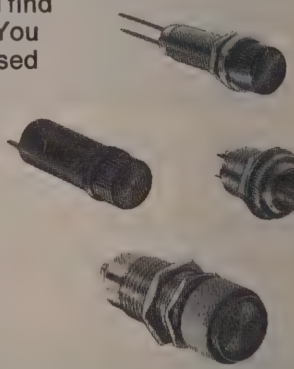

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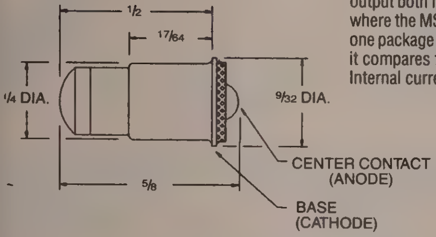
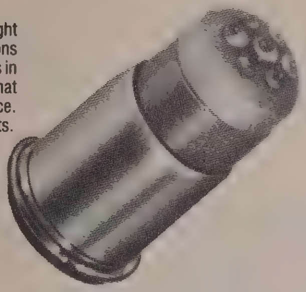
T-1¾ MIDGET FLANGED BASE LED

MODEL 510


½
17/64
¼ DIA.
9/32 DIA.
⅝
CENTER CONTACT (ANODE)
BASE (CATHODE)

The Model 510 six chip LED T1¾ Midget Flange Base lamp has abundant light output both front and side viewing, for use in indicator lights and other applications where the MS25237 (327, 328, etc.) incandescent lamps are used. The six chips in one package give far greater light output totally than earlier single chip LEDs so that it compares favorably in use with the incandescent lamp it is intended to replace. Internal current limiting resistors allow for supply voltages from 5 up to 28 volts.

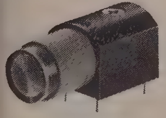


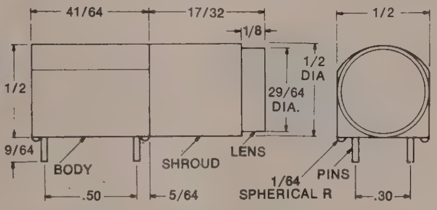
CIRCUIT BOARD MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 864

PARALLEL MOUNT

Q8 Lens Shown




41/64
17/32
1/8
1/2
1/2
DIA
29/64
DIA.
1/2
9/64
BODY
SHROUD
LENS
PINS
1/64
SPHERICAL R
.50
5/64
.30

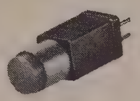
Mounting Pin Dia. 1/32

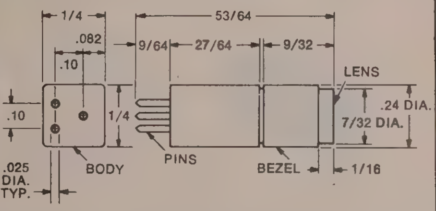
Designed specifically for printed circuit board mounting. May be used where illumination is needed for the circuit board area as well as enunciation thru a panel.
Lens styles available in two diameters: 7/16" (7 series) Q7, QB7, DSC7, DS7 and 1/2" diameter (8 series) QB, QBC8, DS8.

MATERIAL & PROCESSES
BODY—Brass SAE 72 General Purpose Phenolic Linen Based Phenolic MIL-P-15035 Nylon MIL-M-20693 Nickel Plate QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727 Phosphor Bronze QQ-W-321

MODEL 111

PERPENDICULAR MOUNT



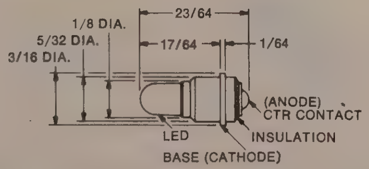

1/4
.082
.10
53/64
9/64
27/64
9/32
LENS
.24 DIA.
7/32 DIA.
.10
1/4
.025
DIA.
TYP.
BODY
PINS
BEZEL
1/16

Same features as 101 Model but unit mounts perpendicular to surface of printed circuit board.
Designed specifically for printed circuit board mounting. Uses any T-1 flange based lamp. For parallel mounting, specify Model 101.

MATERIAL & PROCESSES
BODY—General Purpose Phenolic Nylon MIL-M-20693
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate per QQ-N-290
TERMINAL PINS—Brass SAE 72 Tin Plate MIL-T-20727 Berylium Copper

T-1 SUB-MIDGET FLANGED BASE LED

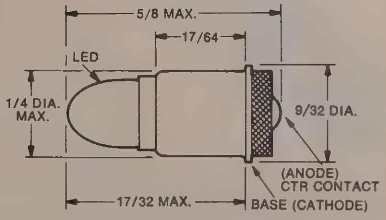
MODEL 4L001


23/64
1/8 DIA.
5/32 DIA.
3/16 DIA.
17/64
1/64
(ANODE)
CTR CONTACT
LED
INSULATION
BASE (CATHODE)

The 4L001, available in diffused lens material is the Sloan T-1 based LED designed to offer diode reliability as a replacement unit in T-1 hardware. When maximum light output is desired using based LEDs in indicator applications, it is recommended that the lens be of transparent material with Fresnel rings. If translucent material is desired, then the lens should be without Fresnel rings.

T-1¾ MIDGET FLANGED BASE LED

MODEL 5L001


5/8 MAX.
17/64
LED
1/4 DIA.
MAX.
9/32 DIA.
(ANODE)
CTR CONTACT
17/32 MAX.
BASE (CATHODE)

The versatile T-1¾ based LED is available in red, green or amber. Viable voltage range is 2.1 volts to 28 volts with power dissipation up to 400mW. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. The higher voltage capability permits the Sloan T-1¾ based LED to be used as direct replacement for incandescent bulbs in applications where light intensity is not critical but diode reliability is required.

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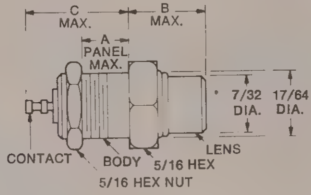
PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

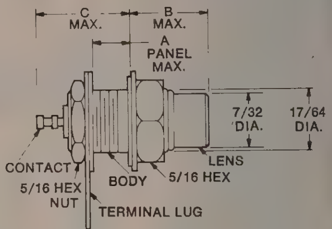
MODEL 102S


C MAX.
B MAX.
A PANEL MAX.
7/32 DIA.
17/64 DIA.
LENS
CONTACT
BODY
5/16 HEX
5/16 HEX NUT

Utilizes the T-1 flanged-based incandescent lamp or LED. An internal silicone rubber pressure pad maintains electrical contact with the lamp and is an effective front-to-back of panel moisture seal.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Delrin per LP-392
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
HDWE—Brass SAE 72 Nickel Plate QQ-N-290 Phenolic per MIL-P-15035 Nylon MIL-M-20693

MODEL 102SI

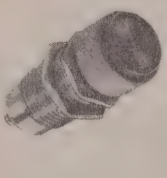

C MAX.
B MAX.
A PANEL MAX.
7/32 DIA.
17/64 DIA.
LENS
CONTACT
5/16 HEX NUT
BODY
5/16 HEX
TERMINAL LUG

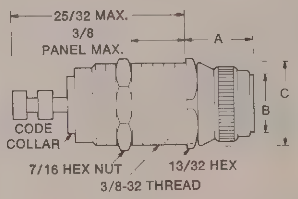
This is the two-terminal version of the basic 102S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

NOTE 1—Both the 102S and the 102SI are available in four body styles: S-(above) provides a bright hex flange on the panel, SK-is a knurled flange, SS-a short low-profile hex, and SR-(above left) a small, plain flange.
NOTE 2—The 102S and 102SI are available in several lens styles: Q, QB, DSC, DS, STD. (Contact Factory)
NOTE 3—The 102 series can be furnished in a waterproof version, and can be RF shielded. (Contact Factory)

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 855S

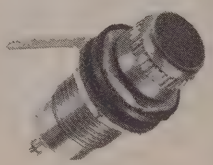


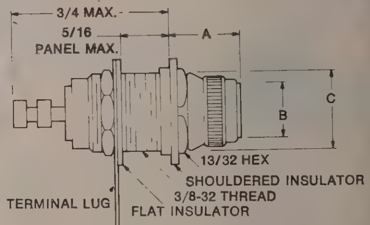

25/32 MAX.
3/8 PANEL MAX.
A
C
B
CODE COLLAR
7/16 HEX NUT
13/32 HEX
3/8-32 THREAD

Among the features of the 855 Series are ● Small Mounting Size ● Front Relamping ● Interchangeable Lens Assemblies. Contact pressure is maintained by a silicone rubber pressure pad which seals out moisture front to back of panel. Uses T-1¾ Flanged Base lamp, incandescent or LED.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Butyrate LP-349 Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727
CODE COLLAR—Nylon MIL-M-20693
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Linen Base Phenolic MIL-P-15035

MODEL 855SI




3/4 MAX.
5/16 PANEL MAX.
A
C
B
13/32 HEX
SHOULDERED INSULATOR
3/8-32 THREAD
FLAT INSULATOR
TERMINAL LUG

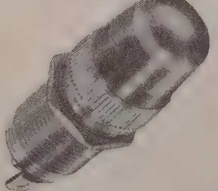
The 855SI Model is the two-terminal version of the 855S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

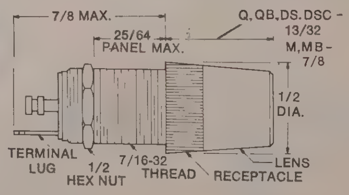
NOTE: Available in Lens styles—Q, QB, DSC, DS, STD, M, MB, D, SE, DDS, U and I, see last page.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693
LENS—Lexan LP-393 Butyrate LP-349 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 856

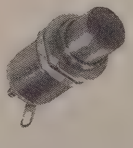


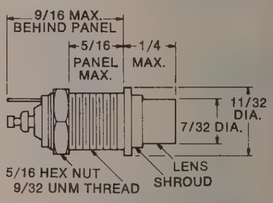

7/8 MAX.
25/64 PANEL MAX.
Q, QB, DS, DSC - 13/32
M, MB - 7/8
1/2 DIA.
TERMINAL LUG
1/2 HEX NUT
7/16-32 THREAD
LENS RECEPTACLE

A two-terminal, front-relampable indicator light designed to use the T-1¾ midget flange based incandescent bulb or LED. An internal silicone-rubber pressure-pad maintains electrical contact inside the lamp body. It also provides an effective moisture seal front to back.
NOTE: Available in lenses styles: Q, QB, DSC, DS, M and MB.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Delrin per LP-392
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

MODELS—121, 122—123, 124




9/16 MAX. BEHIND PANEL
5/16 PANEL MAX.
1/4 MAX.
11/32 DIA.
7/32 DIA.
5/16 HEX NUT
9/32 UNM THREAD
LENS SHROUD

The 121 Model lamp holder is a two terminal, front relampable indicator light specifically designed for use with T-1 Midget Flange Based incandescent or LED lamps. The 122 is a waterproof version of the 121. The Model 123 is the same but with the more conventional ⅝-32 screw body. The 124 is the waterproof version of the 123.
Available in lens styles: STB, STC, DS, DSC, QB, Q.

MATERIAL & PROCESSES
BODY—Alum. 2024 Anodize MIL-A-8625 Nylon MIL-M-20693 Delrin per LP-392
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

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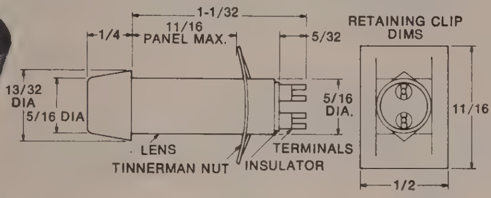
PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT
MODEL 858

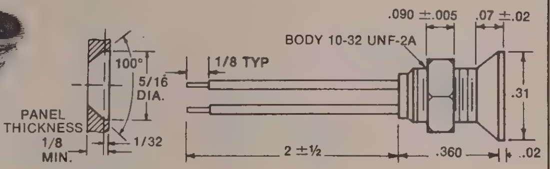

1-1/32
11/16
PANEL MAX.
1/4
5/32
RETAINING CLIP
DIMS
13/32
DIA
5/16 DIA
5/16
DIA.
11/16
LENS
TINNERMAN NUT
TERMINALS
INSULATOR
1/2

Uses the T-2 unbased neon lamp or can be supplied with the T-1 or T-1¾ unbased incandescent lamp. It accommodates long neon lamps (C2A Type) without dropping resistor built-in, as well as short neon lamps (A1C Type) with dropping resistor built-in. When resistor is built-in it can be used directly on commercial line current (115 volts A.C.). For LED applications see note below.

FOR LED APPLICATIONS LED can be supplied as a special in red, green and amber with or without built-in resistor. Voltage up to 28 volts available. (Contact factory).

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish
INSULATOR—General Purpose Phenolic

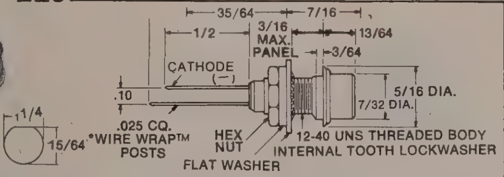
T-1 UNBASED INCANDESCENT/LED PANEL MOUNT FIXED LAMP
MODEL 109/1L9


.090 ±.005
.07 ±.02
BODY 10-32 UNF-2A
100°
1/8 TYP
5/16
DIA.
.31
PANEL
THICKNESS
1/8
MIN.
1/32
2 ±½
.360
.02

The new flush mount design can be used only with any T-1 size LED or incandescent lamp, including the new super bright LED which gives luminous intensity and color never before possible in the T-1 size. LED colors include red, green and amber with red, green amber, clear and white transparent and translucent lens, and are available with or without a resistor and RFI shielding.
The incandescent models offer the brightness and variety of incandescent colors, including red, green, amber, blue, white and clear with either transparent or translucent lens, and the option of RFI shielding.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Lexan LP-393
TERMINALS—26 AWG Stranded Cu. MIL-W-16878 24 AWG Solid Cu. MIL-W-16878
HARDWARE—Brass SAE 72 Nickel Plate QQ-N-290

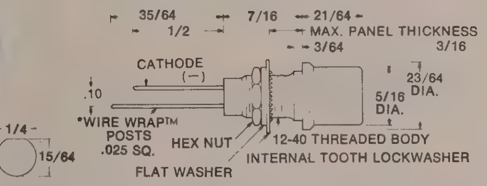
PANEL MOUNT FIXED LAMP
LED
MODEL 2L5


35/64
7/16
1/2
3/16
MAX.
PANEL
13/64
3/64
CATHODE
(−)
.10
5/16 DIA.
7/32 DIA.
1/4
15/64
.025 CQ.
*WIRE WRAP™
POSTS
HEX
NUT
12-40 UNS THREADED BODY
INTERNAL TOOTH LOCKWASHER
FLAT WASHER

This Series incorporate a red, green or amber T-1 size LED in an all-metal threaded body. Available with wire leads or wire wrap™ terminals. Two kinds of color contrast lenses are provided. When unlit, the white or clear lens material alone is visible. When lit, the color LED shows through plainly, giving the appearance of a lens which changes color.
Built-in dropping resistors allow these units to be powered from sources up to 14VDC. Model 2L501 available with superbright LED.
Available with either a round body or flat sided "D" body for consistent terminal location and ease of tightening. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693
TERMINALS—Phosphor Bronze ¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

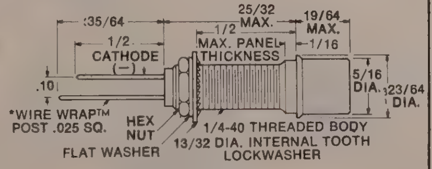
PANEL MOUNT FIXED LAMP
LED
MODEL 2L6


35/64
1/2
7/16
21/64
MAX. PANEL THICKNESS
3/16
3/64
CATHODE
(−)
.10
23/64
DIA.
5/16
DIA.
*WIRE WRAP™
POSTS
.025 SQ.
1/4
15/64
HEX NUT
12-40 THREADED BODY
INTERNAL TOOTH LOCKWASHER
FLAT WASHER

The 2L6 Model incorporates a red, green or amber T-1¾ size Hi-Bright LED in an all-metal threaded body, suitable for panel mounting. Large lens permits 180° visibility, up to 50 mcd. Termination is by wire-wrap™ posts, or wire leads. Lenses available in transparent material for head-on viewing or translucent material for side viewing. Built-in dropping resistors allow these units to be powered from sources up to 14 VDC. Bodies come round or in flat sided "D" for ease of tightening and consistent terminal location. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Nylon per MIL-M-20693 or Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

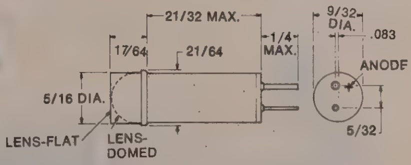
PANEL MOUNT FIXED LAMP
HI-BRIGHT LED
MODEL 2L7/2L703


:35/64
25/32
MAX.
19/64
MAX.
1/2
1/2
MAX. PANEL
THICKNESS
1/16
CATHODE
(−)
.10
5/16
DIA.
23/64
DIA.
*WIRE WRAP™
POST .025 SQ.
HEX
NUT
1/4-40 THREADED BODY
13/32 DIA. INTERNAL TOOTH
LOCKWASHER
FLAT WASHER

Utilizes a T-1¾ Hi-Bright LED. Permits 180° visibility, up to 50 mcd. The lens incorporates Fresnel rings and flutes which allow maximum distribution of light output. Also available with plain lens (no flutes or rings). Termination is by wire leads or wire-wrap™ post. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. 2L703 is waterproof version. Bodies can be round or "D" type.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290 Nylon per MIL-M-20693
LENS—Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
LED/INCANDESCENT/NEON
MODEL 5L2/502


21/32 MAX.
17/64
21/64
1/4
MAX.
9/32
DIA.
.083
ANODE
5/16 DIA.
5/32
LENS-FLAT
LENS-
DOMED

These rugged aluminum cartridges incorporate LED, incandescent or neon light sources. Termination is by stainless steel pins suitable for use with a solder lug socket connector, wire wrap™ post adapter or lead wire terminal connector. *Gardener—Denver
Lens styles are flat or domed in transparent or translucent material. All lenses are furnished with fresnel rings for maximum distribution of light output.

MATERIAL & PROCESSES
BODY—Aluminum 3003 Anodize MIL-A-8625
LENS—Butyrate LP-349 Lexan LP-393
TERMINALS—Stainless Steel
HDWE.—General Purpose Phenolic Brass SAE 72 H.T. Spring Steel (Not shown).

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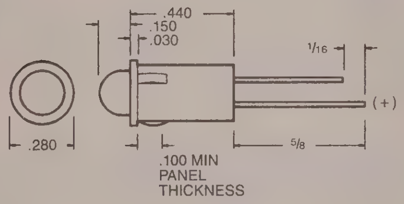
PANEL MOUNT LED

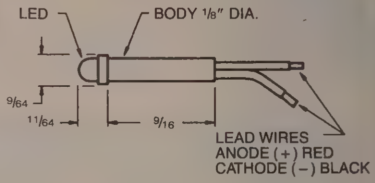
MODEL 240


.440
.150
.030
1/16
(+)
.280
5/8
.100 MIN
PANEL
THICKNESS

This model uses high brightness LEDs mounted in easy press to fit bodies. Ideal for fast production, this model presses into place permanently, eliminating the need for mounting hardware. Uses straight terminal leads to which wires can be soldered directly or the leads can be hand soldered into PC boards either vertically or horizontally by bending the leads.

PANEL MOUNT LED

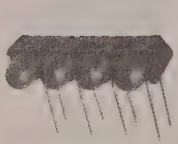
MODEL 5L3

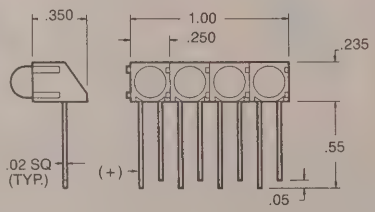

LED
BODY 1/8" DIA.
9/64
11/64
9/16
LEAD WIRES
ANODE (+) RED
CATHODE (−) BLACK

The mini-cartridge provides front panel indication in applications where space is at a premium. The Model 5L3 is one of the smallest panel mount LED on the market. A series resistor is available allowing operation from sources up to 28 volts. Lead wires are color coded for polarity and provide simple solder connections. A speed clip permits easy and positive panel installation.

CIRCUIT BOARD MOUNT LED

MODEL 211

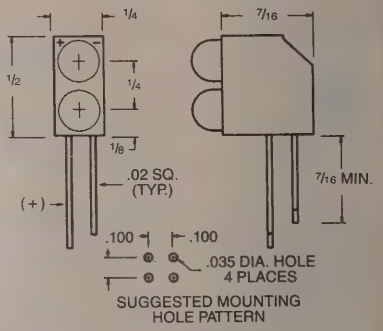



.350
1.00
.250
.235
.02 SQ
(TYP.)
(+)
.55
.05

Designed specifically for parallel mounting to printed circuit boards. Used where two or more indicator lights are needed in arrays of virtually any number. Close tolerance spacing makes assembly of the board with the front panel easy and trouble free.

CIRCUIT BOARD MOUNT LED

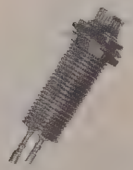
MODEL 220

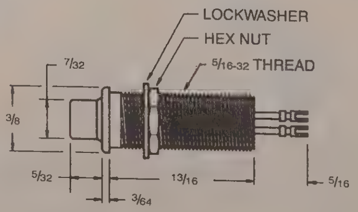

1/4
1/2
1/4
1/8
.02 SQ.
(TYP.)
(+)
7/16
7/16 MIN.
.100
.100
.035 DIA. HOLE
4 PLACES
SUGGESTED MOUNTING
HOLE PATTERN

This is an extremely versatile device for a wide range of applications and space saving status indicator for horizontal mounting in printed circuit boards. The bi-level feature saves board space by cutting space requirements in half. Standard .100 inch center to center distance of the leads make it easy for both assembly and servicing of the circuit board.

PANEL MOUNT LED

MODEL 3L5

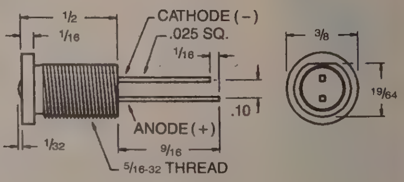



LOCKWASHER
HEX NUT
5/16-32 THREAD
7/32
3/8
5/32
13/16
5/16
3/64

This rugged unit houses high bright T1¾ LEDs in an all metal threaded housing. Termination is by wire wrap posts or solder lugs. Built in current limiting resistors allow these units to be powered from sources up to 28 volts.

PANEL MOUNT LED

MODEL 250


1/2
1/16
CATHODE (−)
.025 SQ.
1/16
.10
ANODE (+)
1/32
9/16
5/16-32 THREAD
3/8
19/64

Utilizes hermetically sealed solid state LEDs with high brightness and wide viewing angle. Can be supplied with standard, JAN Qualified, or JANTX LEDs. It can also be supplied with a current limiting resistor depending on your particular requirement. The Model 251 is supplied with an O-ring for proper panel sealing.

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GENERAL INFORMATION:

- RFI shielding available with virtually all models.
- It is wise to avoid using blue or green lenses with neon lamps.
- It is also wise to avoid using blue lenses with LED lamps.
- Ultra-bright, multichip and other exotic lamps available.
- All materials meet or exceed applicable military specs.

HOW TO ORDER

Example

LED 2L5	RL	DL	5/20
Model No.	Lens Color Transparent Red Lexan	Lens Style Domed Fresnel	Voltage/current

INCANDESCENT OR NEON

855S	A	STD.	327
Model No.	Lens Color Amber Gen. Purpose	Lens Style Standard	Lamp Type

INCANDESCENT LAMP ELECTRICAL SPECIFICATIONS

T-1 LAMPS

LAMP	VOLTS	CURRENT (A)	MSCP	LIFE (K HRS.)	INDUSTRY STD. NO
FB60	5	.060	.050	100	685*
FB59	28	.024	.150	16	—
FB44	18	.026	.150	10	—
					*MS-24515

T-1¾ LAMPS

327	28	.04	.340	4000	—
328	6	.20	.600	1000	—
387	28	.04	.300	7000	—

NEON LAMP ELECTRICAL SPECIFICATIONS

LAMP WITH RESISTOR	VOLTS A.C. OR D.C.	AMPS NOMINAL	WATTS NOMINAL	LIFE	RESISTOR
A1B	105-125	.03	1/25	25,000	220K
A1C	105-125	1.2	1/7	25,000	47K
A9A (NE-2E)	105-125	0.7	1/12	25,000	100K
C2A (NE-2H)	105-125	1.9	1/4	25,000	30K

NOTE: A1C and NE2H are high brightness. Other lamps available. Life figures for A.C—Life at D.C. ½ A.C. (Approx.). 862 Series cannot be supplied with resistor. We suggest that you do not order neon with Green or Blue lenses.

MPORTANT: The lamps shown represent the most popular types normally requested. MANY OTHER LAMPS ARE AVAILABLE—PLEASE CONTACT FACTORY.

COLOR TABLE

LENS MATERIAL	LEXAN	LEXAN	GENERAL PURPOSE	BUTYRATE
Color	**Transparent**	**Translucent**	**Translucent**	**Transparent**
Red	RL	RLUC	R	RTP
Green	GL	GLUC	G	GTP
Blue	BL	BLUC	B	BTP
Amber	AL	ALUC	A	ATP
Clear	CL	—	—	CTP
White	—	WLUC	W	W

LED LAMP INFORMATION

We have virtually any LED you want. The two basic sizes are T-1 and T-1¾ with flanged bases. The brightest varies with color, with green lowest to red highest. To order extra or super bright lamps simply add 01 or 04 to the model number. One more suggestion do not order LEDs with blue lenses.

NO.	LAMP TYPE	T-1	T-1¾
—	Standard-Bright	2 mcd	3-8 mcd
01	Extra-Bright	8-18 mcd	15-18 mcd
04	Super-Bright	20 mcd	60-80 mcd

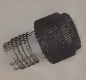
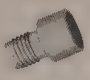
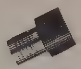
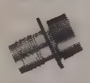
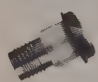
MPRINTING

Lenses may be hot stamped, engraved, or opaqued and engraved so that the character only is displayed.

The chart below designates type size available for hot stamping. Size of lens determines size of type that can be used.

TYPE	ACTUAL SIZE	
	WIDTH	HEIGHT
2 Pt	.050	.060
6 Pt	.060	.080
8 Pt	.080	.110
10 Pt	.090	.120
12 Pt	.110	.160
NOTE: For other size type, contact factory.		

LENS STYLE

STYLE		DESCRIPTION
Q		Clear anodized bezel allows 180° visibility.
QB		Same as Q lens except with black anodized bezel.
DSC		Clear anodized bezel prevents sidelight emission.
DS		Same as DSC lens except with black anodized bezel.
STD		Full 180° visibility. Maximum illumination.
M		Large lens for maximum visibility from all angles. Engineered to offer the most uniform light distribution. Full 180° visibility.
MB		Same as M lens except with black anodized bezel.
D		Skirted lens covers metal parts for neat panel appearance. Large lighted surface assures positive indication.
SE		Edgelight for plastic panels. Small diameter light gasket minimizes wasted panel space.
DDS		DIMMER: Rotating outer collar changes light output from full to minimum. Rotation to dim can be clockwise or counter-clockwise. Easy adjustment with gloved hand.
U		UNLIMITED: Has no lens to diminish light output. Specifically suited to T-1¾ flanged based LED for maximum light output.

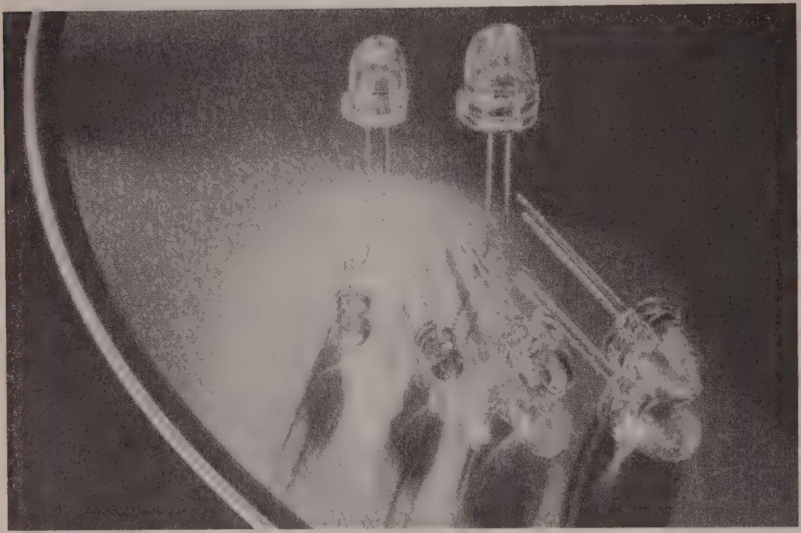
120 SERIES

STB		Full 180° visibility. Maximum illumination. Black bezel.
STC		Full 180° visibility. Maximum illumination. Clear bezel.
QB		Black anodized bezel allows 180° visibility.
Q		Same as QB lens except with clear anodized bezel.

STYLES

FLAT		NOTE: Lens style may be flat or domed, plain or lensed, meaning that the lens is provided with internal concentric rings on the inner face and flutes on the sides, thus giving better light distribution.
DOMED		

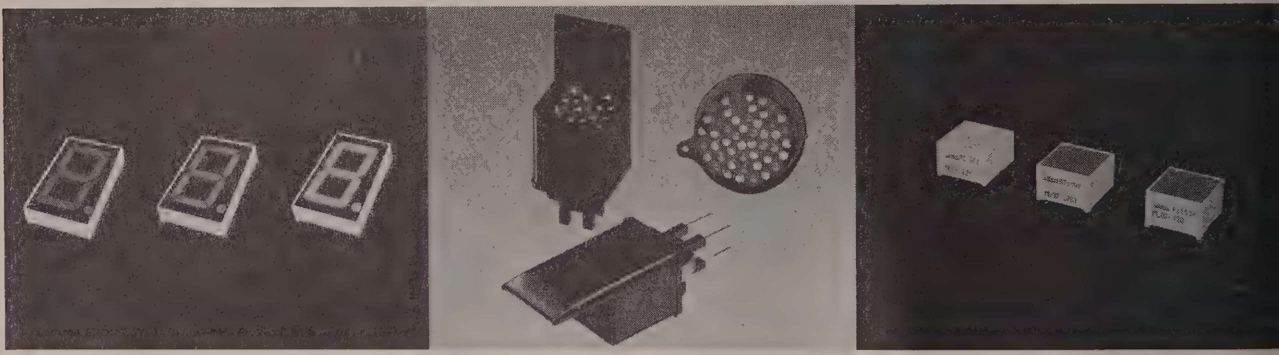
STANLEY WORLD LEADER IN LEDs AND LCDs STANLEY



The widest range of LEDs in the industry

APPLICATIONS:

Office automation
Hand-held instruments
Telephones, pagers
Computer products
Audio and video equipment
Switches
Displays and signage
Automotive
Medical instruments
Keyboards
Optical communications
Photoelectric controls
Bar code scanners



Models and types to match virtually any design requirement and operating environment, indoors and out!

- ***SUPERBRIGHT LEDs*** including reds to 3 cd, high intensity pure green, bright yellow and orange. Bulk or tape-and-reel packaging.
- ***SUPER-INTENSITY, HIGH-SPEED DN AND DNP TYPE INFRARED LEDs*** in T-1, T-1¾ and SMT packages with narrow or wide emission angle lenses.
- ***OUTDOOR, MULTI-COLORED, HIGH-VISIBILITY LED CLUSTERS*** readable in daylight at distances up to 1/2 mile. Weather resistant for outdoor signage, scoreboards and highway signs.
- ***SUPER-INTENSITY LEDs*** with emitted light intensity 8 to 10 times greater than typical rectangular LEDs. Available in red, green, yellow and orange.
- ***HIGH-INTENSITY DOT MATRIX DISPLAYS*** feature wide viewing angle; single, bi- or multicolored in sizes up to 40 sq. mm; and optimized lighting uniformity over total display area.
- ***LOW-CURRENT LEDs*** with a guaranteed luminous intensity at 2 mA vs. 20 mA for regular LEDs. Ideal for low power and battery-operated equipment.
- ***CHIP-TYPE SURFACE-MOUNT LEDs*** for high-density applications using automatic insertion machinery. Offered in virtually any combination of single or dual chips, emitted color, lens shape and polarity orientation.
- ***7-SEGMENT BI-COLOR LEDs*** in .4, .6 and 1 inch are suitable for instrumentation applications. Easily mounte on PCBs and in IC sockets.
- ***LIGHT BAR LED MODULES*** are excellent for backlighting and displaying characters, numbers or designs using mask patterns on the top surface.

Ask for our FREE LED Design Catalog filled with thousands of types and configurations.
Also, ask us about our phototransistors, photodiodes and optoswitches.

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Irvine CA 92714 • Tel: (714) 222-0777
FAX (714) 222-0555 • **(800) LED-LCD1**

STANLEY
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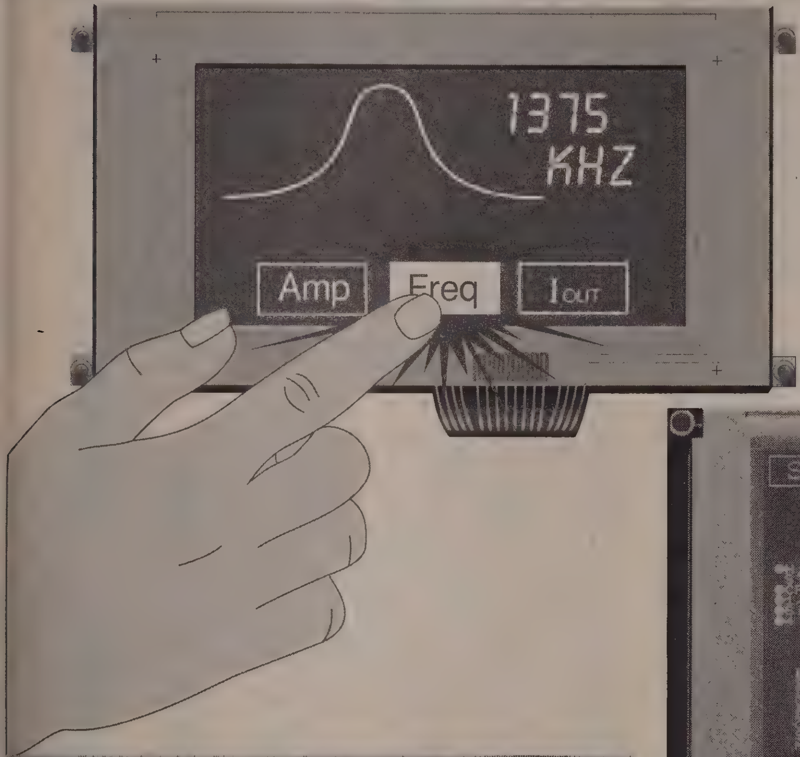
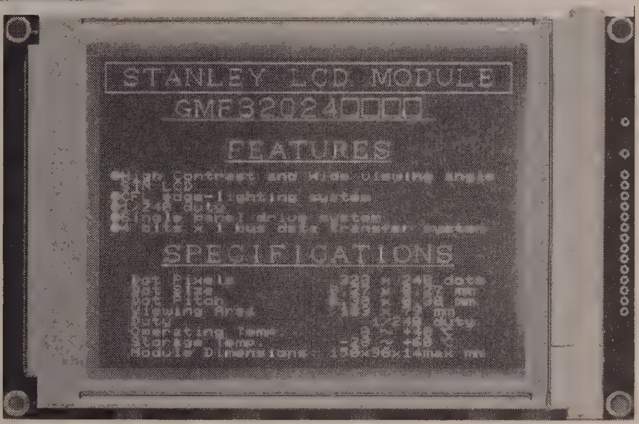
STANLEY WORLD LEADER IN LEDs AND LCDs STANLEY

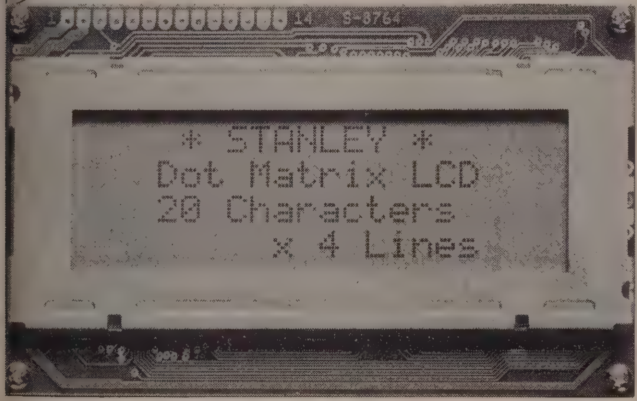


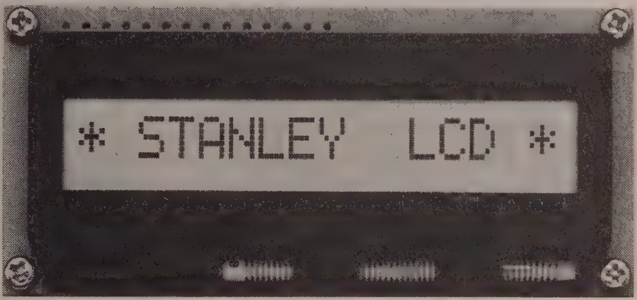
The widest range of LCDs in the industry

APPLICATIONS:

POS terminals
Display panels
Telephones
Copiers
Facsimile equipment
Process control
Medical instruments
Analyzers
Office automation
Computer products
Measuring equipment
Controllers







High contrast, high reliability LCD solutions for virtually any display application.

- ***LOW-PROFILE, LIGHTWEIGHT, CHARACTER-TYPE* LCDS** (GML series) that are industry-standard, but priced 30% below competition.
- ***COMPACT, FILM-COMPENSATED, 320 x 240 LCDs*** (GMF series) with enhanced resolution. Also available in blue mode STN with CFL backlighting or yellow mode STN with LED backlighting.
- ***CHARACTER, DOT-MATRIX LCDs*** with LED and CFL backlighting which ensures uniform lighting in any application.
- ***USER-PROGRAMMABLE, MULTI-FUNCTION TOUCH-PANEL LCDs*** with the lowest prices in the industry. Supertwist 256 x 64 and 256 x 128 configurations let you create your own character and graphic screens.

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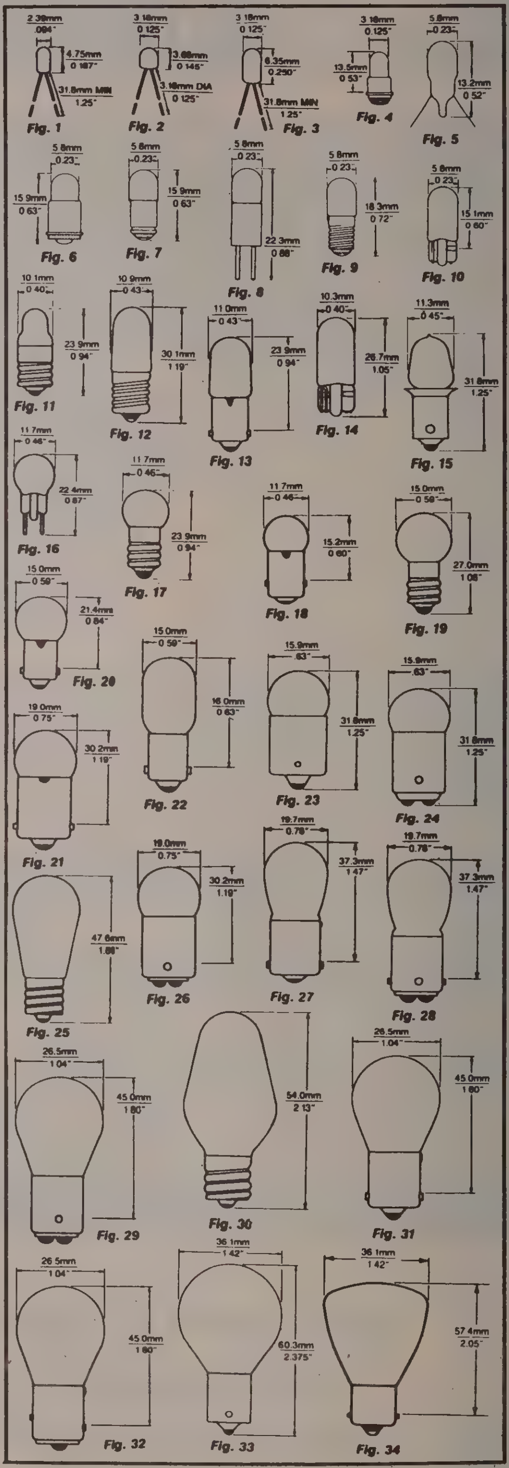
Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.	Net Each, Lots of 1-9	10-99	100-499
PR2	B-3½	2.38	.50	.80	15	**$0.82**	**$0.653**	**$0.571**
PR3	B-3½	3.57	.50	1.50	15	**.84**	**.674**	**.589**
PR4	B-3½	2.33	.27	.40	15	**.84**	**.674**	**.589**
PR6	B-3½	2.47	.30	.45	15	**.84**	**.674**	**.589**
PR7	B-3½	3.7	.30	.90	15	**.95**	**.758**	**.664**
PR12	B-3½	5.95	.50	3.10	15	**.84**	**.674**	**.589**
PR13	B-3½	4.75	.50	2.20	15	**.84**	**.674**	**.589**
PR18	B-3½	7.2	.55	5.5	15	**1.03**	**.821**	**.718**
6S6	S-6	120	6W	.....	25	**1.12**	**.982**	**.912**
7C7	C7	115-125	7W	.....	30	**1.08**	**.943**	**.876**
12	G-3½	6.3	.15	.35	16	**1.18**	**.947**	**.829**
13	G-3½	3.7	.30	.98	17	**.87**	**.695**	**.608**
14	G-3½	2.47	.30	.50	17	**.87**	**.695**	**.608**
19	G-3½	14.4	.10	.90	16	**1.68**	**1.347**	**1.179**
27	G-4½	4.9	.30	1.4	19	**1.29**	**1.032**	**.903**
31	G-4½	6.15	.30	2.0	19	**1.76**	**1.412**	**1.235**
41	T-3¼	2.5	.50	.50	12	**.85**	**.681**	**.596**
43	T-3¼	2.5	.50	.50	13	**1.05**	**.842**	**.736**
44	T-3¼	6.3	.25	.90	13	**.53**	**.421**	**.368**
45	T-3¼	3.2	.35	.50	13	**1.49**	**1.193**	**1.044**
46	T-3¼	6.3	.25	.90	12	**.75**	**.597**	**.522**
47	T-3¼	6.3	.15	.52	13	**.53**	**.421**	**.368**
48	T-3¼	2.0	.06	.04	12	**1.14**	**.912**	**.798**
49	T-3¼	2.0	.06	.04	13	**1.21**	**.968**	**.847**
51	G-3½	7.5	.22	1.0	18	**.71**	**.568**	**.497**
53	G-3½	14.4	.12	1.0	18	**.74**	**.589**	**.515**
53X	G-3½	14.4	.12	1.0	18	**1.00**	**.800**	**.700**
55	G-4½	7.0	.41	2.0	20	**.95**	**.758**	**.664**
57	G-4½	14.0	.24	2.0	20	**.66**	**.526**	**.461**
57X	G-4½	14.0	.24	2.0	20	**.97**	**.779**	**.682**
63	G-6	7.0	.63	3.0	21	**.89**	**.715**	**.626**
67	G-6	13.5	.59	4.0	21	**.76**	**.611**	**.535**
81	G-6	6.5	1.02	6.0	21	**1.21**	**.968**	**.847**
82	G-6	6.5	1.02	6.0	26	**.97**	**.779**	**.682**
87	S-8	6.8	1.91	15.0	31	**1.66**	**1.331**	**1.165**
88	S-8	6.8	1.91	15.0	29	**1.61**	**1.285**	**1.124**
89	G-6	13.0	.58	6.0	21	**.87**	**.694**	**.608**
93	S-8	12.8	1.04	15.0	31	**1.32**	**1.053**	**.921**
112	TL-3	1.2	.22	.....	11	**1.50**	**1.200**	**1.050**
123	G-3½	1.25	.30	.10	17	**.65**	**.521**	**.456**
136	G-4½	1.25	.60	.20	19	**1.76**	**1.412**	**1.235**
158	T-3¼	14.0	.24	2.0	14	**.95**	**.758**	**.664**
161	T-3¼	14.0	.19	1.0	14	**.84**	**.674**	**.589**
168	T-3¼	14.0	.35	3.0	14	**.84**	**.674**	**.589**
194	T-3¼	14.0	.27	2.0	14	**.63**	**.506**	**.442**
222	TL-3	2.25	.25	.....	11	**1.05**	**.842**	**.736**
301	G-5	28.0	.17	3.0	23	**2.39**	**1.915**	**1.676**
302	G-5	28.0	.17	3.0	24	**2.53**	**2.030**	**1.776**
303	G-6	28.0	.30	6.0	21	**2.53**	**2.030**	**1.776**
305	S-8	28.0	.51	15.0	31	**2.37**	**1.894**	**1.658**
307	S-8	28.0	.67	21.0	31	**2.37**	**1.894**	**1.658**
308	S-8	28.0	.67	21.0	29	**3.00**	**2.400**	**2.100**
309	S-11	28.0	.9	32.0	33	**3.42**	**2.738**	**2.395**
313	T-3¼	28.0	.17	3.5	13	**1.11**	**.885**	**.774**
327	T-1¾	28.0	.04	.34	6	**.92**	**.737**	**.645**
328	T-1¾	6.0	.20	.34*	6	**.95**	**.758**	**.664**
330	T-1¾	14.0	.08	.5	6	**.97**	**.779**	**.682**
331	T-1¾	1.35	.06	.006	6	**1.22**	**.977**	**.855**
334	T-1¾	28.0	.04	.34	7	**1.26**	**1.011**	**.885**
344	T-1¾	10.0	.014	.004	6	**1.18**	**.947**	**.829**
382	T-1¾	14.0	.08	.30	6	**1.18**	**.947**	**.829**
387	T-1¾	28.0	.04	.30	6	**.95**	**.758**	**.664**
388	T-1¾	28.0	.04	.30	6	**1.39**	**1.115**	**.976**
680	T-1	5.0	.06	.03	3	**1.81**	**1.450**	**1.269**
682	T-1	5.0	.06	.029	4	**2.45**	**1.960**	**1.715**
683	T-1	5.0	.06	.05	3	**1.37**	**1.097**	**.960**
685	T-1	5.0	.06	.048	4	**2.84**	**2.275**	**1.990**
713	T-1	5.0	.075	.09	3	**1.46**	**1.167**	**1.020**
714	T-1	5.0	.075	.08	4	**2.45**	**1.964**	**1.718**
715	T-1	5.0	.115	.15	3	**1.50**	**1.200**	**1.050**
718	T-1	5.0	.115	.132	4	**2.59**	**2.069**	**1.810**
1003	B-6	12.8	.94	15.0	27	**1.24**	**.989**	**.865**
1004	B-6	12.8	.94	15.0	28	**1.24**	**.989**	**.865**
1034	S-8	12.8 14.0	1.80 .59	32.0 3.0	32	**1.26**	**1.011**	**.885**
1076	S-8	12.8	1.80	32.0	29	**2.05**	**1.642**	**1.436**
1133	RP-11	6.2	3.91	32.0	34	**2.87**	**2.294**	**2.008**
1156	S-8	12.8	2.10	32.0	31	**1.26**	**1.011**	**.885**
1157	S-8	12.8 14.0	2.10 .59	32.0 3.0	32	**.61**	**.485**	**.424**
1176	S-8	12.8 14.0	1.34 .59	21.0 6.0	29	**1.89**	**1.515**	**1.326**
1183	RP-11	5.5	6.25	50.0	34	**4.61**	**3.690**	**3.229**
1195	RP-11	12.5	3.0	50.0	34	**6.29**	**5.032**	**4.403**
1445	G-3½	14.4	.135	.7	18	**.66**	**.526**	**.461**
1447	G-3½	18.0	.15	1.5	17	**.92**	**.738**	**.645**
1495	T-4½	28.0	.30	6.0	22	**2.05**	**1.642**	**1.436**
1764	T-1¾	28.0	.04	.34	5	**.81**	**.650**	**.568**
1784	T-1¾	6.0	.20	.60	5	**.81**	**.652**	**.570**
1813	T-3¼	14.4	.10	.86	13	**.84**	**.674**	**.589**
1816	T-3¼	13.0	.33	3.0	13	**1.03**	**.821**	**.718**
1819	T-3¼	28.0	.04	.34	13	**1.00**	**.800**	**.700**
1820	T-3¼	28.0	.10	1.6	13	**1.00**	**.800**	**.700**
1829	T-3¼	28.0	.07	1.0	13	**.92**	**.738**	**.645**
1847	T-3¼	6.3	.15	.38	13	**.61**	**.485**	**.424**

*At 5 volts.

INDUSTRY STANDARD LAMPS
CONTINUED ON FOLLOWING PAGE


2.38mm .094"
4.75mm 0.187"
31.8mm MIN 1.25"
Fig. 1
3.18mm 0.125"
3.68mm 0.145"
3.18mm DIA 0.125"
Fig. 2
3.18mm 0.125"
6.35mm 0.250"
31.8mm MIN 1.25"
Fig. 3
3.18mm 0.125"
13.5mm 0.53"
Fig. 4
5.8mm 0.23"
13.2mm 0.52"
Fig. 5
5.8mm 0.23"
15.9mm 0.63"
Fig. 6
5.8mm 0.23"
15.9mm 0.63"
Fig. 7
5.8mm 0.23"
22.3mm 0.88"
Fig. 8
5.8mm 0.23"
18.3mm 0.72"
Fig. 9
5.8mm 0.23"
15.1mm 0.60"
Fig. 10
10.1mm 0.40"
23.9mm 0.94"
Fig. 11
10.9mm 0.43"
30.1mm 1.19"
Fig. 12
11.0mm 0.43"
23.9mm 0.94"
Fig. 13
10.3mm 0.40"
26.7mm 1.05"
Fig. 14
11.3mm 0.45"
31.8mm 1.25"
Fig. 15
11.7mm 0.46"
22.4mm 0.87"
Fig. 16
11.7mm 0.46"
23.9mm 0.94"
Fig. 17
11.7mm 0.46"
15.2mm 0.60"
Fig. 18
15.0mm 0.59"
27.0mm 1.06"
Fig. 19
15.0mm 0.59"
21.4mm 0.84"
Fig. 20
19.0mm 0.75"
30.2mm 1.19"
Fig. 21
15.0mm 0.59"
16.0mm 0.63"
Fig. 22
15.9mm .63"
31.8mm 1.25"
Fig. 23
15.9mm .63"
31.8mm 1.25"
Fig. 24
47.6mm 1.88"
Fig. 25
19.0mm 0.75"
30.2mm 1.19"
Fig. 26
19.7mm 0.78"
37.3mm 1.47"
Fig. 27
19.7mm 0.78"
37.3mm 1.47"
Fig. 28
26.5mm 1.04"
45.0mm 1.80"
Fig. 29
54.0mm 2.13"
Fig. 30
26.5mm 1.04"
45.0mm 1.80"
Fig. 31
26.5mm 1.04"
45.0mm 1.80"
Fig. 32
36.1mm 1.42"
60.3mm 2.375"
Fig. 33
36.1mm 1.42"
57.4mm 2.05"
Fig. 34

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INDUSTRY STANDARD LAMPS (CONT'D)

See previous page for illustrations.

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.	Net Each, Lots of		
						1-9	10-99	100-499
1850	T-3¼	5.0	.09	.25	13	$1.68	$1.347	$1.179
1864	T-3¼	28.0	.17	3.0	13	1.11	.885	.774
1869	T-1¾	10.0	.014	.004	5	1.17	.938	.821
1889	T-3¼	14.0	.27	2.0	13	.92	.738	.645
1891	T-3¼	14.0	.24	2.0	13	.79	.632	.553
1893	T-3¼	14.0	.33	2.0	13	.82	.653	.571
1895	G-4½	14.0	.27	2.0	20	.66	.526	.461
2162	T-1¾	14.0	.10	.5	5	.90	.723	.633
2182	T-1¾	14.0	.08	.30	5	.68	.543	.475
2187	T-1¾	28.0	.04	.30	5	.68	.543	.475
6832	T-1	5.0	.06	.05	2	$1.79	$1.431	$1.252
6833	T-¾	5.0	.06	.05	1	1.86	1.490	1.304
6838	T-1	28.0	.024	.15	3	2.33	1.863	1.630
6839	T-1	28.0	.024	.15	4	2.45	1.964	1.718
7152	T-1	5.0	.115	.15	2	1.55	1.241	1.085
7327	T-1¾	28.0	.04	.34	8	1.05	.844	.738
7328	T-1¾	6.0	.20	.6	8	1.22	.973	.852
7344	T-1¾	10.0	.014	.004	8	1.22	.977	.855
7382	T-1¾	14.0	.08	.30	8	1.33	1.064	.931
7387	T-1¾	28.0	.04	.30	8	1.06	.847	.741
7931	T-1¾	1.35	.06	.006	8	1.52	1.216	1.064

WIRE LEAD INDICATOR LAMPS (T-2 BULB) (FIG. 35)

Lamp No.	Volts	Amps.	M.S. C.P.	Net Each, Lots of		
				1-9	10-99	100-499
4ES	4	.04	.03	$1.29	$1.031	$0.902
5ES	5	.04	.04	1.29	1.031	.902
6ES	6	.04	.025	1.29	1.031	.902
10AS	10	.01	.001	1.63	1.302	1.139
10CS	10	.017	.01	1.36	1.085	.949
10ES	10	.04	.07	1.09	.868	.760
12ES	12	.04	.09	1.28	1.026	.897
16CS	16	.017	.016	1.28	1.020	.893
16ES	16	.04	.17	1.25	.999	.874
18ES	18	.04	.14	1.25	.999	.874
24CS	24	.017	.02	1.36	1.085	.949
24ES	24	.04	.12	1.25	.999	.874
28ES	28	.04	.25	1.25	.998	.873
48ES	28	.04	.44	1.52	1.216	1.064

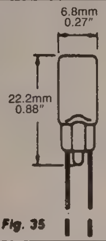

Fig. 35

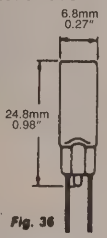

Fig. 36

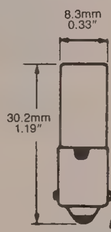

Fig. 37

WIRE LEAD PILOT LAMPS (T-2 BULB) (FIG. 36)

Lamp No.	Volts	Amps	M.S. C.P.	Net Each, Lots of		
				1-9	10-99	100-499
6PS	6	.14	.12	$1.29	$1.031	$0.902
12PS	12	.17	.35	1.25	.999	.874
24PS	24	.073	.5	1.25	.999	.874
28PS	28	.04	.29	1.25	.999	.874
48PS	48	.053	.7	1.25	.999	.874
60PS	60	.05	.73	1.57	1.260	1.102
120PS	120	.025	.36	1.41	1.129	.988
120PS/6	120	.052	1.43	1.41	1.129	.988

MINIATURE BAYONET PILOT LAMPS (T2½ BULB) (FIG. 37)

Lamp No.	Volts	Amps	M.S. C.P.	Net Each, Lots of		
				1-9	10-99	100-499
6MB	6	.140	.12	$1.97	$1.579	$1.382
12MB	12	.170	.35	1.86	1.485	1.299
24MB	24	.073	.50	1.86	1.485	1.299
28MB	28	.040	.29	1.86	1.485	1.299
48MB	48	.053	.70	1.94	1.555	1.361
60MB	60	.050	.73	2.03	1.627	1.423
90MB	90	.033	.37	1.86	1.485	1.299
120MB	120	.025	.36	1.83	1.466	1.283
120MB/6	120	.052	1.43	1.90	1.524	1.333

NEON GLOW INDICATOR LAMPS

Lamp No.	Bulb	Circuit Volts	Ext. Res. (K-ohms)	Fig.	Net Each, Lots of		
					1-9	10-99	100-499
NE-2 (A1A)	T-2	105-125	150	38	$0.50	$0.402	$0.352
NE-2A (A2A)	T-2	105-125	220	38	.50	.402	.352
NE-2V (A2B)	T-2	105-125	100	38	.50	.402	.352
NE-2E (A9A)	T-2	105-125	100	38	.65	.517	.453
NE-51 (B1A)	T-3¼	105-125	220	39	1.06	.851	.745
NE-51H (B2A)	T-3¼	105-125	27	39	1.06	.851	.745
NE-2H (C2A)	T-2	105-125	30	38	.50	.402	.352
NE-2D (C7A)	T-2	105-125	100	40	2.90	2.317	2.027
NE-2J (C9A)	T-2	105-125	30	40	2.66	2.132	1.865
NE-84 (K1A5)	T-2	105-125	30	41	.98	.788	.689

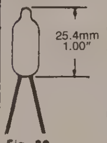

Fig. 38

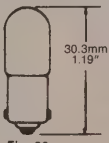

Fig. 39

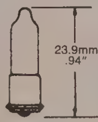

Fig. 40

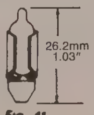

Fig. 41

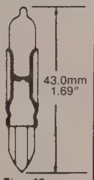

Fig. 42

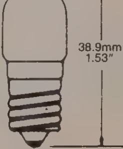

Fig. 43

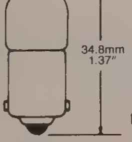

Fig. 44

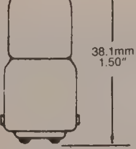

Fig. 45

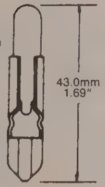

Fig. 46

NEON GLOW CIRCUIT COMPONENT LAMPS

Lamp No.	Bulb	Start. Volts (DC)	Nom. Cur. (mA)	Fig.	Net Each, Lots of		
					1-9	10-99	100-499
NE-96 (4AB)	T-2	120-150	0.5	38	$4.56	$3.650	$3.194
NE-68 (5AC)	T-2	60-90	0.3	38	1.66	1.328	1.162
NE-81 (5AG)	T-2	64-80	0.3	38	1.91	1.531	1.339
NE-76 (5AG-A)	T-2	68-76	0.4	38	3.25	2.602	2.276
NE-83 (5AH)	T-2	60-100	5.0	38	1.53	1.227	1.073
NE-86 (5AJ)	T-2	55-90	1.5	38	3.15	2.523	2.208
NE-4 (8AB)	T-2	60-90	0.3	42	4.91	3.931	3.440

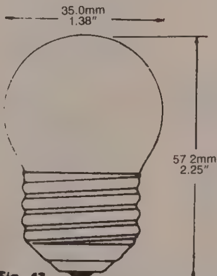

Fig. 47

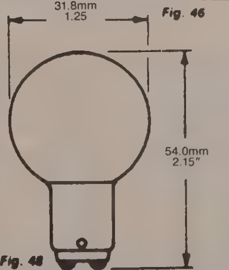

Fig. 48

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INDICATOR CARTRIDGE LAMPS (T-2 BULB) (FIG. 50)

Lamp No.	Volts	Amps.	Average End F.C.	Net Each, Lots of 1-9	10-99	100-499
901	4	.04	145	$2.84	$2.271	$1.987
905	5	.04	225	2.84	2.271	1.987
909	6	.04	160	2.84	2.271	1.987
913	10	.01	—	2.84	2.271	1.987
914	10	.017	10	2.84	2.271	1.987
915	10	.04	540	2.84	2.271	1.987
918	12	.04	550	2.84	2.271	1.987
925	16	.017	75	2.84	2.271	1.987
926	16	.04	750	.87	.694	.608
930	18	.04	800	2.84	2.271	1.987
933	24	.017	200	2.84	2.271	1.987
934	24	.04	650	2.84	2.271	1.987
938	28	.04	1500	2.84	2.271	1.987
941	48	.04	3000	2.84	2.271	1.987

SOCKETS FOR INDICATOR CARTRIDGE LAMPS (FIG. 51)

Part No.	Overall Length	Mtg. Hole Dia.	Term-inals	Net Each, Lots of 1-9	10-99	100-499
SM1	1 11/64″	.375″	Turret	$5.17	$4.136	$3.619
SM1A	1 11/64″	.375″	Solder	5.17	4.136	3.619

PILOT CARTRIDGE LAMPS (T-2 BULB) (FIG. 52)

Lamp No.	Volts	Amps	Avg. End F.C.	Net Each, Lots of 1-9	10-99	100-499
6PC	6	.8	550	$2.39	$1.911	$1.673
12PC	12	2	2400	2.39	1.911	1.673
24PC	24	1.7	3000	2.39	1.911	1.673
28PC	48	1.1	1500	2.39	1.910	1.671
48PC	48	2.5	1500	2.39	1.911	1.673
60PC	60	3	1800	2.39	1.910	1.671
120PC	120	3	1000	2.44	1.955	1.711

SOCKETS FOR PILOT CARTRIDGE LAMPS (FIG. 53)

Part No.	Overall Length	Mtg. Hole Dia.	Term-inals	Net Each, Lots of 1-9	10-99	100-499
SM2	1 3/8″	.375″	Turret	$5.17	$4.136	$3.619
SM2A	1 3/8″	.375″	Solder	5.17	4.136	3.619

LENSES FOR ABOVE SOCKETS (FIG. 49)

Lens Color	Lens No. Trans-parent	Trans-lucent	Net Each, Lots of 1-9	10-99	100-499
Amber	30140	.....	$1.14	$0.912	$0.798
Clear	30141	.....	1.14	.912	.798
Red	30142	30147	1.14	.912	.798
Blue	30143	30148	1.14	.912	.798
Green	30144	30149	1.14	.912	.798
Yellow	.....	30145	1.14	.912	.798
White	.....	30146	1.14	.912	.798

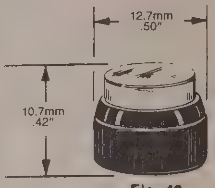

Fig. 49

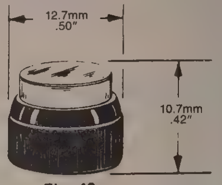

Fig. 49

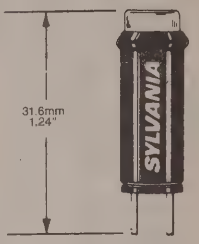

Fig. 50

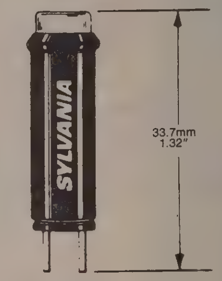

Fig. 52

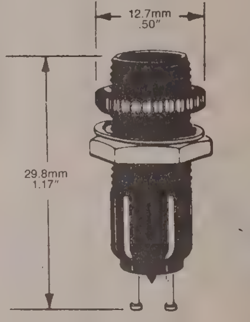

Fig. 51

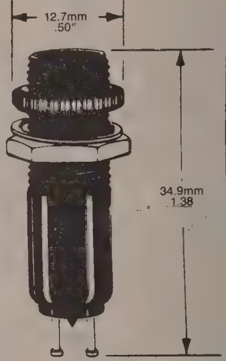

Fig. 53

ANNUNCIATOR LAMPS AND COLOR CAPS

Long life annunciator lamps are designed for use in elevator panels, pushbutton stations, indirect decorative lighting and general signalling applications where a relatively high candlepower miniature light source is necessary. A high degree of light control is made possible by a self-contained aluminized reflector. Unique lighting and signalling effects are attainable using pyrex color caps shown in the chart. Ordering Data: For clear lamps, specify lamp number. For colored lamps, specify color as follows: 6RB/Red, etc. Caps are cemented to lamps when ordered in this manner. Caps may also be ordered separately.

ANNUNCIATOR LAMPS (FIGS. 54 AND 55)

Lamp No.	Base	Volts	Amps	Watts	Net Each, Lots of 1-9	10-99	100-499
6RC	Cand. Screw	6	.14	.8	$2.99	$2.388	$2.090
12RC	Cand. Screw	12	.17	2	2.99	2.388	2.090
24RC	Cand. Screw	24	.073	1.7	2.99	2.388	2.090
28RC	Cand. Screw	28	.04	1.1	2.99	2.388	2.090
60RC	Cand. Screw	60	.050	3	2.99	2.388	2.090
120RC	Cand. Screw	120	.025	3	2.99	2.388	2.090
6RB	Min. Bay	6	.140	.8	2.99	2.388	2.090
12RB	Min. Bay	12	.17	2	2.99	2.388	2.090
24RB	Min. Bay	24	.073	1.7	2.99	2.388	2.090
28RB	Min. Bay	28	.04	1.1	2.99	2.388	2.090
60RB	Min. Bay	60	.05	3	2.99	2.388	2.090
120RB	Min. Bay	120	.025	3	2.99	2.388	2.090

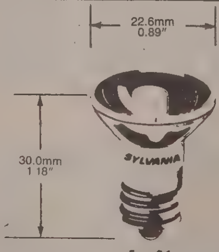

Fig. 54

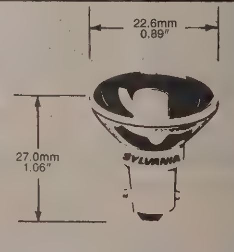

Fig. 55

COLOR CAPS FOR ANNUNCIATOR LAMPS

Cap Color	Cap No.	Net Each, Lots of 1-9	10-99	100-499
Red	38071	$1.40	$1.116	$0.977
Yellow	38072	.65	.521	.456
White	38073	.65	.521	.456
Green	38074	.65	.521	.456
Blue	38075	.65	.521	.456

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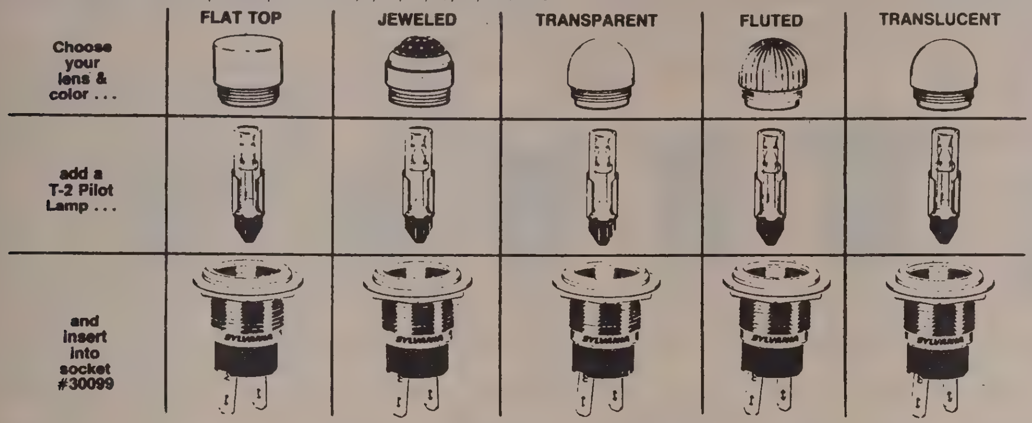
A variety of lens styles, each available in a choice of colors, plus a standard socket (P/N 30099) provide a wide choice of configurations for virtually every application when used with T-2 slide base pilot lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. **Dimensions: Lenses**—Height, .38"; diameter, .63". **Socket**—Front of panel to end of terminals, .91"; mounting hole, .75" dia.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JEWELED
TRANSPARENT
FLUTED
TRANSLUCENT
Choose your lens & color . . .
add a T-2 Pilot Lamp . . .
and insert into socket #30099
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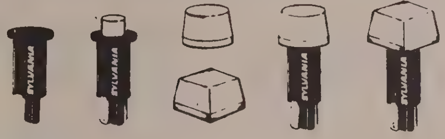
SOCKET AND LENSES

Part No.	Lens Type	Net Each, Lots of		
		1-9	10-99	100-499
30200	Flat Top Translucent—Red	$1.11	$0.891	$0.780
30212	Flat Top Translucent—Green	1.11	.891	.780
30213	Flat Top Translucent—Blue	1.11	.891	.780
30214	Flat Top Translucent—Yellow	1.11	.891	.780
30100	Jeweled—Red	1.28	1.020	.893
30102	Jeweled—Green	1.28	1.020	.893
30103	Jeweled—Blue	1.28	1.020	.893
30106	Jeweled—Amber	1.28	1.020	.893
30110	Transparent—Red	.73	.587	.514
30112	Transparent—Green	.73	.587	.514
30113	Transparent—Blue	.73	.587	.514
30111	Transparent—Amber	.73	.587	.514
30114	Transparent—Yellow	$0.73	$0.587	$0.514
30116	Transparent—Clear	.73	.587	.514
30120	Fluted—Red	.57	.456	.399
30122	Fluted—Green	.57	.456	.399
30124	Fluted—Blue	.57	.456	.399
30126	Fluted—Amber	.57	.456	.399
30125	Fluted—Clear	.57	.456	.399
30130	Dome Translucent—Red	.57	.456	.399
30132	Dome Translucent—Green	.57	.456	.399
30131	Dome Translucent—Yellow	.57	.456	.399
30133	Dome Translucent—White	.57	.456	.399
30099	Pilot Lamp Socket	2.66	2.128	1.862

PILOT LAMP ASSEMBLIES

Socket P/N 30152 plug round (.70" dia. × .48" high) or square (.70" × .70" × .48" high) lens also uses T-2 slide base Pilot Lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. Sockets can also be used without lens, with or without colored end cap covering end of bulb which extends .18" beyond .09" socket flange. **Dimensions:** Socket—1.31" M.O.L.; mounting hole—.50" dia.



LENSES

Color	Ordering Number	
	Round Lens	Square Lens
Red	30160	30170
Clear	30161	30171
Amber	30162	30172
White	30163	30173
Green	30164	30174
Blue	30165	30175

POLYPROPYLENE END CAPS*

Color	Ordering Number
Red	38001
Yellow	38002
White	38003
Green	38004
Blue	38005
Orange	38007

PYREX END CAPS#

Color	Ordering Number
Red	38071
Yellow	38072
White	38073
Green	38074
Blue	38075

*Polycarbonate end caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

#Pyrex end caps must be cemented to the lamp with a translucent silicon rubber adhesive.

PRICES FOR SOCKETS, LENSES AND END CAPS

Description	Net Each, Lots of		
	1-9	10-99	100-499
Pilot Lamp socket P/N 30152	$1.03	$0.825	$0.722
Lenses (round or square)	.49	.391	.342
Pyrex end cap, red	$1.40	$1.116	$0.977
Polypropylene end caps	.46	.370	.324

PILOT LAMPS FOR ABOVE HOUSING AND ASSEMBLIES

Lamp No.	Design			Filament	M.S. C.D.	Average End Foot Candles	Rated Average Life (Hours)	Net Each, Lots of		
	Volts	Amps	Watts					1-9	10-99	100-499
5SLB	5	.12	.6	C-2V	...	1,600	2,500	$1.63	$1.305	$1.142
6PSB	6	.14	.8	C-2F	.12	500	20,000	1.73	1.380	1.208
6SLB	6	.144	.6	C-2V	...	1,700	2,500	1.57	1.260	1.102
12PSB	12	.17	2.0	C-2F	.35	2,000	12,000	1.66	1.326	1.160
24PSB	24	.073	1.7	C-2F	.50	3,000	10,000	1.62	1.295	1.133
28PSB	28	.04	1.1	C-2F	.29	1,600	5,000	1.56	1.244	1.089
48PSB	48	.053	2.5	C-7A	.7	1,800	7,500	1.56	1.244	1.089
60PSB	60	.05	3.0	C-7A	.73	2,600	7,500	1.78	1.427	1.249
120PSB	120	.025	3.0	CC-7A	.36	1,200	10,000	1.67	1.337	1.170

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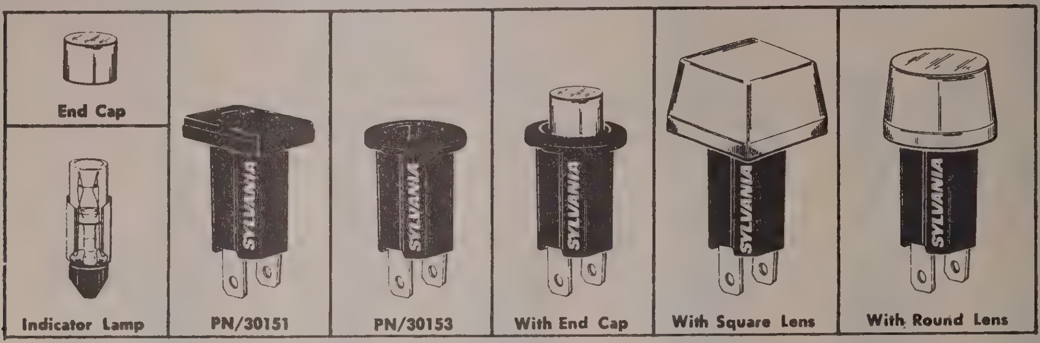
SINGLE SOCKET INDICATOR LAMP ASSEMBLIES

Available sockets include P/N 30153 (round flange) and P/N 30151 (rectangular flange). Sockets may be used with or without colored lens cap covering end of bulb which extends .18" beyond .09" flange. Socket P/N 30153 (round flange) can also be used with round (.70" dia. × .48" high) or square (.70" × .70" × .48" high) lenses. Both sockets 1.14" M.O.L. Mounting hole, .50" dia. Sockets accept T-2 lamps rated 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.



PRICING

Part Number	Description	Net Each, Lots of 1-9	10-99	100-499
30151	Socket, rectangular flange	$0.79	$0.629	$0.550
30153	Socket, round flange	.81	.652	.570
38001	End cap, (*), red	.46	.370	.324
38002	End cap, (*), yellow	.46	.370	.324
38003	End cap, (*), white	.46	.370	.324
38004	End cap, (*), green	.46	.370	.324
38005	End cap, (*), blue	.46	.370	.324
38007	End cap, (*), orange	.46	.370	.324
38071	End cap, Pyrex, red	1.40	1.116	.977
38072	End cap, Pyrex, yellow	.65	.521	.456
38073	End cap, Pyrex, white	.65	.521	.456
38074	End cap, Pyrex, green	.65	.521	.456

*Polypopylene and caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

Part Number	Description	Net Each, Lots of 1-9	10-99	100-499
38075	End cap, Pyrex, blue	$0.65	$0.521	$0.456
30160	Lens, round, red	.49	.391	.342
30161	Lens, round, clear	.49	.391	.342
30162	Lens, round, amber	.49	.391	.342
30163	Lens, round, white	.49	.391	.342
30164	Lens, round, green	.49	.391	.342
30165	Lens, round, blue	.49	.391	.342
30170	Lens, square, red	.49	.391	.342
30171	Lens, square, clear	.49	.391	.342
30172	Lens, square, amber	.49	.391	.342
30173	Lens, square, white	.49	.391	.342
30174	Lens, square, green	.49	.391	.342
30175	Lens, square, blue	.49	.391	.342

Pyrex end caps must be cemented to the lamp with a translucent silicone rubber adhesive.

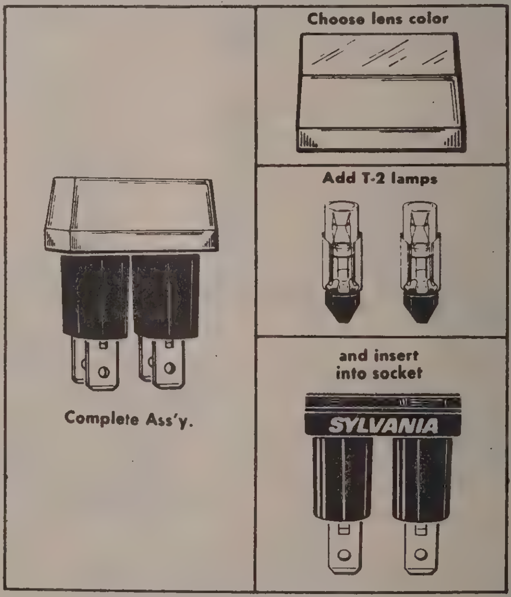
TWIN LIGHT INDICATOR LAMP ASSEMBLIES

TWIN LIGHT LENSES

Ordering Number	Color	Net Each, Lots of 1-9	10-99	100-499
30180	Red	$1.02	$0.812	$0.711
30182	Amber	1.02	.812	.711
30183	White	1.02	.812	.711
30184	Green	1.02	.812	.711
30185	Blue	1.02	.812	.711

TWIN LIGHT SOCKETS

Ordering Number	Description	No. of Contacts	Net Each, Lots of 1-9	10-99	100-499
31351	Both sides common	2	$2.26	$1.807	$1.581
31352	One side common	3	2.26	1.807	1.581
31353	Individual contacts	4	2.26	1.807	1.581



INDICATOR LAMPS FOR ABOVE ASSEMBLIES WILL BE FOUND ON FOLLOWING PAGE.

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**OSRAM
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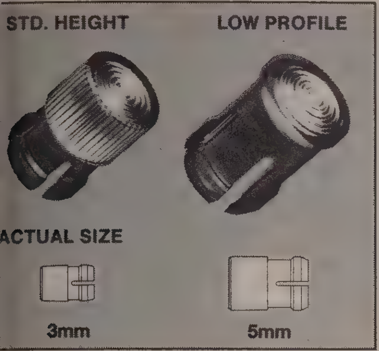
VCC MINIATURE INDICATORS

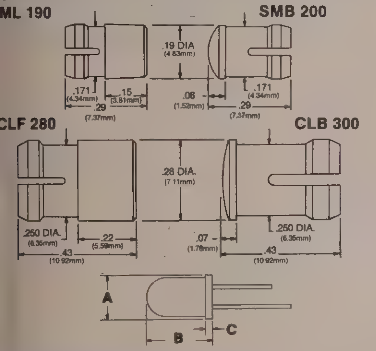
VISUAL COMMUNICATIONS COMPANY, INC.

7920-G Arjons Drive San Diego, CA 92126 U.S.A. In CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546



U.S. & For. Pat. Issued & Pend.

OUTLINE DRAWINGS



RECOMMENDED LEDs

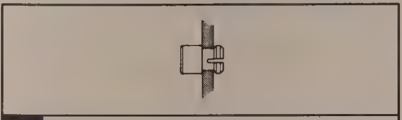
	A	B	C
3mm	.150	.200	.02 MIN to .04 MAX
5mm	.230	.340	.02 MIN to .05 MAX

CLIPLITE® LENS/MOUNTS FOR 3mm & 5mm LEDs

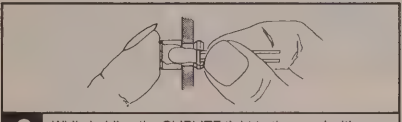
FEATURES

- Installs with finger pressure – no tools required – takes only six seconds
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Protects LED from being pushed back through panel – LED blackout
- Moisture seals easily to panel with the application of common sealants
- Intensifies apparent brightness up to 125% by the use of striated lines and fresnel rings
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

SIMPLE TWO-STEP INSTALLATION



1 Snap the CLIPLITE into panel hole.



2 While holding the CLIPLITE tight to the panel with your finger, insert the LED into the CLIPLITE from the back.

SPECIFICATIONS

MATERIAL Lens - Polycarbonate; Spacer - Nylon (U.L. Listed plastics).

DESIGN Standard and low profile lenses with fresnel rings and striated lines. A low profile lens without rings is available for direct sunlight applications.

MOUNTING: Mounts thru front of panel. Mounting holes should be deburred but not chamfered.
3mm (SML 190, SMB 200) mounts in .171 6.002 (4.34mm) hole on 1/4" centers. Panel thickness foe SML 190, 1/32" to 1/16"| SMB 200, 1/16" to 1/8".
5mm (CLF 280, CLB 300, CLR 301) mounts in .250 6.002 (6.35mm) hole on 3/8" centers. Panel thickness for CLF 280, 1/16" to 1/8"; CLB 300 and CLR 301, 1/32" to 1/4"; for panels less than 3/16", use SPC 125 spacer.

ORDERING CODES

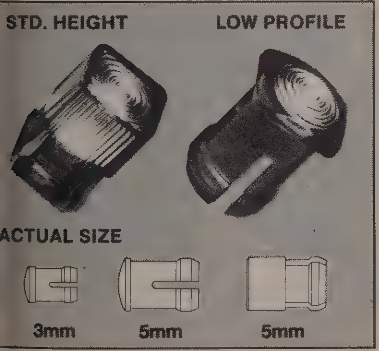
CLF 280 RTP

MODEL
SML 190 (3mm) Std. Hgt.
SMB 200 (3mm) L/Profile
CLF 280 (5mm) Std. Hgt.
CLB 300 (5mm) L/Profile
SPC 125 (Spacer for CLB 300)

COLOR

RTP	Red Transparent
ATP	Amber Transparent
GTP	Green Transparent
BTP	Blue Transparent
YTP	Yellow Transparent
CTP	Clear Transparent

Price in 10,000 - 10 to 11 cent range



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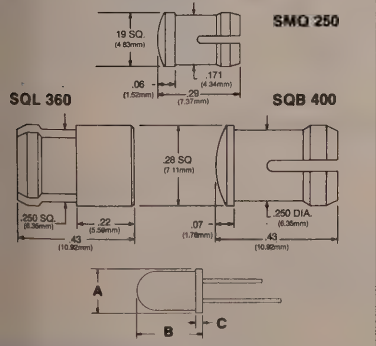
OUTLINE DRAWINGS



RECOMMENDED LEDs

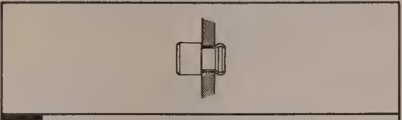
	A	B	C
3mm	.150	.200	.02 MIN to .04 MAX
5mm	.230	.340	.02 MIN to .05 MAX

CUBELITE® SQUARE LENS/MOUNTS FOR LEDs

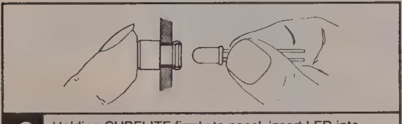
FEATURES

- Enhances aesthetics, square design in both standard and low profile configurations
- Mounts either as a single square lens or stacks in bar configuration
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Intensifies apparent brightness up to 140% by the use of striated lines and fresnel rings
- Installs with finger pressure – no tools required – takes only six seconds
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

EASY TWO-STEP INSTALLATION



1 Snap CUBELITE in a .250 inch panel hole.



2 Holding CUBELITE firmly to panel, insert LED into CUBELITE from the back. Installs in just 6 seconds.

SPECIFICATIONS

MATERIAL LENS - Polycarbonate; Spacer - Nylon (U.L. Listed plastics).

DESIGN Square lens, standard and low profile, fresnel rings and striated lines.

MOUNTING: Mounts thru front of panel. Mounting holes should be deburred but not chamfered.

3mm (SMQ 250) mounts in .171 6.002 (4.34mm) hole on 1/4" centers. Panel thickness from 1/16" to 1/8".

5mm (SQL 360) mounts in .250 6.002 (6.35mm) square punched hole on 3/8" centers. Panel thickness from 1/16" to 1/8".

5mm (SQB 400) mounts in .250 6.002 (6.35mm) round hole on 3/8" centers. Panel thickness from 1/32" to 1/4"; (for panels less than 3/16", optional SPC 125 is available).

Standard metal or plastic washers can also be used to increase panel thickness if necessary.

PUNCH SOURCES: Porter Precision, Cincinnati, OH Strippet, Houdaille Ind., Akron, NY Unipunch Products, Buffalo, NY Wiederman Co., King of Prussia, PA.

ORDERING CODES

SQL 360 RTP

MODEL
SMQ 250 (3mm) L/Profile
SQB 400 (5mm) L/Profile
SQL 360 (5mm) Std. Hgt.
SPC 125 (Spacer for SQB 400)

COLOR

RTP	Red Transparent
ATP	Amber Transparent
GTP	Green Transparent
BTP	Blue Transparent
YTP	Yellow Transparent
CTP	Clear Transparent

Price in 10,000 - 10 to 12 cent range

VISUAL COMMUNICATIONS COMPANY, INC.

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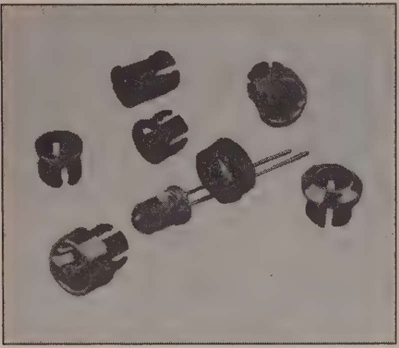
San Diego, CA 92126 U.S.A.
In CA (619) 549-6900
Toll Free (800) 522-5546

CLIPMOUNT CHROMED LED MOUNTING CLIPS

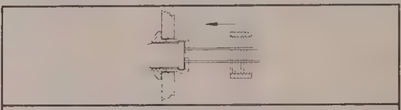


U.S. & For. Pat. Issued & Pend.

FEATURES

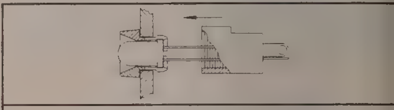
- Universal, used for mounting of all standard 5mm LEDs
- Low cost replacement for expensive plated metal assemblies
- Styles include inner/outer reflector, standard clip type, all in either chrome or black finish
- Low cost red 20mcd LEDs become sun light readable with chromed inner reflector mounts
- LEDs are replaceable when mount is used with Conxrite
- Clipmounts greatly increase the engineer's range of selection in the panel design process

CLIPMOUNT WITH RING



Snap the Clipmount into the panel • insert LED • Press the ring in place to complete the assembly.

CLIPMOUNT WITH CONXRITE



Snap the Clipmount into the panel • insert LED • Press the CONXRITE in place to complete the assembly.

SPECIFICATIONS

MATERIAL: Clip - Polycarbonate; Ring - Poly-propylene;

DESIGN: Style - Inner, outer reflector, standard clip Finish - Chrome or black.

MOUNTING: Mounts thru front of panel. Mounting holes should be deburred but not chamfered.

Hole size .252 (6.35mm) hole on 3/8" centers.

Panel thickness for CLP 125, CLP 127 & CLP 129, 1/32" to 1/8"; CLP 126, 1/8" to 1/4". Complete assembly with RNG 268. Clipmount with Conxrite, maximum panel thickness .110".

LEDs: 5mm standard or low profile, diffused, or non-diffused.

ORDERING CODES

CLP 125 CHR

MODEL

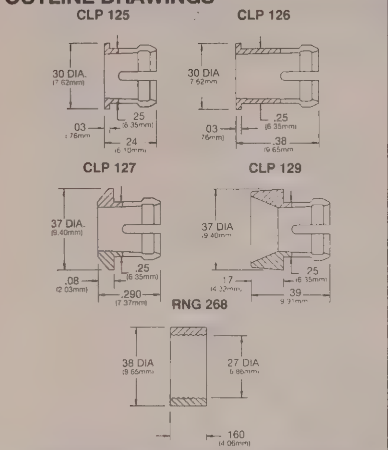
CLP 125 Standard clip
CLP 126 Extended clip (.250 panels)
CLP 127 Outer reflector clip
CLP 129 Inner reflector clip
RNG 268 Ring, (black only)

COLOR

BLK	Black
CHR	Chrome

Price in 10,000 - 6 to 26 cents

OUTLINE DRAWINGS



CONXRITE® SOLDERLESS LED CONNECTOR

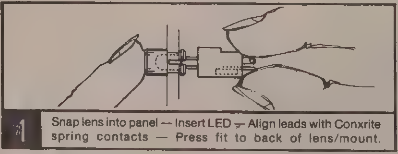
ACTUAL SIZE

U.S. & For. Pat. Issued & Pend.

FEATURES

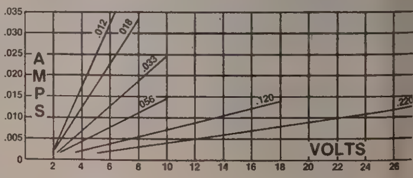
- Internal resistor for 3V to 28V circuits - when external resistor is required or desired. Conxrite is available without built-in resistor
- Requires no tools – provides a simple fast press-fit connection to either Cliplite or Clipmount
- Stress relieved connection controls the problem of broken LED leads
- When preassembled to the wiring harness final assembly of the panel mounted LED is greatly simplified
- Various colored Cliplite lenses are available for use with the Conxrite
- Makes field replacement of defective LEDs practical and cost-effective

EASY INSTALLATION



Snap lens into panel — Insert LED — Align leads with Conxrite spring contacts — Press fit to back of lens/mount.

RESISTOR SELECTION GUIDE



SPECIFICATIONS

MATERIAL:

HOUSING —	Polypropylene (natural).
TERMINALS —	Phosphor bronze, tin plated. Compatible with Terminals.
RESISTOR —	Melf 1/4 watt resistor provides current limiting to 28 volts.
PANEL MOUNTS —	Cliplite or Clipmount Series - Polycarbonate
NOTE:	Trim LED lead length to .275 +/- .010 (7.24 .254mm).

ORDERING CODES

CNX 310 01

MODEL

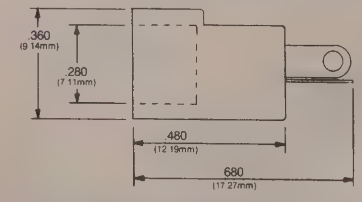
RESISTER CODE

CODE	VALUE
000	NO RESISTOR
012	120 OHMS
018	180 OHMS
033	330 OHMS
056	560 OHMS
120	1200 OHMS
220	2200 OHMS

Price in 10,000 - 30 to 40 cents range

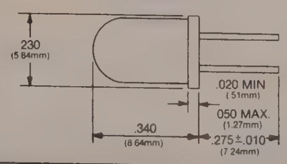
OUTLINE DRAWINGS

CNX 310



RECOMMENDED LEDs

5mm SIZE



VCC MINIATURE INDICATORS

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FAX (619) 549-3520 Toll Free (800) 522-5546

P-C-LITE® PCB MOUNTS FOR 3mm & 5mm LEDs

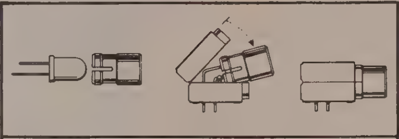
ACTUAL SIZE
3mm
5mm

U.S. & For. Pat. Issued & Pend.

FEATURES

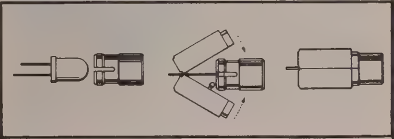
- Wave solders horizontally or vertically without special jogs or fixtures
- Stabilizes LED during packaging and physically protects after assembly
- Mounts flush, recessed or fully extended thru display panel without attachments
- Height compatible with switches and other circuit board mounted components
- Increases LED apparent brightness and viewing angle up to 180 degrees
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

HORIZONTAL MOUNT



Snap LED into lens — insert LED leads through holes in mount base — close mount, bending leads into position.

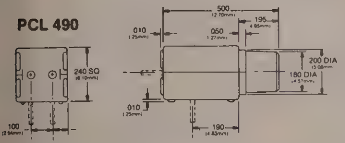
VERTICAL AMOUNT



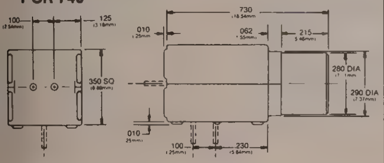
Snap LED into lens — insert LED leads through holes in mount — close mount.

OUTLINE DRAWINGS

PCL 490


500
(12.70mm)
195
(4.95mm)
010
(.25mm)
050
(1.27mm)
240 SQ
(6.10mm)
200 DIA
(5.08mm)
180 DIA
(4.57mm)
010
(.25mm)
100
(2.54mm)
190
(4.83mm)

PCR 740


100
(2.54mm)
125
(3.18mm)
730
(18.54mm)
010
(.25mm)
062
(1.55mm)
215
(5.46mm)
350 SQ
(8.89mm)
280 DIA
(7.1mm)
290 DIA
(7.37mm)
010
(.25mm)
100
(.25mm)
230
(5.84mm)

RECOMMENDED LEDs
See Cliplite Lens Data Page.

SPECIFICATIONS

MATERIAL Body – General Purpose Nylon (U.L. Listed).

Lens – Polycarbonate (U.L. Listed).

MOUNTING P C board, horizontally or vertically on .100 inch hole centers.

3mm (PCL 490 with SML 190) panel thickness from 1/64" to 3/16" thru a 7/32" clearance hole.

5mm (PCR 740 with CLF 280) panel thickness from 1/32" to 9/32" thru a 5/16" clearance hole. CLP series of the CLIPLITE clipmounts may also be used.

Permits flush mounting to full projection of the lens portion thru the panel.

LEDs Standard LEDs, diffused or nondiffused. See drawings. No attempt should be made to bend a lead with a stepped thickness.

ORDERING CODES

PCL 490

MODEL (BODY)
PCL 490 (3mm)
PCR 740 (5mm)

SML 190 RTP

MODEL (LENS)
SML 190 (3mm)
CLF 280 (5mm)

COLOR

RTP	Red Transparent
GTP	Green Transparent
ATP	Amber Transparent
YTP	Yellow Transparent
CTP	Clear Transparent
BTP	Blue Transparent

Price in 10,000 quantity – Body 11 to 12 cents, Lens 10 to 11 cent range

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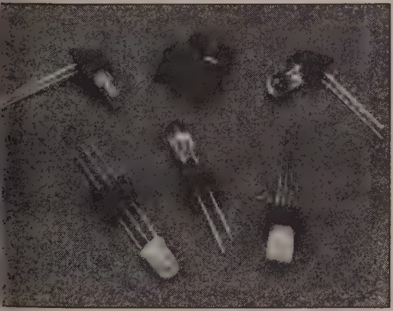
P-C-LITE® MOUNT FOR BI/TRI-LEAD LEDs

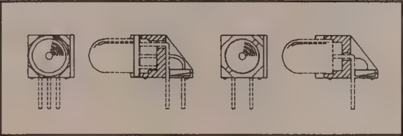


U.S. & For. Pat. Issued & Pend.

FEATURES

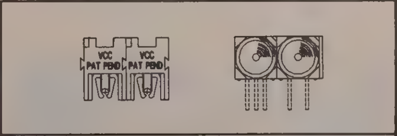
- Right angle PCB mount for bi and tri-lead LEDs for use as logic and diagnostic indicators.
- Accommodates round and rectangular shapes of LEDs with or without flanges.
- Dove-tail interlock feature allows mounting of both mono and multi-colored LEDs
- Mount forms LED leads which are locked into position by retaining tabs.
- Formed LED leads are staggered in their length permitting easier PCB insertion.
- Molded standoffs permit the easy cleaning of PCB after wave solding operation.

PCB MOUNTING OF BI & TRI-LEAD LEDs



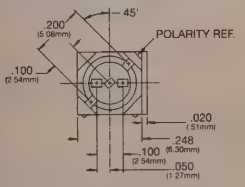
Form leads with the mount, snap leads into retaining tabs.

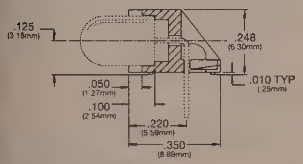
PCB MOUNTING OF LEDs in ARRAYS


VCC
PAT PEND
VCC
PAT PEND

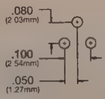
Bi-lead and tri-lead LEDs can be combined with dove-tail interlocking feature.

OUTLINE DRAWINGS


45'
.200
(5.08mm)
POLARITY REF.
.100
(2.54mm)
.020
(.51mm)
.248
(6.30mm)
.100
(2.54mm)
.050
(1.27mm)


.125
(3.18mm)
.248
(6.30mm)
.010 TYP
(.25mm)
.050
(1.27mm)
.100
(2.54mm)
.220
(5.59mm)
.350
(8.89mm)

PCB HOLE PATTERN


.080
(2.03mm)
.100
(2.54mm)
.050
(1.27mm)

SPECIFICATIONS

MATERIALS: Housing – Nylon (black) U.L. 94 VO.

MOUNTING: PCH 175 – Right angle Thru-The-Hole mount for LEDs. Can be used as a single LED mount or banded together in an array with its dove-tail interlocking feature.

When banded together with the PCH 175 the LEDs are on .250" centers.

LED: 5mm size - round or rectangular shape with or without flange. Bi-lead, standard .100" lead spacing. Tri-lead, either .050" or .100" lead spacing. Both the bi-lead and tri-lead LEDs can also be combined in arrays with one another.

ORDERING CODES

PCH 175

MODEL

Price in 10,000 quantity – 4 cents

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MINIATURE INDICATORS

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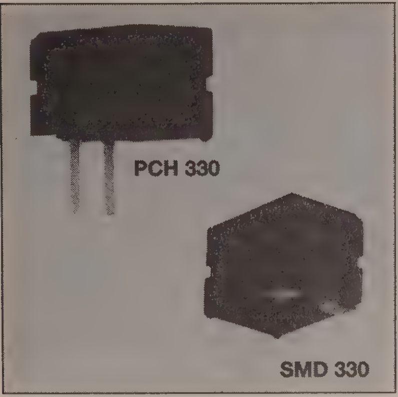

PCH 330
SMD 330

SPECIFICATIONS

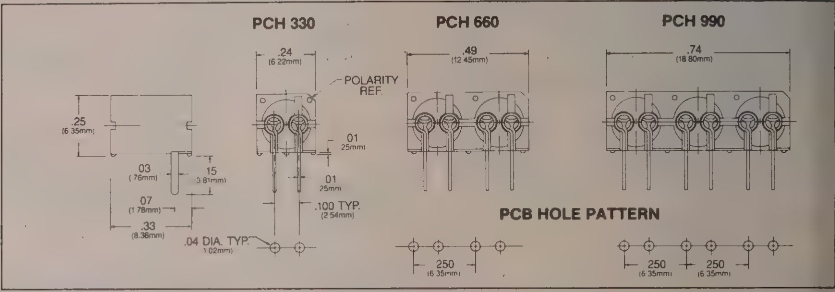
MATERIALS:	HOUSING – NYLON, U.L. 94 VO (black. CONTACTS – Phosphor bronze, 60/40 tim plated.
MOUNTING:	PCH Series – Thru hole, horizontal mounting sockets, .035 (.89mm) holes on .100 (2.54mm) centers. PCV Series – Thru hole, vertical mounting sockets, .035 (.89mm) holes on .100 (2.54mm) centers with optional .060 (1.52mm) holes for opposite side mounting. Same side mounting, delete the .060 holes. SMD Series – Surface mount, horizontal mounting sockets, .060 (1.52mm) X .060 (1.52mm) component pad. SMD 330 available in bulk, on tape/reel and in tubes. SMD 660 & 990 available in bulk and in tubes. NOTE: Insert LED leads into SMD socket from pad end only. SMV Series – Surface mount, vertical mounting sockets, .045 (1.15mm) dia. pad on .100 (2.54mm) centers. SMV 200 available in bulk and in tubes. SPACER – STD standoff series
LED DATA:	Type – 3mm or 5mm Leads – Min. .017 (.43mm) round or square. Max. .030 (.76mm) thickness – .040 (1.02mm) width.

P-C-LITE® THT & SMT SOCKETS FOR LEDs

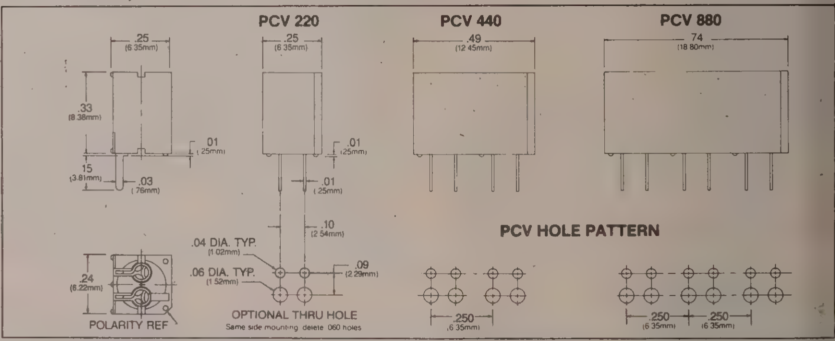
FEATURES

- Relampable – no direct soldering of LEDs
- Used to mount round, square, triangular, odd sizes and various shapes of LEDs
- Easy installation, replacement of phototransistors, IR emitters, incandescent bi-pin lamps
- Mounting of PCB status, logic, fault indicator lights
- Mounts horizontally or vertically – LEDs can b inserted from either end of socket
- Designed for lock type security of LEDs used in hig shock and vibration environments

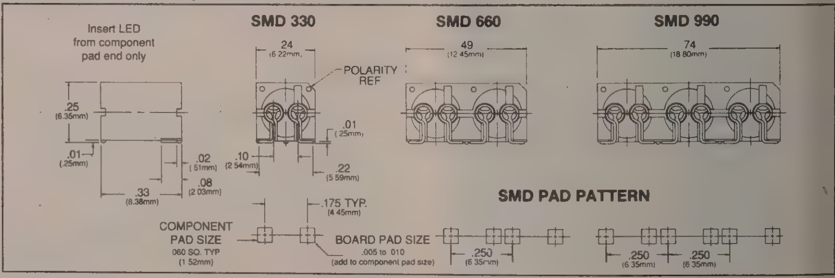
THRU HOLE, HORIZONTAL SOCKET - PCH SERIES


PCH 330
PCH 660
PCH 990
.24 (6.22mm)
POLARITY REF.
.49 (12.45mm)
.74 (18.80mm)
.25 (6.35mm)
.01 .25mm)
.03 (.76mm)
.15 (3.81mm)
.01 .25mm
.07 (1.78mm)
.100 TYP. (2.54mm)
.33 (8.38mm)
.04 DIA. TYP. 1.02mm)
PCB HOLE PATTERN
.250 (6.35mm)
.250 (6.35mm)
.250 (6.35mm)

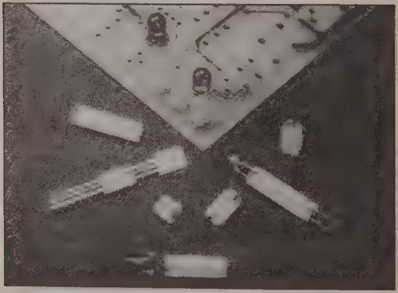
THRU HOLE, VERTICAL SOCKET - PCV SERIES


PCV 220
PCV 440
PCV 880
.25 (6.35mm)
.25 (6.35mm)
.49 (12.45mm)
.74 (18.80mm)
.33 (8.38mm)
.01 (.25mm)
.01 (.25mm)
.15 (3.81mm)
.03 (.76mm)
.01 (.25mm)
.10 (2.54mm)
.04 DIA. TYP. (1.02mm)
.06 DIA. TYP. (1.52mm)
.09 (2.29mm)
.24 (6.22mm)
POLARITY REF
OPTIONAL THRU HOLE
Same side mounting, delete .060 holes
PCV HOLE PATTERN
.250 (6.35mm)
.250 (6.35mm)
.250 (6.35mm)

SURFACE MOUNT, HORIZONTAL SOCKET - SMD SERIES


Insert LED from component pad end only
SMD 330
SMD 660
SMD 990
.24 (6.22mm)
POLARITY REF
.49 (12.45mm)
.74 (18.80mm)
.25 (6.35mm)
.01 (.25mm)
.01 (.25mm)
.02 (.51mm)
.10 (2.54mm)
.22 (5.59mm)
.08 (2.03mm)
.33 (8.38mm)
.175 TYP. (4.45mm)
SMD PAD PATTERN
COMPONENT PAD SIZE .060 SQ. TYP (1.52mm)
BOARD PAD SIZE .005 to .010 (add to component pad size)
.250 (6.35mm)
.250 (6.35mm)
.250 (6.35mm)

Price in 10,000 quantity – 28 to 65 cent range



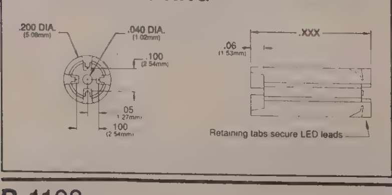
U.S. Pat. Pend.

P-C-LITE® BI/TRI-LEAD LED STANDOFFS

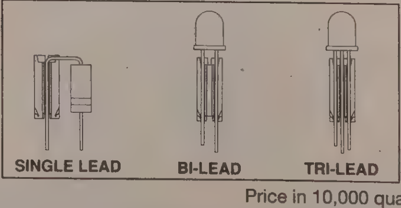
FEATURES

- Standoffs for mounting bi-lead, tri-lead LEDs, opto components on PC boards; used in industrial, commercial and medical products.
- Standoffs can accommodate various configurations of both bi and tri-lead LEDs. Lead spacing can vary from .050" to .100" on center. Standoffs will form the leads for easy insertion into the PCB.
- Provide component height control, help eliminat component tilting, lead shorting, while securin LEDs to the standoffs.
- Cylindrical plastic body has lead separation char nels, clearance pads for PCB cleaning, lead reten tion tabs to maintain standoff and component as unit prior to board insertion.

OUTLINE DRAWING


.200 DIA. (5.08mm)
.040 DIA. (1.02mm)
.100 (2.54mm)
.05 (1.27mm)
.100 (2.54mm)
.06 (1.53mm)
.XXX
Retaining tabs secure LED leads

STANDOFF ASSEMBLIES


SINGLE LEAD
BI-LEAD
TRI-LEAD

ORDER CODE

STD XXX
LENGTH EQUAL INCHE
91 lengths availab

XXX = Length in inches starting from .100 inch thru 1.0 inch in graduated increments of .010 inches.

Price in 10,000 quantity – 3 to 4 cent range

TMP®

TMP INC.

1701 E. Edinger Avenue, F1, Santa Ana, CA 92705 U.S.A.
PHONE: (714) 558-8028 • FAX: (714) 972-9658

UL
E147028

5 Year Product Warranty.

ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING

FEATURES:

- Low Cost Economic Design.
- High Frequency - 45 KHz, Resonant operation to provide high efficiency with 27% energy savings over electromagnetic ballasts.
- No flicker so they are easy on the eyes.
- Can also be used with circular or U-shaped lamps.
- Minimum starting temperature: 50 deg. F.
- Power Factor >97%.
- Total harmonic distortion:
  - – Rapid Start: 15% max.
  - – Instant Start: 11% max.
- Third harmonic distortion:
  - – Rapid Start: 10% max.
  - – Instant Start: 7% max.
- Crest factor: 1.4 typical.
- Sound rating: Class A.
- UL thermal rating: Class P.

RAPID START

A. T-8 LAMP TYPE

For Single, Dual, & Triple Lamps

- F17T8
- F25T8
- F32T8

B. T-12 LAMP TYPE

For Single, Dual, & Triple Lamps

- F40T12/T10

INSTANT START

A. T-8 LAMP TYPE

For Single, Dual, Triple & Four Lamps

- F17T8
- F25T8
- F32T8
- F40T8
- F96T8
- F18BX (BIAX)
- F27BX (BIAX)
- F39BX (BIAX)
- F40BX (BIAX)

B. T-12 LAMP TYPE

For Single & Dual Lamps

- F96T12

SEE OUR COILS, CHOKES IN VOLUME A PAGE 1300; AND TRANSFORMERS IN VOLUME A PAGE 2580.

DATA LINKS

RECEIVERS

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise time/Fall time (ns) (typical)	Operating Temperature
AMP Incorporated	B•1202	√			10 Mb/s to 1 Gb/s		
Analog Modules	B•1210	√		LED, Laser diode	350 Mbft/sec	3 ns	–20 to 70°C.
Litton Poly-Scientific	B•1218	√	√				
Optelecom Inc.	B•1223	√	√	LED, Laser	6Hz - 75MHz Analog D.C. to 30 Mb/sec Digital		–20°C to +60°C.
Ross Engineering Corp.	B•1228	√		LED		DC - 1MHz Analog	0 to 40°C.
S.I. Tech	B•1229	√	√	PIN	50 Mbps		0 to 50°C.

TRANSMITTERS

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise time/Fall time (ns) (typical)	Operating Temperature
AMP Incorporated	B•1202	√		LED, Laser	10 Mb/s to Gb/s		
Analog Modules	B•1210	√		LED, Laser diode	200 Mbft/sec	3 ns	–20 to +60°C.
Laser Diode Inc.	B•1213	√	√	LED, Laser diode	10 to 65Mb/sec.		
Litton Poly-Scientific	B•1218	√	√				
Optelecom Inc.	B•1223	√	√	LED, Laser	6Hz - 75MHz Analog D.C. to 30 Mb/sec Digital		–20°C to +60°C.
Ross Engineering Corp.	B•1228	√		LED		DC - 1 MHz Analog	0 to 40°C.
S.I. Tech	B•1229	√	√	PIN	50 Mbps		0 to 50°C.

FIBER OPTIC CABLE ASSEMBLIES

CABLE ASSEMBLIES

Manufacturer	Starting EEM Page No.	Type	Connector 1	Connector 2	Cable Type
S.I. Tech	B•1229	Multimode and single mode	ST/ST	SMA/ST	FDDI

Cable Type Code:
LDS = Light Duty Single
LDD = Light Duty Dual (zip style)
DU = DUALAN (2 fibers in single jacket)
DUP = DUALAN Plenum (2 fibers in single jacket)
PLDD = Plenum Light Duty Dual (zip style)

CONNECTORS

Manufacturer	Starting EEM Page No.	Style (Diamond, SMA, DIN47256, NTT, FC, ST, SC, FDDI, etc.)	Single Mode	Multi-mode	Inner diameter range	Connecting Loss (dB)
AMP Incorporated	B•1202	ST, FSMA, FDDI, BNC, SC, FC, D4	√	√	125 - 1000 µM	0.3 to 1.0 dB

SYSTEMS (Custom)

Manufacturer	Starting EEM Page No.	Optical Sensing	Trans-mission
Analog Modules	B•1210	√	√
Laser Diode Inc.	B•1213	√	√
Ross Engineering Corp.	B•1228		√
S.I. Tech	B•1229		√

DIODES

Manufacturer	Starting EEM Page No.	Wave-length (mm)	Output Power (mW) Typical	Rise Time/ Fall Time (ns) Typical	Type (Specify GaAlA, In GaAsP, etc.)
AMP Incorporated	B•1202	1300	Various		InGaAsP
Laser Diode Inc.???	B•1213	1300	Various	.05	InGaAsP
Ross Engineering Corp.	B•1228	820, 1300			

FIBER OPTIC TEST EQUIPMENT

Manufacturer	Starting EEM Page No.	Parameters/Function	Units	Connectors	Power From	Fiber Type	(nm) Wavelengths	Range/	Source Type
EXFO E.O.	B•1211			ST, SC, SMA or FC		Multimode and single mode	850, 1300 and 1550	+3 to -55 dBm	Laser and LED

ST-Style Connectors

Multimode and singlemode versions available. Choice of ceramic, polymer composite or stainless steel ferrule. Single crimp termination for cables up to 3 mm in diameter. Clear tubing allows termination of 900 micron buffered fiber with no strength members (Kevlar material). Strain relief boots available in long, short, and right angle versions and in various colors.

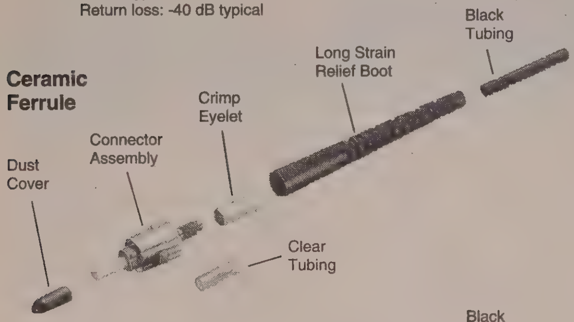
Low loss - Multimode:
0.3 dB typical (ceramic),
0.7 dB typical (polymer composite),
0.5 dB typical (stainless steel).
Singlemode:
0.3 dB typical
Return loss: -40 dB typical

Ferrule Type	Strain Relief	Hole Size (µm)	Part Number
Multimode - for cable O.D. up to 3.0 mm			
Ceramic - Aluminum Oxide	Long Boot (Black)	125	501380-1
	Short Boot (Black)	125	1-501380-5
	Right Angle Boot (Black)	125	502674-1
	Long Boot (Black)	140	501380-2
	Short Boot (Beige)	140	1-501380-2
	Right Angle Boot (Black)	140	502674-2
Ceramic - Zirconia Oxide	Long Boot (Black)	125	501380-5
	Long Boot (Black)	140	501380-6
Polymer Composite	Long Boot (Black)	125	502160-1
	Long Boot (Black))	140	502160-2
	Long Boot (Black)	230	502160-3
	Short Boot (Black))	500	502160-4
	Short Boot (Black)	1000	502160-5
Stainless Steel	Short Boot (Blue)	125	502575-1
	Right Angle Boot (Blue)	125	502675-1
	Short Boot (Blue)	140	502575-2
	Right Angle Boot (Blue)	140	502675-2
Singlemode			
Ceramic	Long Boot (Yellow)	125	502579-1
	Short Boot (Yellow)	125	502580-1
	Long Boot (Yellow)	126	502579-2
	Short Boot (Yellow)	126	502580-2
	Long Boot (Yellow)	127	502579-3
	Short Boot (Yellow)	127	502580-3

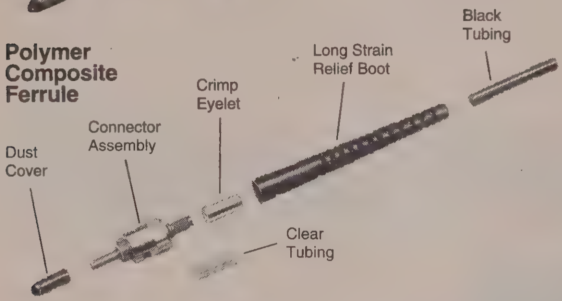
Bulk packaged components, and kits with other strain relief color and type, are available.

IS 6935 (for P/Ns 501380-x, 502640-x)
IS 9624 (for P/Ns 502575-x, 502327-x, 502675-x)
IS 9464 (for P/Ns 502160-x, 502668-x)
IS 9645 (for P/Ns 502579-x, 502580-x)

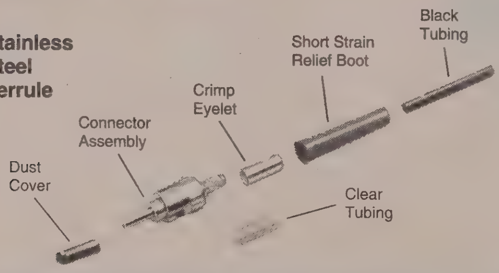
Ceramic Ferrule


Black Tubing
Long Strain Relief Boot
Crimp Eyelet
Connector Assembly
Dust Cover
Clear Tubing

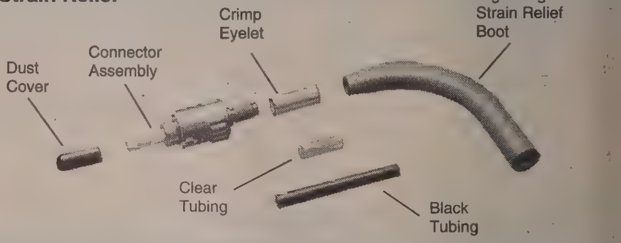
Polymer Composite Ferrule


Black Tubing
Long Strain Relief Boot
Crimp Eyelet
Connector Assembly
Dust Cover
Clear Tubing

Stainless Steel Ferrule


Black Tubing
Short Strain Relief Boot
Crimp Eyelet
Connector Assembly
Dust Cover
Clear Tubing

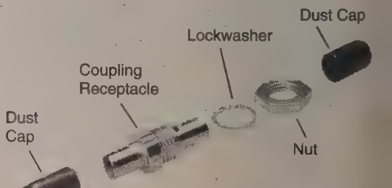
Right Angle Strain Relief


Crimp Eyelet
Right Angle Strain Relief Boot
Connector Assembly
Dust Cover
Clear Tubing
Black Tubing

ST-Style Coupling Receptacles

Precision mating adapter for all ST compatible connectors

Alignment Sleeve Material	Application	Packaging	Part Number
Polymer Composite	Multimode	Single	501381-1
Metal	Singlemode/Multimode	Single	504021-1
		Bulk (50)	504021-2
Zirconia Ceramic	Singlemode/Multimode	Single	502750-1

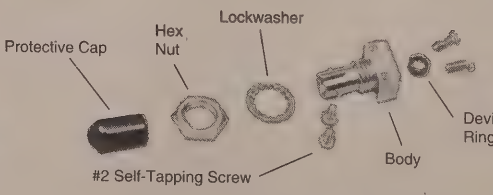

Dust Cap
Lockwasher
Coupling Receptacle
Dust Cap
Nut

Use with two plugs to make a free-hanging splice or panel feed-through connection

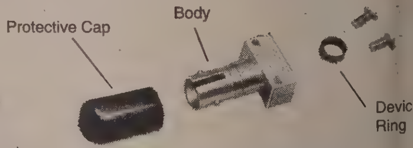
Active Device Mounts

Multimode – Used to mate an ST-Style Connector to an active device: TO-18, TO-46 and TO-52.

Low Profile
Part No. 504022-2
Part No. 504022-3 (Bulk 50)


Protective Cap
Hex Nut
Lockwasher
Device Ring
Body
#2 Self-Tapping Screw

Part No. 501474-1


Protective Cap
Body
Devic Ring

Low Profile
Part No. 502585-2

Specifications subject to change.

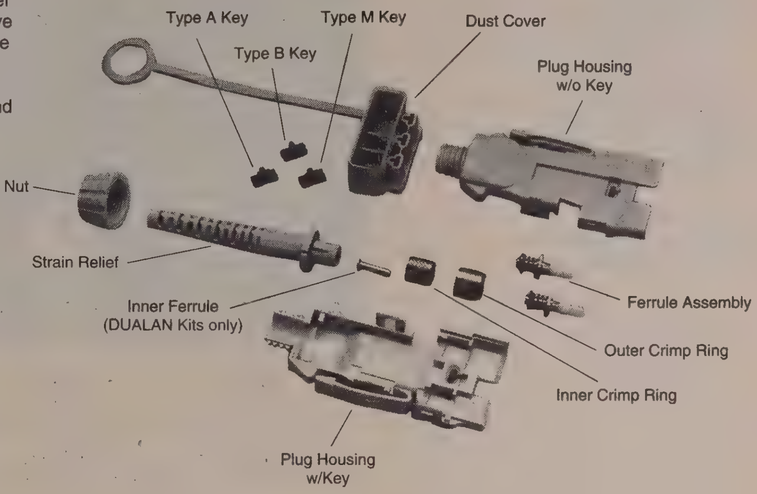
SD (Fixed Shroud Duplex) System

For more information request Catalog 82188

e AMP FSD (Fixed Shroud Duplex) System meets the quirements of the ANSI X3T9.5 Fiber Distributed Data Interface DDI) standard. The FSD System hardware is used for high rformance FDDI local area networks or other applications quiring duplex fiber optic interconnections. The FSD connector is wo-channel snap-fit connector that combines low loss (0.6 dB ical) with positive side-latch mating, polarization, keying and fiber ain relief. The fiber ferrules are 2.5 mm ceramic. A rigid protective roud guards the connector's free floating ferrules against damage m mishandling or mismating. The connector is available for field rmination or as a preterminated cable assembly. The FSD plug n mate directly to data links. A variety of connector couplings, and ll outlets for fixed building cabling are available.

Multimode
Meets requirements of FDDI PMD – ANSI X3.166 – 1990

DI Compatible, plug uses 2.5 mm ceramic free-floating rrules for low loss — 0.6 dB typical. Plug has positive de-latch mating, designed-in polarization, keying, and nd-limiting strain relief.



Hole Diameter (µm)	Plug Part Numbers		Replacement Ferrules
	Cable Type		
	DUALAN	Light Duty Dual	
125	501780-1	502015-1	501779-1*
140	501780-2	502015-2	501779-3*

art number is for individual ferrule IS 9373

FSD Receptacles

- Multimode
- Self-aligning, free-floating interface for constant, low loss mating.
- Conforms to the requirements of the FDDI PMD – ANSI X3.166 – 1990 Specification.

FSD Bulkhead Adapter

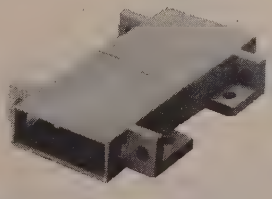
Connects FSD plug to two ST-Style plug connectors.

Plastic Housing

Housing Material	Threaded Insert Size	Part Numbers			
		Keying Type			
		A	B	M	S
Plastic	4-40	501798-1	501798-2	501798-3	501798-4
Plastic	M3	501933-1	501933-2	501933-3	501933-4

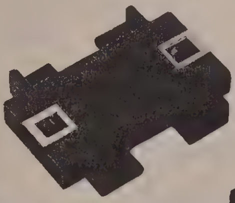
FSD Duplex-to-Duplex Coupling

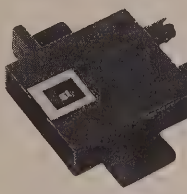
Allows mating of two duplex plugs. Available with and without mounting ears.

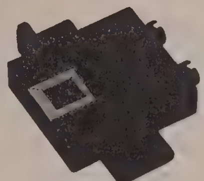


Style	Threaded Insert Size	Part Numbers	
		Keying Type	
		A to B	M to S
With Mounting Ears	4-40	501926-1	501926-2
	M3	501931-1	501931-2
Without Mounting Ears	—	501805-1	501805-2

FSD MC (Multi-Exit Connector System)


FSD MC – FSD MC Coupling Assembly


FSD MC – ST-Style Coupling Assembly


FSD MC – FC Type Coupling Assembly

Product Facts

- Multimode and singlemode
- Meets requirements of ANSI/ISO FDDI PMD standards
- Field keyable connectors and receptacles
- Stackable horizontally and vertically

FSD MC Coupling Assemblies

Description	Part Numbers			
	Black		Beige	
	Metal Sleeve	Ceramic Sleeve	Metal Sleeve	Ceramic Sleeve
Multimode				
FSD MC—FSD MC	502806-1	502806-3	502806-2	502806-4
FSD MC—ST-Style	502808-1	502808-3	502808-2	502808-4
FSD MC—FC Type	502873-1	502873-3	502873-2	502873-4
Singlemode				
FSD MC—FSD MC	—	502807-1	—	502807-2
FSD MC—ST-Style	—	502809-1	—	502809-2
FSD MC—FC Type	—	502874-1	—	502874-2

eying for FDDI All connectors and cable assemblies are shipped with color-coded keys to ensure oper connection. Key styles A and B are used with dual attach stations. Key styles M (master) and (slave) are used for the attachment of a single attach station to a concentrator, with M at the ncentrator end, and S at the station end. Three keys are provided (A, B & M), to be installed by the customer/user. The connector without a key installed is a type S, and will mate to any receptacle, regardless of its key style.

Specifications subject to change.

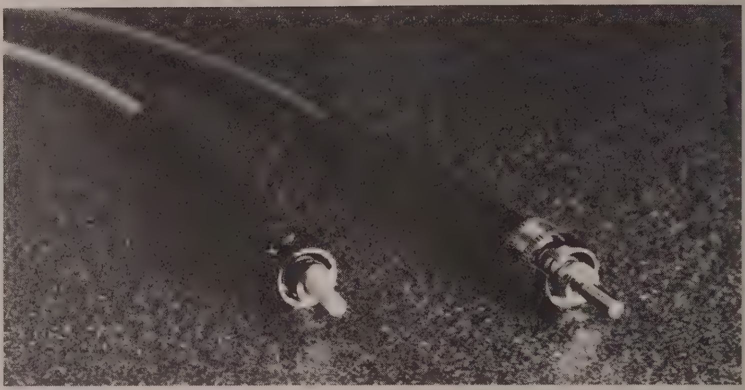
For more information request Catalog 82188

LightCrimp XTC No-Epoxy Fiber Connectors

AMP's LightCrimp ST-Style Connectors feature an easy-to-use, reliable new technology. An epoxyless termination of fiber optic cable is accomplished in less than two minutes.

Product Facts

- Singlemode or multimode
- No epoxy required



Fiber Type	Ferrule Material	Buffer Size µm	Part Numbers
Multimode 125 µm	Stainless	900/1000	504034-1
		250	504034-5
	Ceramic	900/1000	504001-1
		250	504001-3
Multimode 140 µm	Stainless	900/1000	504034-3
		250	504034-7
Singlemode	Ceramic	900/1000	504000-1
		250	504000-3

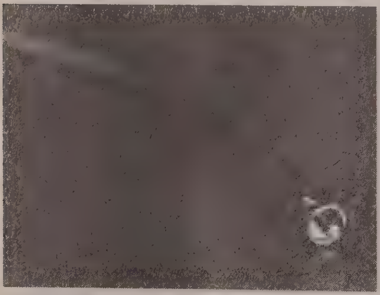
IS 9860

AMP Mini-BNC Fiber Optic Connectors

The AMP Mini-BNC connectors have been designed to provide full form, fit, and function compatibility with IBM's 8219 and 8220 high-speed, fiber optic network specification.

Product Facts

- Low loss (µ = 0.21 dB)
- Low back reflection (PC)
- Stainless steel, radius ferrules (PC)



Description	Part Number
Multimode, 125 µm BNC Stainless Steel Ferrule	504002-1
Multimode, 140 µm BNC Stainless Steel Ferrule	504002-2

AMP SC1 Connectors

All AMP SC connectors are compatible with NTT SC connectors and are made under license of NTT. AMP SC connector products provide high performance and ease of use.

Product Facts

- Multimode and singlemode
- Field installable
- PC finish
- Compatible with all SC connectors

Zirconia Ceramic

Fiber Diameter	Part Numbers	
	Singlemode	Multimode
125 µm	502882-1	502883-1
126 µm	502882-2	—
127 µm	502882-3	—
140 µm	—	502883-2

Specifications subject to change.

Call 1-800-522-6752 for product information and 1-800-722-1111 for tooling information.

AMP Hybrid Adapters

Product Facts

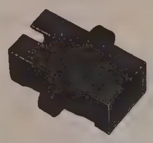
- Multimode or singlemode
- Available with mounting screws

Description	Simplex (Blue)	Duplex (Blue)
AMP SC to ST-Style		
Metal Alignment Sleeve	502780-2	503137-2
Ceramic Alignment Sleeve	502780-5	503137-5
AMP SC to FC Type		
Metal Alignment Sleeve	502781-2	503135-2
Ceramic Alignment Sleeve	502781-5	503135-5
FC Type to ST-Style		
Metal Alignment Sleeve	502782-2	—
Ceramic Alignment Sleeve	502782-5	—

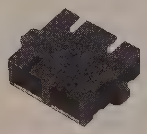
AMP SC Coupling Receptacles

Product Facts

- Can be used with either SC1 or SC2
- The Duplex Receptacle will accept either two individual connectors or one duplex connector
- Multimode or singlemode
- Available with mounting screws
- Other colors available



AMP SC Simplex Coupling Receptacle



AMP SC Duplex Coupling Receptacle

AMP SC Coupling Receptacles

Description	Simplex (Blue)	Duplex (Blue)
Metal Alignment Sleeves		
without dust covers	502632-2	502776-2
with dust covers	502632-8	502776-8
Ceramic Alignment Sleeves		
without dust covers	502632-5	502776-5
with dust covers	1-502632-1	1-502776-1

AMP SC Low Loss Loopback

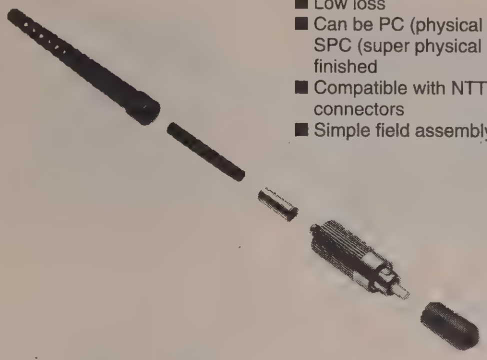
Part Number 503141-1
[.500] centerline
0.6 dB insertion loss

For more information request Catalog 82188

FC/PC Type Connectors

Product Facts

- Multimode and singlemode
- Low loss
- Can be PC (physical contact) or SPC (super physical contact) finished
- Compatible with NTT-FC connectors
- Simple field assembly



Hole Diameter (μm)	Long Strain Relief	
	Singlemode	Multimode
125	1-501505-2	502156-7
126	1-501505-3	—
127	1-501505-4	—
140	—	502156-8

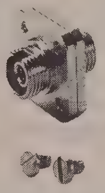
IS 9263

Receptacle Coupling Bushing

For singlemode or multimode

Part No. 501506-1
(Ceramic Sleeve)

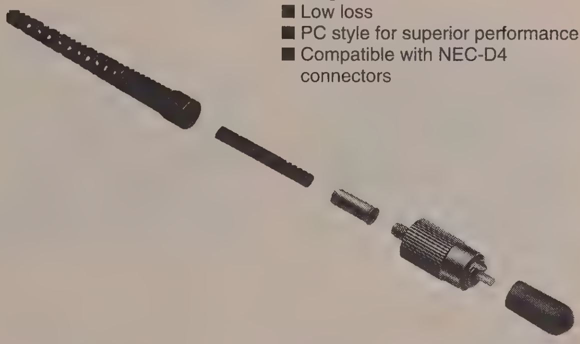
Part No. 501506-2
(Metal Sleeve)



D4/PC Type Connectors

Product Facts

- Singlemode
- Low loss
- PC style for superior performance
- Compatible with NEC-D4 connectors



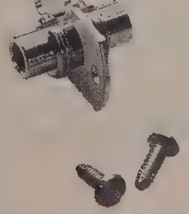
Ferrule Material	Hole Diameter (μm)	Long Strain Relief
Alumina Ceramic	125	501508-2
	126	501508-3
	127	501508-4

IS 9263

Receptacle Coupling Bushing

Part No. 501509-1
(Ceramic Sleeve)

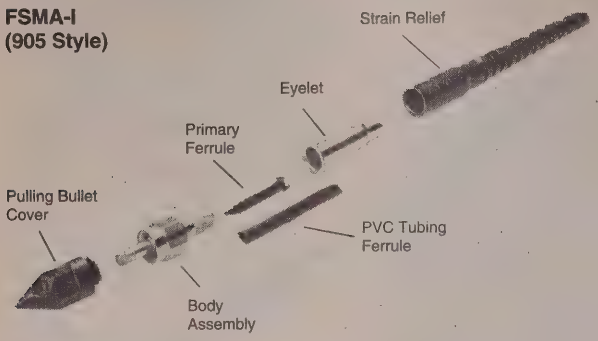
Part No. 501509-2
(Metal Sleeve)

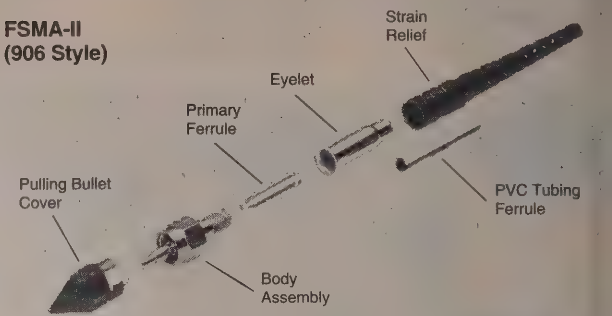


Specifications subject to change.

For more information request Catalog 8218

FSMA Connectors


FSMA-I
(905 Style)
Strain Relief
Eyelet
Primary Ferrule
Pulling Bullet Cover
PVC Tubing Ferrule
Body Assembly


FSMA-II
(906 Style)
Strain Relief
Eyelet
Primary Ferrule
Pulling Bullet Cover
PVC Tubing Ferrule
Body Assembly

FSMA Plugs

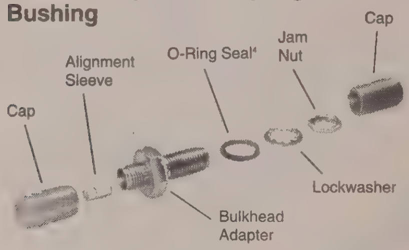
- Multimode
- Industry Compatible with 905 (FSMA- I)/906(FSMA-II)
- Terminates fiber sizes from 125 through 1000 microns in diameter
- Single crimp design allows all crimps to be made simultaneously with one tool
- Design parameters conform to the proposed NATO and IEC interface standards for military and instrument applications
- Resilient tip design of FSMA-I connectors minimizes mating tolerance problems

Connector Body Material	Fiber Diameter[1] (μm)	Part Numbers[3]					
		Nominal Jacket O.D. Less Than 3.0 w/o Strength Members		Nominal Jacket O.D. 3.0 w/ Strength Members[2]		Nominal Jacket O.D. 3.8 w/ Strength Members	
		FSMA-I	FSMA-II	FSMA-I	FSMA-II	FSMA-I	FSMA-II
Nickel Plated Brass	125	501002-1	—	501003-1	—	501004-1	—
	140	501002-2	—	501003-2	—	501004-2	—
	230	501002-4	—	501003-4	—	501004-4	—
	500	501002-8	—	501003-8	—	501004-8	—
	1000	1-501002-1	—	1-501003-1	—	1-501004-1	—
Stainless Steel	125	—	504014-1	—	504014-1	—	504014-2
	140	—	1-504014-1	—	1-504014-0	—	1-504014-1

[1] Nominal cable jacket O.D.
[2] Spacer tube included with these kits.
[3] For environmental sealing, order optional O-ring No. 19195-2.

905 Style - IS 2969
906 Style - IS 9863

FSMA Receptacle Coupling Bushing


Cap
Jam Nut
Alignment Sleeve
O-Ring Seal[4]
Cap
Lockwasher
Bulkhead Adapter

Use with two standard FSMA-I or FSMA-II plugs O-ring seal included with 501050-1 only.

Part No. 501049-1[1]
(Unsealed)
Part No. 501050-1[1,2]
(Sealed)

[1] Includes lockwasher, jam nut and protective cap.
[2] Includes O-ring seal.
[4] O-ring seal included with 501050-1 only.

Multimode and Singlemode Cable Assemblies

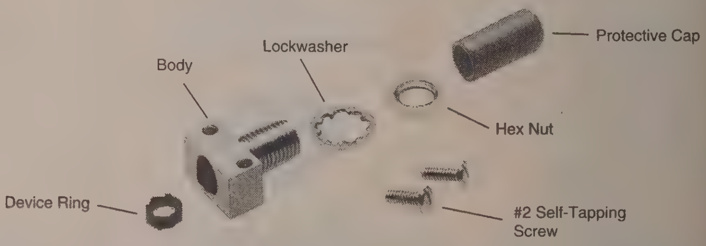
Product Facts

- Standard and custom assemblies
- All use AMP's bend limiting strain relief
- Any connector style, cable type, strain relief, and length are available
- All cable is OFNR or OFNP rated
- All assemblies are 100% tested prior to shipment
- PC or SPC finished singlemode

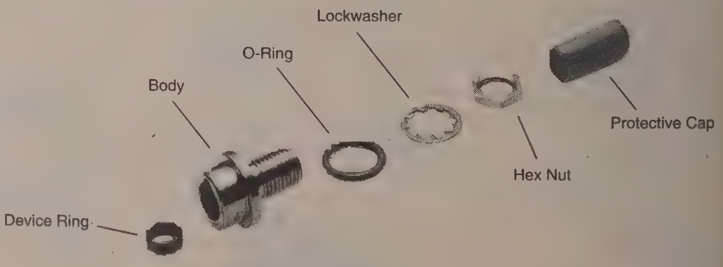
FSMA Active Device Mounts

- Accepts TO-18, TO-46, TO-52 and Honeywell Low-Cost Plastic Sweetspot active devices
- PC Board and Panel Mount designs available
- Corrosion resistant construction
- Use with FSMA-I or FSMA-II plugs (see above)
- Environmentally sealed and unsealed versions available

PC Board Mount— **Part No. 501054-1**[2,4]
PC Board/Panel Mount—**Part No. 501055-1**[1,2,4] (Stainless Steel)
Part No. 502136-1[1,2,4] (Nickel Plated, Zinc Die Cast)


Protective Cap
Lockwasher
Body
Hex Nut
Device Ring
#2 Self-Tapping Screw

Panel Mount—**Unsealed Part No. 501052-1**[1,2,4]
Sealed Part No. 501053-1[1,2,4]


Lockwasher
O-Ring
Body
Protective Cap
Hex Nut
Device Ring

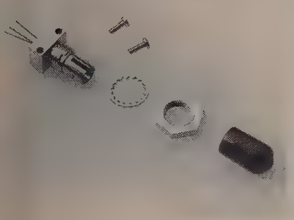
Instruction Sheet IS 9082

Specifications subject to change.

Call 1-800-522-6752 for product informatio
and 1-800-722-1111 for tooling information

For more information request Catalog 82188

ST-Style Board Mount LED

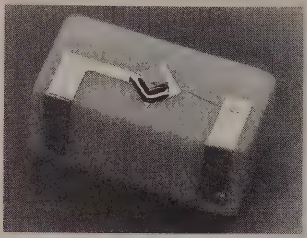


MP InGaAsP SLED ST-Style ADM roducts offer high coupled powers or digital fiber optic transmission pplications. Compatible with ndustry standards, AMP LED DMs consist of hermetically sealed O-18 style SLEDs which have een actively aligned for maximum oupled power. Also available in SMA, FC, SC and biconic active evice mounts.

roduct Facts

- High coupled power typically 75 µW into 62.5 µm fiber
- High reliability MTTW 2.3 x 10^8 hours
- Wavelength centered at 1320 nm
- -40° to +85°C operating temperature
- Hermetically sealed TO-18 style package installed in industry standard ADMs

Submounted PIN



Submounted PIN design balances high-speed performance with noise-free linear output. Spectral response has been optimized for the long wave-length region of 1150 nm to 1600 nm. Every component delivered has passed extensive high-temperature screening for long-term reliability.

Product Facts

- High reliability passivated planar structure
- High responsivity
- Low dark current
- Low capacitance
- -40° to +85°C operating temperature

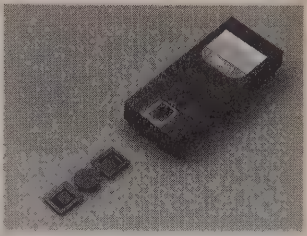
PIN/Preamp Module

The AMP PIN/Preamp module offers an InGaAs PIN photodetector coupled with a GaAs transimpedance amplifier in a hermetically sealed TO-18 package installed in an industry standard receptacle. The module also includes on chip AGC for wide dynamic range (36 dB optical) as well as low noise, wide bandwidth operation. The PIN/Preamp module is ideally suited for data rates ranging from 1 Mb/s up to SONET OC-1 fiber optic receiver applications. PIN/Preamp modules are processed to comply with Bellcore advisory TA-TSY-000983. Available in SC, ST and FC active mounts.

Product Facts

- 50 MHz analog bandwidth
- Low noise
- -43 dBm sensitivity
- Automatic gain control
- Industry standard ADM
- Each unit serialized

FSD Multimode Transceiver



The transmitter produces a shaped optical output signal from an ECL electrical input. The receiver produces an ECL signal from an optical input.

Product Facts

- Fiber Distributed Data Interface (FDDI) compliant
- 22-pin multisourced package
- AMP FSD (Fixed Shroud Duplex) Interface with field programmable keys
- Internally shielded plastic package with low EMI/RFI emission
- High optical power budget
- 125 Mb/s performance
- Compatible with all standard FDDI chip sets
- Single power supply

T-Style Board Mount PIN

MP InGaAs PIN photodetectors ffer high responsivity for nearly all igital and analog fiber optic pplications. Also available in SMA, FC, SC and biconic active evice mounts.

roduct Facts

- High reliability passivated planar structure
- High responsivity
- Low dark current
- Low capacitance
- Hermetically sealed TO-18 style package installed in industry standard ADMs
- -40° to +85°C operating temperature

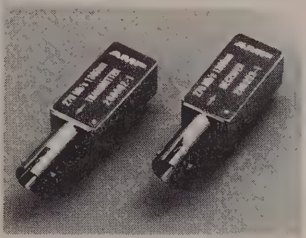
SC/PC and FC/PC Minicom Laser Module

The Minicom Laser module is a connectorized component with a standard SC/PC or FC/PC Type interface for singlemode fiber applications. The high temperature laser module incorporates a 1300 nm InGaAsP buried crescent laser diode. The Minicom Laser is ideal for most short and medium distance digital loop transmission applications over singlemode fiber. Laser modules are processed to comply with Bellcore advisory TA-TSY-000983.

Product Facts

- 1300 nm wavelength
- -40°C to +85°C operating temperature
- Hermetically sealed
- FC or SC connector interface
- High speed (1 GB/s)
- InGaAs monitor detector
- Four-lead package
- Each unit serialized

Small Outline Transmitter and Receiver 16-Pin FDDI Modules

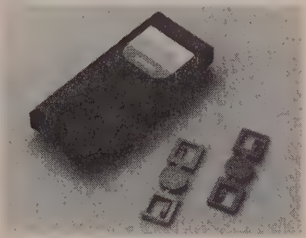


AMP Small Outline Datalinks provide Simplex logic-to-logic data transmission over a fiber optic transmission path. It has the advantage of small shielded rugged packaging which can be mounted on most circuit boards.

Product Facts

- Fiber Distributed Data Interface (FDDI) compliant
- 16-pin multisourced packages
- ST-Style optical interface
- High optical power budget
- Compatible with all standard FDDI chip sets
- Single power supply
- Temperature and power supply compensated transmitter optical output

Singlemode FDDI Laser Transceiver



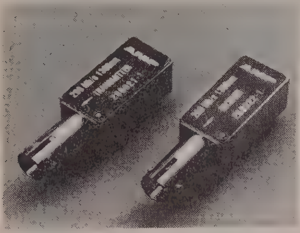
The transmitter launches a minimum of -19 dBm 1300 nm laser light into the 9/125 µm singlemode optical fiber.

Product Facts

- FDDI Category 1 singlemode compliant
- 22-pin multimode package
- Drops in to 22-pin multimode footprint
- AMP Singlemode FSD (Fixed Shroud Duplex) connector interface
- Field keyable case polarized for singlemode connector
- Internally shielded plastic package with low EMI/RFI emission
- Single power supply
- Compatible with all standard FDDI chip sets

Specifications subject to change.

Small Outline Transmitter and Receiver 16-Pin 200 Mb/s Modules



The AMP 200 Mbits/s Small Outline Transmitter and Receiver provide for 1300 nm wavelength high-speed transmission over 62.5/125 µm multimode optical fiber.

Product Facts

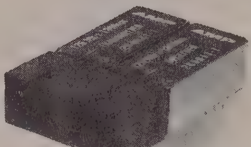
- 10 Mbits/s to 200 Mbits/s NRZ operation
- 16-pin multisourced packages
- ST-Style optical connector interface
- Single +5 V power supply

Applications

- High Speed Channel Extenders
- Low Cost Peripheral Link
- Channel Extenders
- Backbone

Note: RSD 200 Mb/s Transceiver also available

Small Outline SC DUPLEX FDDI Transceiver

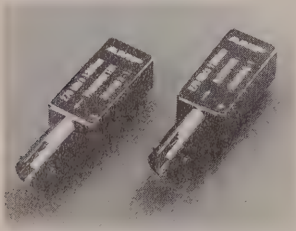


AMP SC DUPLEX Transceivers offer full functionality, for FDDI and related Data Link applications, in a new multisourced high density footprint.

Product Facts

- New multisourced footprint
- SC DUPLEX interconnect
- Compatible with all standard FDDI chip sets
- Single power supply
- Temperature compensated output
- Full FDDI 2 km budget performance
- Compatible with 10H, 10K and 100K raised ECL

Small Outline Transmitter and Receiver 16-Pin Fiber Channel Modules



AMP small outline 16-pin data links offer full functionality for 270 Mbits/s Fiber Channel applications.

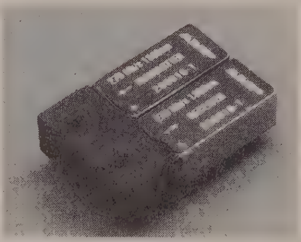
Product Facts

- 10 Mbits/s to 270 Mbits/s NRZ operation
- 16-pin small outline footprint
- Full FC-0 1 km budget performance at 270 Mbits/s per 25-M6-LE-1
- Single power supply
- ST-Style optical connector interface

Applications

- Fiber Channel FC-0
- Point to Point High Speed Serial Links
- Channel Extenders
- Backbone

Small Outline SC DUPLEX Fiber Channel Transceiver



AMP SC DUPLEX Transceivers offer full functionality, for Fiber Channel and related Data Link applications, in a new multisourced high density footprint.

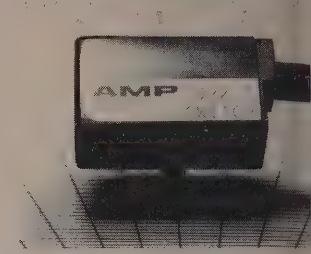
Product Facts

- New multisourced footprint
- SC DUPLEX interconnect
- Compatible with all standard Fiber Channel chip sets
- Single power supply

Applications

- Fiber Channel FC-0
- Point to Point Links for Peripheral I/O, PBX Internode Links, Multiplexers, Clock Distribution, Multi-processors
- Active Star Networks

Latching and Nonlatching Fiber Optic Switches



Single-pole, double-throw (SPDT) and double-pole double-throw (DPDT) switches permit the transfer of optic signals from an input fiber to either of two output fibers without significant loss. These miniature switches are well-suited to printed circuit board mounting.

Fiber Optic Switch Base Part Numbers

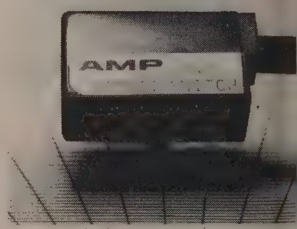
Style	Electrical Interface	Connector	Pigtail Options			
			1 x 2 SPDT, Low Proifle		Dual 1 x 2 DPDT	
			1.2 mm Loose Tube	3 mm Jacket	1.2 mm Teflon	3 mm Cable
Latching	Bent Pin	None	99400	99401	99961	99962
		ST-Style	99412	99413	99963	99964
		FSMA II	—	—	99965	99966
	Straight Pin	None	99418	99419	99967	99968
		ST-Style	99424	99425	99969	99970
		FSMA II	—	—	99971	99972
Nonlatching	Bent Pin	None	99402	99403	99973	99974
		ST-Style	99414	99415	99975	99976
		FSMA II	—	—	99977	99978
	Straight Pin	None	99420	99421	99979	99980
		ST-Style	99426	99427	99981	99982
		FSMA II	—	—	99983	99984

Dash Numbers

Fiber Size (µm)		
50/125	62.5/125	100/140
-1	-2	-3

Part Numbers
To determine a part number, select a base part number that describes the desired switch style. Add dash number suffix from the dash number table to specify fiber size.

Fiber Optic Bypass Switches



Fully reversing FDDI bypass switches provide bypass protection for token-passing, fiber optic ring networks per IEEE 802.5 and ANSI FDDI standards. A "self-test path" permits testing the node's transmitter against its receiver when the switch is in the bypass mode.

FDDI, Low Profile, 2 x 2 Fully Reversing Bypass Switches

Electrical Interface	Connector	Pigtail Options	
		1.2 mm Loose Tube	3 mm Jacket
Bent Pin	None	99404	99405
	ST-Style	99416	99417
Straight Pin	None	99422	99423
	ST-Style	99428	99429

Note: Use dash number table above to specify fiber size

Applications

- Logical ring networks
- FDDI installations

Specifications subject to change.

Call 1-800-522-6752 for product informatio
and 1-800-722-1111 for tooling informatior

For more information request Catalog 82188

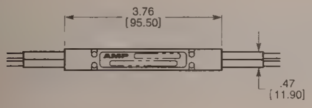
ultimode Couplers

ultimode, bi-directional couplers split and ombine light from fibers without significant loss. hese branching devices are used in pplications of optical busses, communication nd local area networks, and test/sensor ystems.

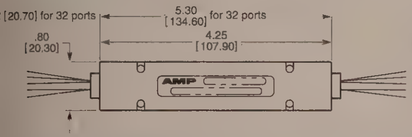
art Numbers

o determine a part number, select a base part umber that describes the desired coupler style. dd dash number prefix and/or suffix from the ash number table to specify connectors and/or ber size.

-Port Coupler Heavy-Duty Package



tar Coupler Heavy-Duty Package



ase Part Numbers

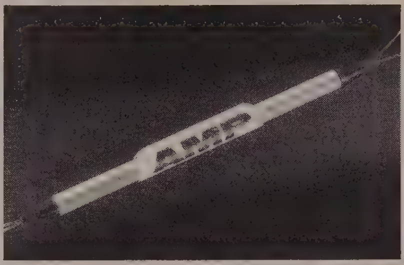
Size	Heavy-Duty Package	
	Medium-Duty Pigtail 19.7 [.5 m] length	Heavy-Duty Pigtail 39.4 [1 m] length
1 x 2	—	502324
2 x 2	—	502325
1 x 4	502424	95013
4 x 4	502420	95010
1 x 8	502425	95014
8 x 8	502421	95011
1 x 16	502426	95015
16 x 16	502422	95012
1 x 32	502427	Not Available
32 x 32	502423	Not Available

ash Numbers

Connector	Fiber Size (μm)			
	50/ 125	62.5/ 125	85/ 125	100/ 140
.5 mm Bayonet (ST-Style)	-8	-3	-9	-4
SMA I (905-Style)	-13	-11	-14	-12
SMA II (906-Style)	-5	-1	-6	-2

ther connectors available. Also available w/o nnectors.

Singlemode Wideband Coupler/Splitter



Couplers are available in a wide range of styles and sizes to split and combine light without significant loss. These branching devices are used in applications of subscriber loop, broadband communication networks, and test/sensor systems.

Applications

- Communication system branching and duplexing (video and sensors)
- CATV
- Subscriber loop
- Taps for signal monitoring
- Test equipment

Note: Contact AMP for the full range of split ratios, package styles, specifications and connector types.

Wavelength Division Multiplexers (WDMs)

MULTIMODE MUX
AMP
S/M MUX

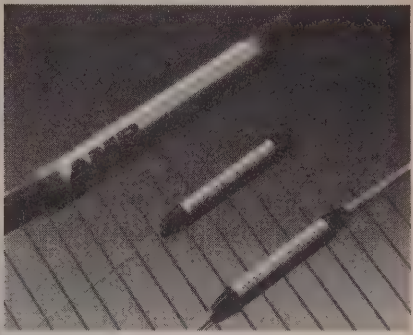
Multiplexers allow use of a single fiber for simultaneous transmission of two signals of different wavelengths (colors). They combine two signals for output onto a single fiber. Demultiplexers separate the combined wavelengths from the single fiber into individual fibers. They are available both for multimode as well as singlemode applications.

Note: Contact AMP for information on the complete line of WDMs and the various package styles, performance levels and connector options available.

Applications

- ISDN subscriber loop
- Long-haul telecommunication
- Multichannel video
- Broadband multichannel communication
- Terminal and telephone communication
- High-speed, computer-to-peripheral links
- Two-way, single-fiber CATV links
- CCTV
- LAN, MAN & WAN

Fixed Optical Fiber Attenuator 1310 or 1550 nm ±40 nm; 1200-1600 nm Broadband



In-Line Fixed Attenuators may be used to reduce optical intensity without introducing additional system noise or back reflections. The in-line fixed attenuator is wavelength insensitive and is used over a wide range of optical sources.

Product Facts

- Singlemode fiber
- Passive all-fiber design
- No additional back reflection noise
- In-line style
- Compact package
- Easily installed
- Environmentally stable

Singlemode Variable Attenuator

Part Number 107059

AMP's singlemode variable attenuator is a passive in-line component. It reduces optical power without introducing back reflection.

Product Facts

- Extremely low back reflection
- Completely bi-directional operation
- Temperature stable over range -40°C to +75°C
- Slimline design allows dense mounting and easy access to adjustment screw
- Wide range of connector and pigtail options

Dash Numbers for Connector Option	Part Number 107059
None	-1
2.5 mm Threaded (FC/PC)	-2
2.0 mm Threaded (D4)	-3
Biconic	-4
AMP SC	-5
ST-Style	-6
Super FC/PC	1- -2
Super D4	1- -3
Super AMP SC	1- -5

Part Numbers

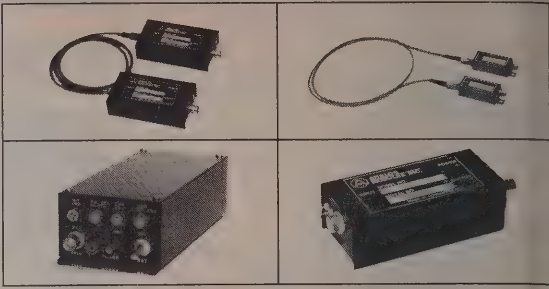
From table above, select dash number prefix and/or suffix to specify connectors.

Specifications subject to change.

Call 1-800-522-6752 for product information and 1-800-722-1111 for tooling information.

ANALOG MODULES, INC.

Specialists in Analog Electronics and Electro-Optics



Analog Modules, Inc. is a leader in analog electronics and electro-optic products. Since 1979, we have continued to provide solutions to otherwise difficult transmitter/receiver problems. Call our applications staff today to discuss your requirements.

- ■ **ANALOG FIBER-OPTIC LINKS**
- ■ **LED AND LASER DIODE DRIVERS/TRANSMITTERS**
- ■ **PHOTODETECTOR — AMPLIFIER MODULES**
- ■ **CUSTOM MODULES (MIL SPECS AVAILABLE)**

ANALOG FIBER OPTIC LINKS

Model	Type	Link 1. Bandwidth	Input TX 2. Output Rx	Dynamic Range (Min)	Wave-length	Supply Voltage (V)	Pkg. Dim. (Inches)	Special Features
731Tx	Analog	.005Hz-100MHz	0 to 1V (50Ω)	52db (voltage) peak signal to rms noise	780nm	+/- 15	3.5 x 2.03 x 0.92	High speed link with 1.2% THD typical. Adjustable scale factor and offset at Receiver.
731Rx	Analog		0 to 1V (into 50Ω)			+/- 15	3.5 x 2.03 x 0.92	
732Tx	Analog/Digital	DC-10MHz	±2.5V or 0-5V(50Ω)	55db (voltage) peak signal to rms noise	850nm	+/- 12	2.96 x 1.0 x 0.61	Transparent transmission of DC and AC information, Vin = Vout. No coding needed for digital use. Adjustable scale factor and offset at receiver.
732Rx	Analog/Digital		±2.5V or 0-5V (into 1KΩ)			+/- 12	2.96 x 1.0 x 0.61	

1. **Model 731** Tx/Rx offers DC restoration as an option. Other Bandwidths available. 2. Other Input/Output ranges available.

LED AND LASER DIODE DRIVERS/TRANSMITTERS

Model	Type	Pulse Rate	Output Current	Current Risetime	Pulse Width	Diode Voltage	Noise (A/√Hz)	Supply Voltage (V)	Pkg. Dim. (Inches)	Special Features
761	Laser Tx	To 100KHz	2 to 50	1 to 70nS	4 to 100nS	5-15V	N/A	+15 to +28 or 115VAC	6.016 x 1.5 diameter	Fast current risetime and tube mount design for easy alignment.
774	LED Tx	DC	5-100mA	DC	Continuous	10V	35pA	+24	3.12 x 1.5 x 1.09	Low noise current source for detector biasing or LED/Laser diode drive, 35 pA/√Hz over 40MHz bandwidth.
775	LED Tx	DC-100MHz	0-150mA	4nS	Set by control I/P	5V	2nA	-15	3.12 x 1.5 x 1.09	Wideband, programmable, current source for LED/Laser diode drive.
776	Laser Tx	100Hz-6KHz	10 to 50	70nS	100nS-1μS	15V	N/A	+28 or 115VAC	6.016 x 1.5 diameter	Longer pulsewidths and short current risetime with tube mount design for easy alignment.
778	Laser Tx	15Hz-1KHz	1-100	0.5 or 5μS	50μS-1mS Standard	20V	N/A	+12 to +28	7.38 x 3.1 x 2.0	High Power laser diode pulser, pulsewidths to 1 mS and duty factor >5%. Available in various voltage/current configurations.

PHOTODETECTOR—AMPLIFIER MODULES

Model	Input Photo-detector	Amplifier Type	Frequency 1. Response	Gain (V/W)	Noise (W√Hz)	Output Load (Ω)	Dynamic Range (Voltage)	Supply Voltage (V)	Pkg. Dim. (Inches)	Special Features 2.
711	Si, InGaAs	311	DC-1.5MHz	77V/nW to 0.5V/μW	0.1fW	50	> 45db	+/-15	3.12 x 1.5 x 1.09	Choice of various pin and APD detectors
712A	Si, InGaAs	312A	200Hz-80MHz	.05-7V/μW	9fW	50	> 45db	+15	3.5 x 2.03 x 0.92	Choice of various pin and APD detectors
713A	Si, InGaAs	313A	200Hz-300MHz	7.4-1500V/mW	0.1pW	50	> 45db	+15	3.5 x 2.03 x 0.92	Choice of various pin and APD detectors

1 DC response also available. 2. **Model 521** HV Power Supply and **Model 522** temperature compensated HV power supply available for APD photobiasing.

Also Available from Analog Modules, Inc.:

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- ■ **LASER RANGEFINDER ELECTRONICS**
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EXFO
Electro-Optical Engineering

FIBEROPTIC TEST INSTRUMENTS

EXFO
Electro-Optical Engineering

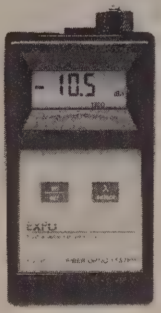
465 Godin Ave., Vanier, Quebec, Canada G1M 3G7 Fax:418-683-2170 **Tel.: 1-800-663-EXFO**

EXFO manufactures a complete line of fiberoptic test equipment for every application: network installation (LAN, WAN, ISDN, FDDI), telephony, manufacturing, laboratory etc. This page presents only a few of our high quality reputable instruments. Call now for more details.

FAX US THIS AD WITH YOUR NEXT ORDER AND GET A 2 % DISCOUNT

RUGGED POWER METERS: FOT-10 & FOT-20

- EXFO's most affordable meters.
- Perfect for LAN and FDDI.
- Measure at 3 wavelengths (630/820/850 or 850/1300/1550).
- Calibrated electronically for maximum reliability.
- Large dynamic range: +3 to -55 dBm.
- CATV (high power) version available.
- FOT-10 reads in dBm, FOT-20 reads in dB, dBm, and Watts.
- Comes with AC adapter, case, connector-adapter and battery.
- Pocket size: 5 3/4 x 3 1/8 x 1 1/2 in.
- Delivery from stock, from $495.00.



FOT-10

FOT-20

FOT-30

ATTENUATION TESTERS

Low cost attenuation meter (FOT-30)

- Source and meter in one instrument.
- Designed for bi-directional or loop-back testing.
- Performance and features of FOT-20.
- Choice of general purpose LED source: 850, 1300 or 1550 nm.
- Rugged, pocket size 6 x 3 1/4 x 1 3/8 in.
- Stock to 2 weeks, from $995.00.

HIGH PERFORMANCE TEST SET: FOT-50

- +3 to -70 dBm range, ± 0.2 dB accuracy.
- Reads in dB, dBm, and Watts.
- Optimal Singlemode or multimode source (850, 1300 or 1550 nm).
- RS-232 interface in option.
- Stores one reference for each wavelength.
- Measures at 20 wavelengths.
- Rechargeable battery, charger, case and connector-adapter included.
- Widely accepted by telephone companies.
- CATV version available.
- Compact, impact resistant casing 7 x 3 7/8 x 1 7/8 in.
- Delivery from stock, from $950.00.

FOT-50

LED AND LASER LIGHT SOURCES:

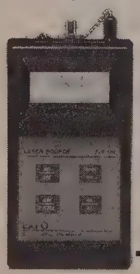
FOS-120

Inexpensive LED source (FOS-120)

- Choice of 850, 1300, 1550 and 850/130 nm.
- Two output powers: Low and High.
- Continuous or pulsed (2 kHz) transmission.
- Can be used for fiber identification purposes.
- Provided with ST, SC SMA or FC connectors.
- Singlemode or multimode applications.
- Small and light weight for maximum portability 5 3/4 x 3 1/8 x 1 1/2 in.
- Delivery from stock, from $495.00.

Low cost laser source (FLS-130)

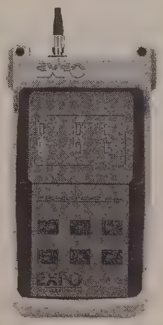
- Same features as FOS-120 except:
- Transmits at 1300, 1550 and 1300/1550.
- Connectors are ST and FC.
- Delivery from stock, from $1095.00.



FLS-130

VISUAL FAULT LOCATOR: FLS-230A

- Bright laser light at 650 nm (0.95 mW) shows through fiber jacket.
- Pinpoints faults, poor splices and connections, bends, etc.
- 2 output powers: Low (saves batteries) and High (maximum visibility).
- Operates on AC charger, NiCd or alkaline battery.
- Auto off to extend battery life.
- Sold with protective holster, charger, strap, stand and case.
- Delivery from stock, from $1795.00.



FLS-230A

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	D•2221
Batteries, Product Selection Guide	D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	C•1003
Capacitors, Product Selection Guide	A•1003
Coils, Chokes, Inductors, Product Selection Guide	A•1179
Connectors, Terminals & Sockets, Product Selection Guide	C•1139
Cores, Magnets & Ferrites	A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	A•1326
DC-DC Converters	D•2049
DC Power Supplies, Product Selection Guide	D•1488
Delay Lines, Product Selection Guide	A•1513
Discrete Semiconductors, Product Selection Guide	A•2130
Displays, Readouts, & CRTs, Product Selection Guide	B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	C•1557
Fiber Optics, Product Selection Guide	B•1200
Filters, Power, Product Selection Guide	A•1584
Filters, Signal, Product Selection Guide	A•1617
Instruments, Test & Measuring, Product Selection Guide	D•1215
Interconnection Systems, Product Selection Guide	C•1670
Keyboards & Keypads, Product Selection Guide	B•1818
Lamps, Lights, & Indicators, Product Selection Guide	B•1131
Microwave Components, Product Selection Guide	A•1719
Military Qualified Products List	B•1002
Motors, Drives, & Rotating Components, Product Selection Guide	B•1231
Oscilloscopes, Product Selection Guide	D•1402
Panel Hardware, Product Selection Guide	C•1522
Panel Meters, Analog & Digital, Product Selection Guide	D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	A•2053
Power Supplies, AC, Product Selection Guide	D•2221
Power Supplies, DC, Product Selection Guide	D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	B•1341
Relays, Product Selection Guide	B•1401
Resistors, Product Selection Guide	A•1859
Solenoids, Product Selection Guide	B•1626
Switches, Product Selection Guide	B•1658
Thermal Components, Product Selection Guide	B•1857
Transducers & Encoders, Product Selection Guide	B•1911
Transformers, Product Selection Guide	A•2229
Wire & Cable, Product Selection Guide	C•1701

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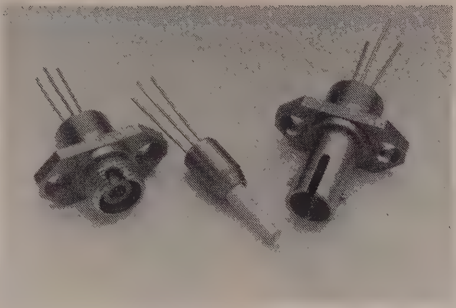
FIBEROPTIC COMPONENTS

aser Diode, Inc. is leading manuacturer in the opto-electronics ndustry with over 25 years of expeience. The Company designs and roduces electro-optic semiconducor materials, components and subystems for applications in telecomnunications such as SONET, data ommunications, avionics, sensors, nd other applications requiring igh reliability, quality, and dvanced performance.



Laser diode packages: FC/PC receptacle, pigtailed coax and ST receptacle

1300nm, 1500nm and 830nm Lasers

Laser Diode's series of long wavelenth lasers consist of an InGaAsP buried crescent laser chip coupled to a singlemode or multimode fiber pigtail.

Light Emitting Diodes

Laser Diode manufactures many models of both edge and surface emitting LEDs. These devices are available at wavelengths of 1300, 1550 and 830nm, and are supplied in dual in-line (DIL), FC/ST receptacles, or coaxial pigtail packages.

300nm, 1550nm & 830nm LASERs

Model~	Wavelength (nm)	Min. Pwr. (mW)	Thresh. current (mA)	Modulation current (mA)	Spectral width (nm)	Rise/fall time (ns)	Fiber or conn. type
300nm LASER's – Cooled 14 pin DIP							
CW 1301-001	1270-1330	0.25	20	30	3	0.5	9/125
CW 1301-003	1270-1330	1.0	20	30	3	0.5	9/125
CW 1301-004	1270-1330	2.0	20	50	3	0.5	9/125
CW 1311-003	1270-1330	1.0	20	30	1.7nm rms max	0.5 (max)	9/125
CW 1301-001	1270-1330	1.0	20	30	3	0.5	50/125
CW 1301-003	1270-1130	4.0	20	30	3	0.5	50/125
Uncooled 14 pin DIP							
CW 1301-001	1270-1330	0.15	20	30	3	0.5	9/125
CW 1301-003	1270-1330	0.50	20	30	3	0.5	9/125
Pigtailed Coax							
CW 1306-025	1270-1330	0.25	20	30	3	0.5	9/125
CW 1306-100	1270-1330	1.0	20	30	3	0.5	9/125
Receptacle							
CW 1308-025	1270-1330	0.25	20	30	3	0.5	FC/PC
CW 1308-100	1270-1330	1.0	20	30	3	0.5	FC/PC
CW 1328-025	1270-1330	0.25	20	30	3	0.5	ST
CW 1328-100	1270-1330	1.0	20	30	3	0.5	ST
1550nm LASERS – Cooled 14 pin DIP							
CW 1501-001	1520-1580	0.25	20	30	3	0.5	9/125
CW 1501-003	1520-1580	1.0	20	30	3	0.5	9/125
CW 1501-001	1520-1580	1.0	20	30	3	0.5	50/125
CW 1501-002	1520-1580	2.0	20	30	3	0.5	50/125
Uncooled 14 pin DIP							
CW 1501-001	1520-1580	0.1	20	30	3	0.5	9/125
CW 1501-003	1520-1580	0.5	20	30	3	0.5	9/125
Pigtailed Coax							
CW 1506-025	1520-1580	0.25	20	30	3	0.5	9/125
CW 1506-050	1520-1580	0.50	20	30	3	0.5	9/125
Receptacle							
CW 1508-025	1520-1580	0.25	20	30	3	0.5	FC/PC
CW 1508-050	1520-1580	0.50	20	30	3	0.5	FC/PC
CW 1528-025	1520-1580	0.25	20	30	3	0.5	ST
CW 1528-050	1520-1580	0.50	20	30	3	0.5	ST
830nm LASER's							
CW 8300	800-850	5.0	80	20	1.5	0.5	–
Cooled 14 pin DIP							
CW 8301-001	800-850	2.0	80	20	1.5	0.5	50/125
CW 8301-002	800-850	3.0	80	20	1.5	0.5	50/125

pical values unless otherwise noted.

1300nm & 1550nm ELEDs

Model	Peak Wavelength (nm)	Min. Pwr. (μW)	Max. Drive Current (mA)	Spectral width (nm)	Rise/fall time (ns)	Fiber or conn. type
1300nm EDGE EMITTING LED's – Uncooled 14 pin DIP						
LDT-362-001	1270-1330	40	150	70	4	50/125
LDT-362-003	1270-1330	150	150	70	4	50/125
LDT-60005-001	1270-1330	4	150	70	4	9/125
LDT-60005-003	1270-1330	50	150	70	4	9/125
Cooled 14 pin DIP						
LDT-362E-001	1270-1330	40	150	70	4	50/125
LDT-362E-003	1270-1330	150	150	70	4	50/125
LDT-60005E-001	1270-1330	4	150	70	4	9/125
LDT-60005E-003	1270-1330	50	150	70	4	9/125
Pigtailed Coax						
IRE-1306-020	1270-1330	20	150	70	4	9/125
IRE-1326-100	1270-1330	100	150	70	4	50/125
Receptacle						
IRE-1308-008	1270-1330	8	150	70	4	FC/PC
IRE-1308-012	1270-1330	12	150	70	4	FC/PC
IRE-1328-008	1270-1130	8	150	70	4	ST
IRE-1328-012	1270-1330	12	150	70	4	ST
1550nm EDGE EMITTING LED's – Uncooled 14 pin DIP						
IRE-1502-001	1520-1580	4	150	90	4	9/125
IRE-1502-004	1520-1580	20	150	90	4	9/125
IRE-1522-002	1520-1580	40	150	90	4	50/125
IRE-1522-003	1520-1580	60	150	90	4	50/125
Cooled 14 pin DIP						
IRE-1502E-001	1520-1580	4	150	90	4	9/125
IRE-1502E-003	1520-1580	12	150	90	4	9/125
Pigtailed Coax						
IRE-1506-008	1520-1580	8	150	90	4	9/125
IRE-1526-080	1520-1580	80	150	90	4	50/125
Receptacle						
IRE-1508-008	1520-1580	8	150	90	4	FC/PC
IRE-1508-012	1520-1580	12	150	90	4	FC/PC
IRE-1528-008	1520-1580	8	150	90	4	ST
IRE-1528-012	1520-1580	12	150	90	4	ST

Typical values unless otherwise noted.

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FIBEROPTIC COMPONENTS

Surface Emitting LED's

SLED's offer stable performance over temp. Custom submounts available

Model	Peak Wave-length (nm)	Min. Pwr (µW)	Forward current (mA)	Special width (nm)	Rise/Fall time (ns)	Fiber or connector type
IRE-160-004	810-850	100	100	55	12	–
IRE-160-005	810-850	165	100	55	12	–
IRE-160FB	810-850	60	100	55	12	50/125
IRE-331-002	810-850	10	100	55	12	SMA
IRE-331-005	810-850	25	100	55	12	50/125
IRE-832-051	810-850	80	100	60	4/6	50/125
IRE-832-100	810-850	750	100	60	4/6	100/140
IRE-832E-051	810-850	80	100	60	4/6	50/125
IRE-832E-100	810-850	750	100	60	4/6	100/140

Pulsed Laser Diodes

Ideal for fiberoptic test and measurement equipment.

Model	Wave-length (nm)	Min. Peak Power (mW)	Thresh. current (mA)	Modula-tion current (mA)	Spectral width (nm)	Rise/Fall time (ns)	Fiber or connector type
QPS 123-001	1270-1330	10	30	120	3	0.5	9/125
QPS 123-002	1270-1330	20	30	150	3	0.5	9/125
QPM 123-001	1270-1330	70	30	150	3	0.5	50/125
QPS 125-001	1520-1580	10	40	140	3	0.5	9/125
QP 106-001	1059-1069	30	1000	2500	4	1	100/140

PIN Diodes

LDI PIN diodes feature low noise and high responsivity over a wide operating temperature range.

Model	Wave-length (nm)	Respon-sivity (A/W)	Diameter (µm)	Rise/fall time (ns)	Fiber or connector type
Submounts					
LPD 0081	800-1700	0.8	75	0.5	–
LPD 0101	800-1700	0.8	100	0.5	–
LPD 0301	800-1700	0.8	300	0.5	–
TO-46					
LPD 1080	800-1700	0.8	75	0.5	–
LPD 1100	800-1700	0.8	100	0.5	–
LPD 1101	800-1700	0.8	100	0.5	–
LPD 1300	800-1700	0.8	300	0.5	–
LPD 1301	800-1700	0.8	300	0.5	–
Receptacle					
LPF 2100	800-1700	0.8	100	0.5	FC
LPS 2100	800-1700	0.8	100	0.5	ST
Pigtailed Coax					
LCP 3080	800-1700	0.8	75	0.5	50/125/900
LCP 3101	800-1700	0.8	100	0.5	62.5/125/900

Typical values unless otherwise noted.

Super Radiant Diode's

Ideal for fiberoptic gyroscope and optical sensor applications.

Model	Peak Wave-length (nm)	Min. Pwr (mW)	Forward current (mA)	Modula-tion depth (%)	Spectral width (nm)	Rise/fall time (ns)	Fiber or connec. type
SRD 8301-001	810-840	0.5	140	60	20	1.0/2.0	5/125
SRD 8301-PPF-001	810-840	0.5	140	60	20	1.0/2.0	5/125*
SRD 1302-001	1270-1330	0.30	10	75	25	2.0/3.0	9/125
SRD 1302-002	1270-1330	0.50	150	75	25	2.0/3.0–	9/125
SRD 1302-PPF-001	1270-1330	0.30	100	75	25	2.0/3.0	9/125*
SRD 1302-PPF-002	1270-1330	0.50	150	75	25	2.0/3.0	9/125*

Pinfet Optical Receivers

These devices provide data rates from 1 Mb/s to 1000 Mb/s, a wide dynamic range to 55 dB, and sensitivities to -55 dBm. A low noise transimpedance design provides optimum performance.

Model	Band-width (MHz)	Data Rate (Mb/s) NRZ	Wave-length	Sen-sitivity (dBm)	Trans-imped-ance (K^{9})	Dyn. Range (dB)	Fiber Pigtail (+m)
14 pin DIP							
LDPF 0004	4	6	1300/1500	–56	1000	27	50/125
LDPF 0024	24	34	1300/1550	–50	330	27	50/125
LDPF 0032	32	45	1300/1550	–49	220	27	50/125
LDPF 0065	65	90	1300/1550	–44	85	27	50/125
LDPF 0120	120	168	1300/1550	–40	32	27	50/125
LDPF 0250	250	350	1300/1550	–35	6	27	50/125
LDPW 0003	3	4	1300/1550	–55	1000	55	50/125
LDPW 0024	24	34	1300/1550	–40	330	49	50/125
LDPW 0036	36	52	1300/1550	–47	140	47	50/125
LDPW 0065	65	90	1300/1550	–43	60	43	50/125
LDPW 0110	110	155	1300/1550	–43	40	40	50/125
LDPS 0052	60	52	1300/1550	–43	40	40	50/125
LDPS 0155	200	155	1300/1550	–37	12	34	50/125
LDPS 0622	450	622	1300/1550	–32	6	29	50/125
LDSF 0250	250	350	800	–31	6	27	100/140
LDPM 0700	700	1000	1300/1550	–29	4.2	23	50/125
LDPM 1000	1000	1300	1300/1550	–27	2.8	21	50/125
Receptacles & Pigtailed Coax							
LDRF 0052	60	52	1300/1550	–43	40	40	FC
LDRS 0052	60	52	1300/1550	–43	40	40	ST
LDRF 0155	200	155	1300/1550	–36	12	33	FC
LDRS 0155	200	155	1300/1550	–36	12	33	ST
LDRF 0622	450	622	1300/1550	–30	6	27	FC
LDRS 0622	450	622	1300/1550	–30	6	27	ST
LDCP 0052	60	52	1300/1550	–43	40	40	50/125
LDCP 0155	200	155	1300/1550	–36	12	33	50/125
LDCP 0622	450	622	1300/1550	–30	6	27	50/125

* Polarization Preserving Fiber

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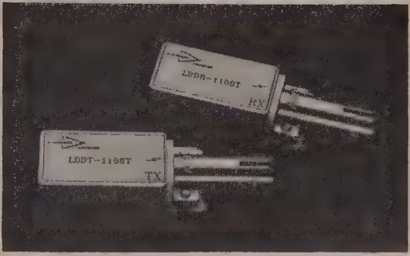
FIBEROPTIC DATA LINKS

Laser Diode, Inc. offers a full range of fiber optic transmitters & receivers which utilize the company's high performance optical components. State of the art hybrid technology is incorporated to achieve products which find applications in advanced systems requiring unique performance, such as burst data operation, or rugged screening to MIL-STD-883C. Transmitters & receivers are available with TTL, ECL or PECL interface. Connectorized or pigtailed units operating over singlemode of multimode fiber are available. Call the Sales department for complete data sheets.



ECL/PECL Laser Transmitters

Wide Temperature uncooled or T.E. cooled options.

Model	Data Rate, Mb/s	Wave-length, nm	Mean Power, dBm
TL1003-013	10-200	1300	–13
TL1003-010	10-200	1300	–10
TL1003-008	10-200	1300	–8
TL1005-013	10-200	1550	–13
TL1005-010	10-200	1550	–10
TL1005-008	10-200	1550	–8
TL1023-013	10-650	1300	–13
TL1023-010	10-650	1300	–10
TL1023-008	10-650	1300	–8
TL1025-013	10-650	1550	–13
TL1025-010	10-650	1550	–10
TL1025-008	10-650	1550	–8
TL1113-004	10-200	1300	–4
TL1115-006	10-200	1550	–6
TL1133-004	10-650	1300	–4
TL1135-006	10-650	1550	–6

TTL Transmitters

Mil-Qualification available.

Model	Data Rate, Mb/s	Wave-length, nm	Mean Power, dBm
TE-3063-027	DC-50	1300	–27[1]
TE-3063-024	DC-50	1300	–24[1]
TE-3065-027	DC-50	1550	–27[1]
TE-3063-017	DC-50	1300	–17[2]
TS-3153-017	DC-50	1300	–17[4]
TS-3158-016	DC-50	820	–16[4]
TL-3110-004	DC-50	1300/1550	–4[1]

NOTES:

[1] Coupled into 9/125μm singlemode fiber

[2] Coupled into 50/125μm multimode fiber

[3] Coupled into 100/140μm multimode fiber

[4] Coupled into 62.5/125μm multimode fiber

TTL Receivers

Continuous or burst data.

Model	Maximum Data Rate, Mb/s	Wave-length, nm	Sensitivity
RT-3404-001	1	1300/1550	–54
RT-3404-010	10	1300/1550	–52
RT-3404-050	50	1300/1550	–46
RT-3408-010	10	820	–49
RT-3444-001	1	1300/1550	–46
RT-3444-010	10	1300/1550	–44
RT-3444-050	50	1300/1550	–36
RT-3448-001	1	820	–42
RT-3448-010	10	820	–40
RT-3448-050	50	820	–32

The RT-344X series is designed for burst data.

SONET/SDH

Multisourced 20 pin package

Model	Data Rate, Mb/s	Wave-length, nm	Mean Power dBm
Transmitters			
TL1163-013	200	1300	–13
TL1163-008	200	1300	–8
TL1165-013	200	1550	–13
TL1165-008	200	1550	–8
Receivers			**Sensitivity**
RT1534-052	52	1300/1550	–45
RT1534-155	200	1300/1550	–38

ECL/PECL LED Transmitters

Ideal for singlemode LED applications.

Model	Data Rate Mb/s	Wave-length, nm	Mean Power, dBm
TE-1063-027	10-160	1300	–27[1]
TE-1065-027	10-160	1550	–27[1]
TE-1063-017	10-160	1300	–17[2]

ECL/PECL Receivers

High sensitivity & single power supply operation.

Model	Data Rate Mb/s	Wave-length, nm	Sensitivity
RT-1504-010	10	1300/1550	–52
RT-1504-052	52	1300/1550	–46
RT-1504-125	125	1300/1550	–39
RT-1504-155	155	1300/1550	–39
RT-1504-270	270	1300/1550	–34
RT-1508-100	100	1300/1550	–38
RT-1524-350	350	1300/1550	–34
RT-1524-565	565	1300/1550	–32.5
RT-1524-622	622	1300/1550	–32
RT-1604-155	155	1300/1550	–38
RP-1704-160	160	1300/1550	–32
RP-1708-100	100	820	–30

Analog Links

D.C. powered modules or 19" rack mounted.

Model	Band Width MHz	Source	Wave-length, nm	Fiber
LDAL-1008	120	SLED	820	MMF
LDAL-1011	125	SLED	1300	MMF
LDAL-1000	125	ELED	1300	SMF
LDAL-1001	125	ELED	1300	MMF
LDAL 1001 R	125	ELED	1300	MMF
LDAL-1200	35	LASER	1300	SMF
LDAL-1210	10	LASER	1300	SMF
LDAL-1400	250	LASER	1300	SMF
LDAL-2200	1200	LASER	1300	SMF
LDAL-2250	600	DFB	1300	SMF

Laser Diode, Inc. 4 Olsen Avenue, Edison, NJ 08820 • Tel: 908/549-9001 • Fax: 908/906-1559

SI UNITS

RELATIVE QUANTITY SYMBOLS

≠	not equal to
≈	approximately equal to
∝	proportional to
<	smaller than
≤	smaller than or equal to
«	much smaller than
>	larger than
≥	larger than or equal to
»	much larger than
≡	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol $^{-1}$	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u, υ	ms^{-1}	—	distance/time
velocity, angular	ω	second^{-1}	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

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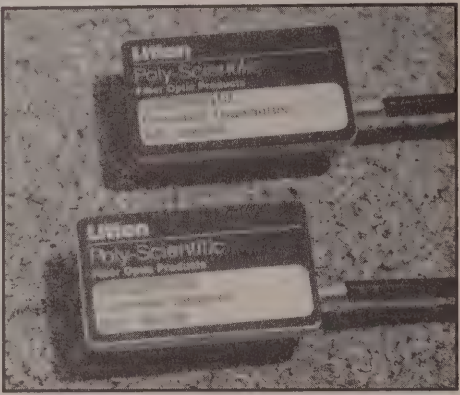
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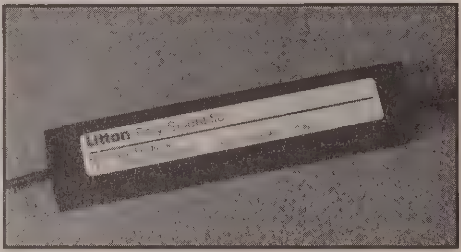
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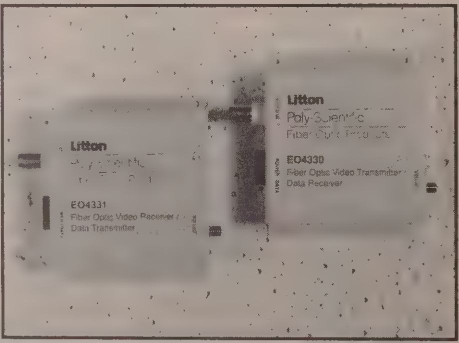
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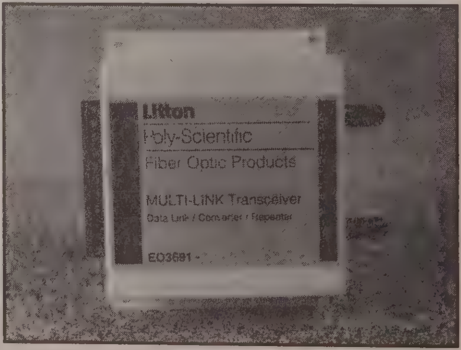
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MULTI-LINK Transceiver
Data Link / Converter / Repeater
EO3691

Transmitters and Receivers

Miniature, Hybridized units for Point-to-Point and Data Bus Applications

AC or Edge-coupled with data rates up to 100 Mbps NRZ. Transmitters with high launch power, and receivers with superior sensitivity and broad dynamic range. Electrical interface compatibility includes PECL, ECL and TTL. Qualifiable to MIL-STD-883. Products specifically designed to meet the requirements of:

- ARINC 629
- ARINC 636
- MIL-STD-1773
- STANAG 3910

Couplers

A full line of couplers is available including singlemode couplers and multimode star couplers. Used in both commercial and military systems, including many applications requiring full MIL specification. Will operate in a temperature range of -55° to 125°C. These couplers are designed to meet environmental conditions for land, shipboard and aircraft.

Video/Data Transceiver Modules

For Security Applications

E04330/4331 sends control information and returns video signals over a single fiber when remote CCTV cameras require pan, tilt and zoom (PTZ) control signals. The video signal portion is compatible with a variety of EIA CCTV standards including RS-170, RS-330 and RS-343. The data portion of the transceiver is capable of transmitting either RS-232, RS-422 or TTL data.

E03691 is an extremely flexible and versatile multiple format digital data transceiver module that functions as a data link/converter/repeater. The unit provides inputs and outputs for RS-232, RS-422 and TTL data format devices, allowing the unit to be used for a variety of control signal applications without the need to stock transceivers for each specific data format.

NEW Litton's new FM video system is capable of providing one to three video channels plus bi-directional voice and data signals over a single fiber. The use of FM technology permits multiplexing of video, data and voice channels on a single fiber. The video portion is compatible with a variety of EIA CCTV standards including RS-170, RS-330, and RS-343. The data portion is capable of transmitting RS-232, RS-485, and TTL data up to 1Mbps. Voice channels provide quality voice communications (300Hz - 3.5KHz)

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Fiber Optic Rotary Joint (FORJ)

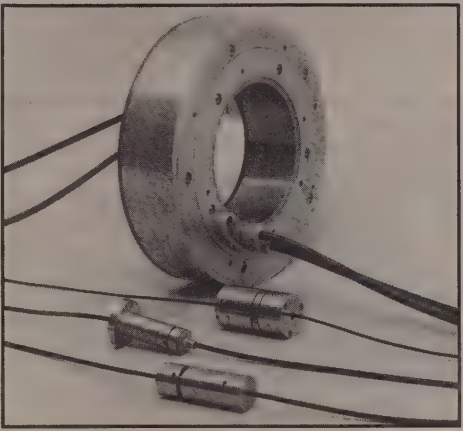
A FORJ is designed to provide a single optical path across a rotating interface. Litton offers several FORJs:

On-Axis: A compact, totally passive single fiber device which occupies the centerline of rotation.

Low Cost: This small unit offers a low cost alternative to our on-axis FORJ.

Off-Axis: A multi-channel active/passive device with 4" bore (for running hydraulic or pneumatic lines, or structural members). Transmitter and receiver are supplied with the FORJ. Data rates up to 50 Mbits/sec.

Single Mode: Provides rotary coupling for single mode fiber links.



Rack-Mounted Transmitter and Receiver Systems

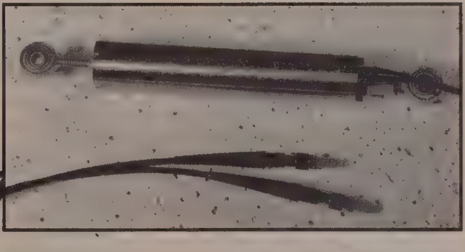
Many of our traditional components are available in modular, 19" rack-mounted versions. Ten bays can accommodate up to twenty standard transmitters and receivers plus a common power supply. Connected to a 110 VAC outlet, it has a master on/off switch and a fuse for protection from overloads.

All connections (electrical and optical) are on the backplate of the modules. SMA receptacles for optical interfaces and BNC connectors for the electrical interface are standard. Other connector interfaces are available upon request.

Optical Sensors

Environmental (pressure, liquid level, vibration, chemical, etc.) and position (rotary and linear) are available. Custom sensors can be designed and manufactured to meet your specific needs.

Also available are sensor systems combining computer control of optically integrated modules containing emitters, detectors, optical splitters, WDMs, filters and spectrum analyzers.



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MINIGLOSSARY
BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In

(CC)	Communication Control
(FE)	Format Effector
(IS)	Information Separator

DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon

<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
—	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C

CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E

EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J

JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K

kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L

LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P

PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

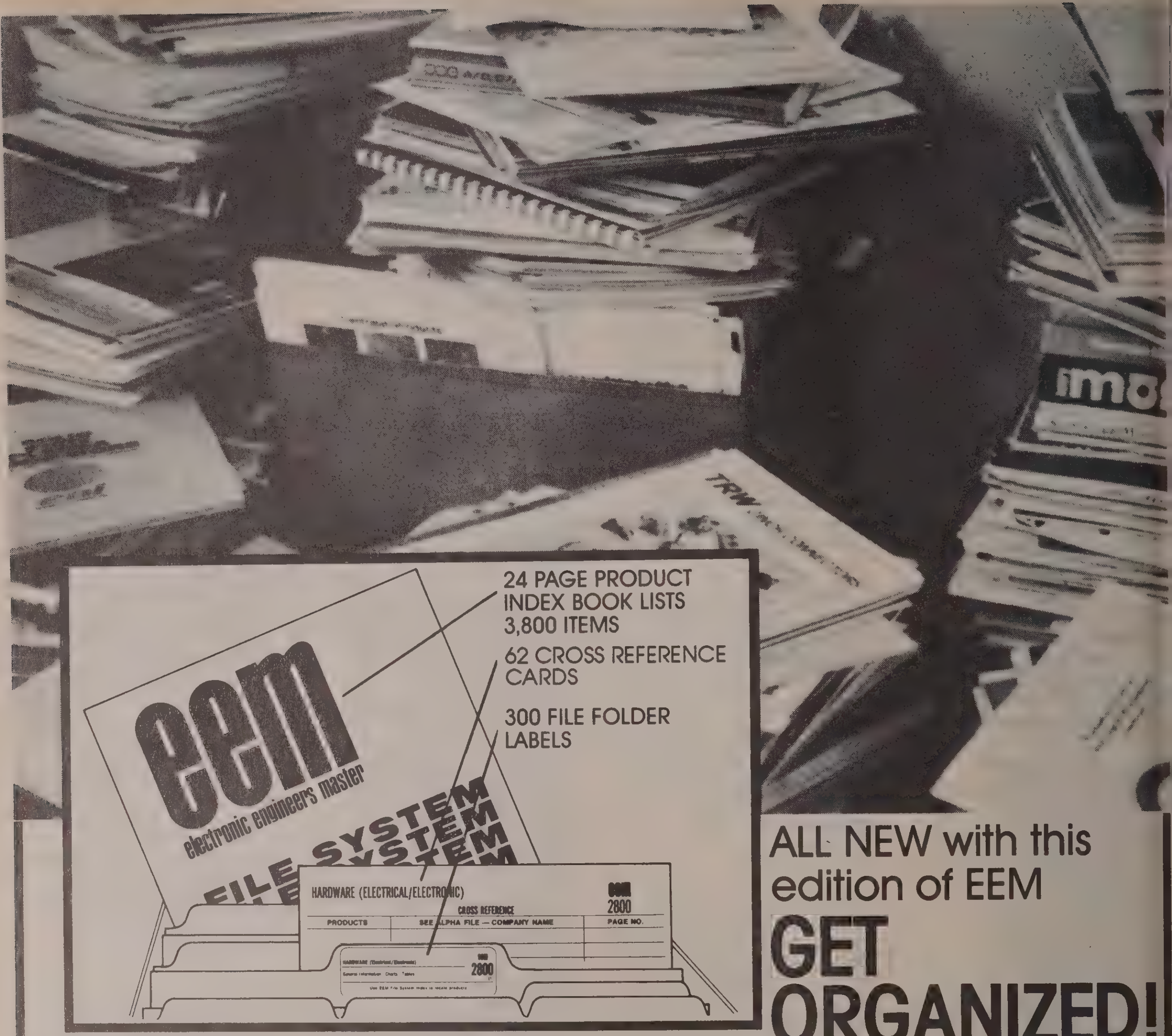
WPS word processing software

Y

YIG yttrium iron garnet

Z

ZIF zero insertion force



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EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

FIBER OPTIC VIDEO, VOICE AND DATA TRANSMISSION PRODUCTS

CALL OPTELECOM
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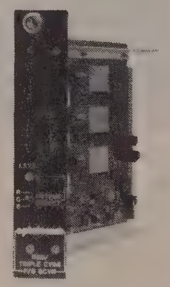
optelecom
FIBER OPTIC
RS232C MODEM
OUT
IN

MODEL 4145
DATA MODEM



MODEL 5052 RRR
RGB CARD

IGH RESOLUTION VIDEO RANSMISSION SYSTEMS

o transmit sharp, flawless high resolution graphics from ne location to another via fiber, Optelecom provides:

- High resolution RGB/VGA video transmission systems that send 75MHz bandwidth video signals 3.5 miles. These units support pixel clock rates up to 120MHz.

ATA COMMUNICATION PRODUCTS

or top of the line data communication products that keep our bottom line looking good, Optelecom offers a wide election of modems and multiplexers that transmit and eceive RS232, RS422, TTL and/or clock signals over one r more fibers.

OPTICAL I/O
DATA/AUDIO
LOOP
SYNC

MODEL 3710AT
VIDEO/VOICE/DATA

VIDEO, VOICE AND DATA TRANSMISSION SYSTEMS

Ideal for CCTV, video conferencing, and broadcast applications, Optelecom's video, voice and data transmission systems send multiple signals in one or both directions over one or more fibers, without crosstalk or interference.These systems use superior PFM technology to transmit high quality signals over a longer distance at a lower cost and include:

- Single fiber transmission systems that combine video, voice and data signals into one optical signal that can be transmitted 12 miles.
- Broadcast quality transmission system that exceeds RS250C medium haul requirements and sends video and audio signals 25 miles over a single fiber.

DEDICATED CUSTOMER SERVICE & SUPPORT

Optelecom's commitment is to provide you with one complete source of fiber optic transmission systems combined with total customer support.

PTELECOM, INC.
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HIGH RESOLUTION RGB/VGA VIDEO TRANSMISSION WITH AUTOMATIC GAIN CONTROL VIA 3 FIBERS

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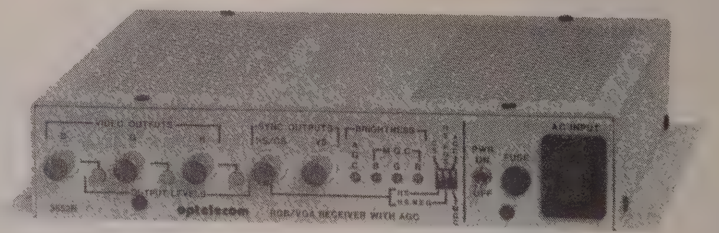

MODEL 3652

Extend the transmission distance of a graphics workstation to 21,000 feet via fiber optics with Optelecom's Model 3652 High Resolution RGB/VGA Video Transmission System. The Model 3652 transmitters and receivers are compact stand alone wall or desk mount units. Front panel switches let the user program the transmitter for sync on all colors, sync on green, or external sync input scenarios. Consult factory for rack mount versions.

POWERFUL ADVANTAGES INCLUDE

- Transmits high resolution RGB or VGA signals 21,000 feet via 3 multi mode fibers.
- Transparent to all VGA modes and software.
- Colors are balanced automatically with AGC circuitry.
- Contains switch selectable inputs for sync on all colors, sync on green, or external sync.
- Transmits 2Hz to 75MHz bandwidth and supports pixel clock rates up to 120MHz.
- Available with SMA or ST™ connectors.

LIST OF MODELS

MODEL		OPTICAL PORT	WAVELENGTH	MAX RANGE* AT FULL BANDWIDTH** OVER 50/125μm OR 62.5/125μm FIBER
TRANSMITTER	RECEIVER			
3652T-S-SM	3652R-S-SM	SMA	850nm	1,500′ @ 50MHz
3652T-S-ST	3652R-S-ST	ST	850nm	1,500′ @ 50MHz
3652T-H1-SM	3652R-S-SM	SMA	850nm	1,000′ @ 75MHz
3652T-H1-ST	3652R-S-ST	ST	850nm	1,000′ @ 75MHz
3652T-L1-ST	3652R-L-ST	ST	1310nm	21,000′ @ 75MHz

** Bandwidth limited by chromatic and modal dispersion in the fiber.*
***Distance based on 3dB/km at 865nm and 1.5dB/km at 1310nm, including a 3dB safety margin.*

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REAL TIME VIDEO AND BI-DIRECTIONAL VOICE AND DATA TRANSMISSION OVER LONG DISTANCES VIA ONE FIBER

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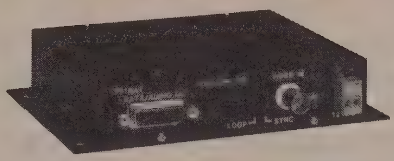

MODEL 3710AT

Transmit and receive real time video and bi-directional voice and data signals 12 miles over a single fiber with Optelecom's Model 3710A and Model 5710A fiber optic transmission system. Using superior PFM technology, these units operate without adjustment and are versatile and easy to install.

The Model 3710A is a compact, stand alone unit. The Model 5710A is a circuit card that plugs into Optelecom's System 5000 chassis.

POWERFUL ADVANTAGES INCLUDE

- Transmits 12 miles (20km), depending on the model.
- Transmits composite video in one direction and audio and RS232, RS422, or TTL/CMOS compatible data signals in both directions over a single optical fiber, without crosstalk or interference.
- Supports 4KHz audio bandwidth, DC to 19.2 baud data rate (up to 3 channels).
- Uses PFM, FDM, and PCM techniques for high quality, adjustment free operation.
- Available with SMA, ST™ or FC connectors.

LIST OF MODELS

MODEL		OPTICAL PORT	WAVELENGTH		BANDWIDTH** OVER	
TRANSMITTER	RECEIVER		TX to RX	RX to TX	50/125μm FIBER	SINGLE MODE FIBER
3710AT-H1-SM-S-62 5710AT-H1-SM-S-62	3710AR-S-SM-S-62 5710AR-S-SM-S-62	SMA	865nm	850nm	1.8km*	N/A
3710AT-H1-ST-S-62 5710AT-H1-ST-S-62	3710AR-S-ST-S-62 3710AR-S-ST-S-62	ST	865nm	850nm	1.8km*	N/A
3710AT-L-SM-S-62 5710AT-L-SM-S-62	3710AR-L-SM-S-62 5710AR-L-SM-S-62	SMA	1300nm	850nm	6km*	N/A
3710AT-L-ST-S-62 5710AT-L-ST-S-62	3710AR-L-ST-S-62 5710AR-L-ST-S-62	ST	1300nm	850nm	6km*	N/A
3710AT-L1-ST-S-62 5710AT-L1-ST-S-62	3710AR-L-ST-L-62 5710AR-L-ST-L-62	ST	1300nm	1300nm	8km*	N/A
3710AT-L2-ST-L-09 5710AT-L2-ST-L-09	3710AR-L-ST-L1-09 5710AR-L-ST-L1-09	ST	1300nm	1300nm	N/A	20km*
3710AT-L2-FC-L-09 5710AT-L2-FC-L-09	3710AR-L-FC-L1-09 5710AR-L-FC-L1-09	FC	1300nm	1300nm	N/A	20km*

** Limited by chromatic and modal dispersion in the fiber.*

***Distance based on 3dB/km at 865nm and 1.5dB/km at 1310nm, including a 3dB safety margin.*

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VIDEO AND AUDIO TRANSMISSION VIA A SINGLE FIBER

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Transmit and receive 10MHz bandwidth video and 50KHz audio signals up to 20km over a single fiber with Optelecom's Model 3257 and Model 5057. The Model 3257 transmitters and receivers are small stand alone units and the Model 5057 are circuit cards that plug into Optelecom's System 5000 chassis. All units use band limited Pulse Frequency Modulation or "square wave FM" techniques to transmit video and audio on two different FM carrier frequencies. These techniques provide adjustment free operation over a wide dynamic range.

POWERFUL ADVANTAGES INCLUDE

- Transmits high quality composite or monochrome video and audio signals up to 20km, depending on the model, over a single optical fiber. Consult factory for longer distance versions.
- Wide dynamic range (22dB).
- PFM (pulse frequency modulation) techniques eliminate the need for Automatic Gain Control (AGC) circuitry.
- 10MHz video bandwidth, 50KHz audio bandwidth.
- Available with SMA, ST™ or FC connectors.

LIST OF MODELS

MODEL		OPTICAL PORT	WAVELENGTH	TYPICAL TRANSMISSION RANGE**	
TRANSMITTER	RECEIVER			50/125μm FIBER	SINGLE MODE FIBER
3257T-S-SM 5057T-S-SM	3257R-S-SM 5057R-S-SM	SMA	850nm	1.8km*	N/A
3257T-S-ST 5057T-S-ST	3257R-S-ST 5057R-S-ST	ST	850nm	1.8km*	N/A
3257T-H1-SM 5057T-H1-SM	3257R-S-SM 5057R-S-SM	SMA	865nm	1.8km*	N/A
3257T-H1-ST 5057T-H1-ST	3257R-S-ST 5057R-S-ST	ST	865nm	1.8km*	N/A
3257T-L-SM 5057T-L-SM	3257R-L-SM 5057R-L-ST	SMA	1300nm	8km	N/A
3257T-L-ST 5057T-L-ST	3257R-L-ST 5057R-L-ST	ST	1300nm	8km	N/A
3257T-L1-ST 5057T-L1-ST	3257R-L1-ST 5057R-L1-ST	ST	1300nm	12km	10km
3257T-L2-ST 5057T-L2-ST	3257R-L2-ST 5057R-L2-ST	ST	1300nm	15km*	20km*
3257T-L2-FC 5057T-L2-FC	3257R-L2-FC 5057R-L2-FC	FC	1300nm	15km*	20km*

** Bandwidth limited by chromatic and modal dispersion in the fiber.*
***Distance based on 3dB/km at 865nm and 1.5dB/km at 1310nm, including a 3dB safety margin.*

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ASYNCHRONOUS AND SYNCHRONOUS RS232 DATA TRANSMISSION VIA A SINGLE FIBER

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Transmit and receive full duplex synchronous or asynchronous RS232 signals 1.6km over a single multimode fiber with Optelecom's Model 4151. This small modem communicates with DTEs (data terminal equipment) and operates in Data Transmission Mode (one high speed channel and two low speed channels) or Modem "Handshake" Mode (one high speed channel with handshaking).

POWERFUL ADVANTAGES INCLUDE

- Transmits 1.6km via a single multimode fiber.
- Plugs directly into DTEs (data terminal equipment).
- Male or female DB25 I/O port.
- Compatible with EIA RS232D (CCITT V.24).
- Transmits one data and two control lines in each direction.
- Available with SMA, ST™ or FC connectors.
- Verifies proper system operation with remote loopback and SYNC indicator.
- Supports external clock input.
- Consult factory for longer distance versions.

LIST OF MODELS

MODEL	OPTICAL PORT	RS232 PORT
4151P-S-SM	SMA	Male
4151P-S-ST	ST	Male
4151S-S-ST	ST	Female
4151S-S-SM	SMA	Female

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FIBER OPTIC AMPLIFIERS AND TRANSMISSION SYSTEMS ANALOG WIDE-BAND DC-1MHz

SPECIFICATIONS

INPUT VOLTAGE RANGES:

Switch selectable with 1 megohm 30 PF input
0-±1VPK,±10VPK, ±100VPK, ±1000VPK,
or ±0.1VPK, ±1VPK, ±10VPK, ±100VPK

OUTPUT VOLTAGE

DC-1MHz

0-±10VPK DC-1MHz
into 10 Kohms or more

BASIC ACCURACY:

DC-1MHz

0.3%DC
0.5%1Hz-400Hz
3% 400MHz-100KHz
10%100KHz-1MHz

TRANSMISSION DISTANCE:

DC-1MHz

1 Kilometer

Signal transmission not affected by shock, vibration or change in light intensity.

POWER REQUIREMENTS:

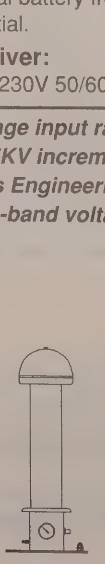
Transmitter:

115V/230V 50/60Hz and 12V DC powered, with integral charger. Optional remote on/off controlled by separate fiber optic cable. Standard battery provides 8-15 hours of operation between charges, longer available. Also isolated power source available for continuous operation without integral battery from power source at ground potential.

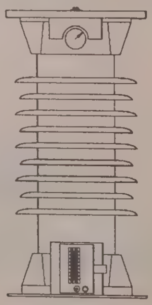
Receiver:

115V/230V 50/60Hz or 12V DC powered.

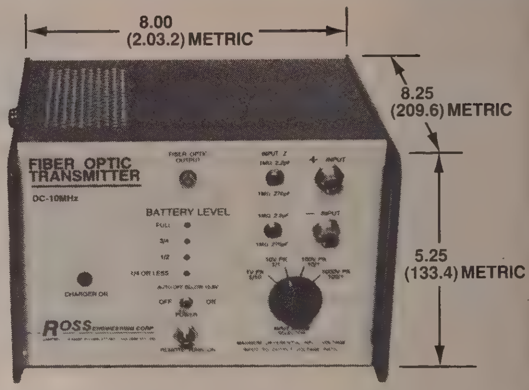
Voltage input range can be extended in 15KV increments to 900KV PK by Ross Engineering Corporation's wide-band voltage dividers.



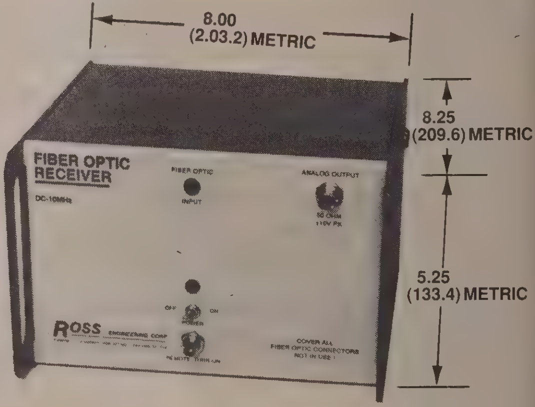
VD60 KV INDOOR



VD120 KV OUTDOOR

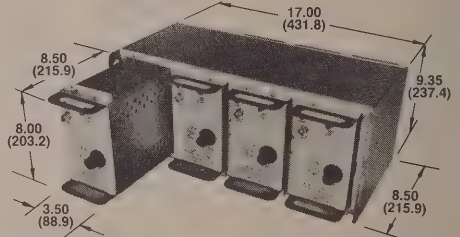

8.00
(2.03.2) METRIC
8.25
(209.6) METRIC
5.25
(133.4) METRIC
FIBER OPTIC TRANSMITTER
DC-10MHz
BATTERY LEVEL
FULL
3/4
1/2
1/4 OR LESS
CHARGER ON
OFF
ON
POWER
ROSS ENGINEERING CORP

AC/DC POWERED TRANSMITTER WITH 12V DC 8-15HR. BATTERY PACK


8.00
(2.03.2) METRIC
8.25
(209.6) METRIC
5.25
(133.4) METRIC
FIBER OPTIC RECEIVER
DC-10MHz
FIBER OPTIC
INPUT
ANALOG OUTPUT
50 OHM
110V PK
OFF
ON
POWER
ROSS ENGINEERING CORP
COVER ALL FIBER OPTIC CONNECTORS NOT IN USE

AC POWERED RECEIVER

DIMENSIONS IN INCHES (METRIC)


17.00
(431.8)
8.50
(215.9)
9.35
(237.4)
8.00
(203.2)
3.50
(88.9)
8.50
(215.9)

4 CHANNEL FIBER OPTIC SYSTEM ALSO AVAILABLE:

Each channel is independent, self-contained, and removable for separate operation. Powered by 115V/230V 50/60Hz.

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SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

*See our additional products in **Volume B,** Relays – Sect. 4500, Switches – Sect. 5100; and **Volume D,** Instruments, Test & Measuring – Sect. 2900.*

S.I.TECH

Fiber Optic Modems & Multiplexers

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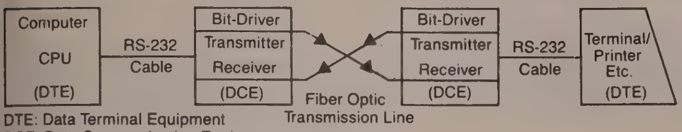
TYPICAL APPLICATION



DTE: Data Terminal Equipment
DCE: Data Communication Equipment

Designed to convert various computer interfaces to optical and reconvert at remote end. Typical application shown in the diagram at left. Fiber optic communication is immune to EMI/RFI, lightning, ground loops and can be used for secure data. Cables are small, lightweight, lower loss over large transmission distances, and provide error free data communications. Glass fibers of various sizes such as 50/125, 62.5/125 & 100/140 can be used. Most have a range of 6600 ft. (2 Km), 15000 ft. (5Km) optional.

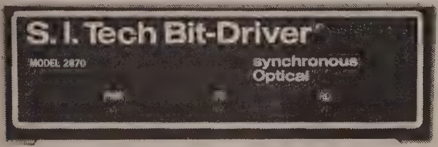
STAND ALONE FIBER OPTIC MODEMS

it Driver is a simplex or full duplex system capable of transmitting data
p to 56K bps over fiber optic cable. Stand alone component with RS-
32 interface and input/output transmission connection. LEDs indicate
tatus. 6000 ft maximum distance capability. Operating temperature is
rom 0° to 50°C. AMP Optimate connector receptacles with SMA/ST
onnections optional. UL & CSA listed.

S.I. TECH #	Enclosure	Operating Mode	Price ea.
2001	Metal	Asynchronous	100
2004	Metal	Synchronous	400
2005	Metal	Asynchronous	300

These modems can be obtained in card style to fit Model 3000 Card Cage.

OCAL AREA NETWORK - FIBER OPTIC MODEMS



ach modem is designed to operate with various networks (see table).
iber optic bit drivers eliminate many disadvantages of standard
ansmission lines. All types are stand alone and allow easy change from
xisting lines to fiber optic line using 2 SMA (ST-option) connector fiber
ptic receptacles. Also comes with power supply and status indicators. 2
M standard, 5 KM & 1300 nm options. UL & CSA listed.

S.I. TECH Number	Interface	Network	Data Rate/MBps
2105 Mini	RS-232	RS-232 Ring	0.1
2107 Mini	RS-485	Unisys	2.0
2117 Mini	RS-485	IBM RS/6000	0.2
2836	Twinax	IBM/36/38/AS/400	1.0
2852	RS-485 TP	OMNINET	1.0
2853	Coax	ARCNET	2.5
2870	Coax	IBM SNA	2.35
2875/76	IBM TP	IBM TokenRing	4.0
2877	IBM TP	IBM TokenRing	16.0/4.0
2890	Coax	T-1	1.54

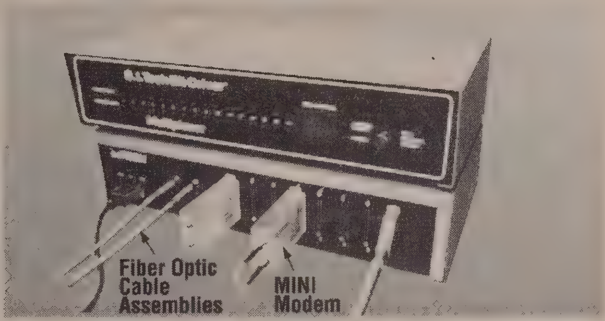
IBER OPTIC IDEO SYSTEM

esigned for CCTV with color or black & white video. Can be applied to
V monitors, security system, surveilance and industrial applications.
as BNC bulkhead jack with 75 ohm impedance, with an input voltage of
Vpp. SMA or ST connectors. Maximum operating distance to 5000 ft. in
mperature range of 0° to 50°C. Plastic case is 6" x 6.5"

.I. TECH Number
309 Transmitter
310 Receiver

ack mounted, mini & card types available. 1300 nm option for long distance.

MINI OPTICAL BIT DRIVERS



Features simplex or full duplex operation, SMA (ST-option) receptacles, DTE, or DCE switch selectable, LED Indicator for transmit and receive data and RS-232C connectors (cable not required). 2505 is 0 to 56K bps asynchronous operation up to 5000 ft. maximum operating distance. Requires Type 2101 external transformer. 2507 is 50 to 19.2K bps asynchronous operation up to 3000 ft. maximum operating distance. Powered by DTE. See picture above. Long distance options.

S.I. TECH Number	Data Rate/MBps	Distance	Features
2101	—	—	Power Supply
2106	56.0	5000	RS-422
2110	56.0	5000	RS-485 JohnsonControl
2116	38.4	5000	RS-422, C, X, L BUS
2185	38.4	5000	RS-485, T.I.
2320	19.2	5000	PC XT/AT BUS Boardlevel
2505	56.0	5000	RS-232, Pin9 or 2101Power
2506	19.2	3000	RS-232, Handshake Lines
2507	19.2	3000	RS-232, DTE Power

FIBER OPTIC MULTIPLEXERS

Time division multiplexers with various interfaces. Status indicators show activity of each channel & the integrity of fiber link. Standard models 6600 ft. (2Km) with 5 Km optical, SMA connectors are standard with ST optional UL, CSA, FCC certified. See picture above.

FIBER OPTIC MULTIPLEXERS

Model No.	Key Feature	No. of Channels
2006	RS-232, Async/Sync	Up to 8
2016	RS-232, Async	16
2017	RS-232, Async	4
1000	RS-232, Async/Sync	Up to 48
9304	IBM Twinax/AS 400	4
9308	IBM Twinax/AS 400	8
3700	IBM Coax 3174 & 3274	4 to 32

FIBER OPTIC CABLE, 1 & 2 FIBER, PRETERMINATED ASSEMBLIES

S.I. Tech Part #	Fiber Size* Micron	No. of Fibers	Connector** Type	Length Ft. (m)
5201-0003-8255	62.6/125	1	ST	3 (1)
5201-0003-8252	62.5/125	1	SMA	3 (1)
5201-0010-8255	62.5/125	1	ST	10 (3)
5201-0010-8252	62.5/125	1	SMA	10 (3)
5202-0003-8255	62.5/125	2	ST	3 (1)
5202-0003-8252	62.5/125	2	SMA	3 (1)
5202-0010-8255	62.5/125	2	ST	10 (3)
5202-0010-8252	62.5/125	2	SMA	10 (3)

*For 50/125 fiber, change part # to 7 from 5, e.g. 7201-003-8255.
**Other cable lengths and connector types available, such as Biconic, Mini BNC, FC, D4, and FDDI.

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- Patented and Licensed the World Over.

■ **Coreless DC motors:** (PG. **B**•1294)	■ .1-30 W continuous output power ■ .01-7.09 oz -in. max. continuous torque ■ Speeds up to 16,000 RPM.
■ **PMDC motors:** (PG. **B**•1295)	■ 4-430 W continuous output power ■ .91-415 oz-in. max. continuous torque ■ Custom windings available up to 180 VDC. ■ Speeds up to 6,000 RPM.
■ **Precision gearheads:** (PG.B•1296-1297)	■ Diameters from 10mm-120mm (.39-4.72 in.) ■ Continuous output torque to 96 ft.-lb. ■ Bidirectional operation in ratios up to 1,000,000:1

ALSO AVAILABLE:

■ Tacho-Generators	Call for Latest Data
■ Optical Encoders	See **B**•1968
■ Magnetic Encoders	See **B**•1968
■ Precision Gearheads	See **B**•1296-1297
■ Motor-Tachometers	Call for Latest Data
■ Zero Back Lash Gearing	See **B**•1296
■ Brushless Motors	Call for Latest Data
■ Control Systems	See **D**•1164-1165, **D**•2316
■ Brakes & Clutches	Call for Latest Data

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MOTORS AND DRIVES

Manufacturer	Starting EEM Page No.	DC Motors						AC Motors			Speed Reducers
		Brushless	Brush-Type	Torque	Servo	Step	Permanent Magnet	Induction	Synchronous	Torque	
Automotion Inc.	B•1240	√			√						
Barber Colman (Motor Div.)	B•1241		√		√		√				√
Bertsch U.S.	B•1242		√		√		√				
Burgess-SAIA	B•1244		√			√	√		√		√
Crouzet Corp.	B•1246		√			√	√		√		
Eastern Air Devices	B•1249	√	√	√	√	√	√	√	√	√	√
Electro-Miniatures Corp.	B•1251		√				√				
Eltrol	B•1250				√						√
Glentek, Inc.	B•1262	√	√		√		√				
Hurst Manufacturing	B•1266	√				√	√		√		
Infranor Inc.	B•1271	√	√		√	√	√				√
Kollmorgen Industrial and Commercial Products	B•1273	√	√		√	√	√				
Litton Poly-Scientific	B•1278	√	√	√	√	√	√				
Mabuchi Motor	B•1293		√				√				
MFM Technology Inc.	B•1298	√		√	√		√				
Micro Mo Electronics	B•1294	√	√		√	√	√				√
Motor Technology	B•1299	√	√		√		√				√
NMB Technologies	B•1303	√				√	√				
Pittman Corp.	B•1304	√	√		√		√				√
Shinano Kenshi Corp.	B•1307	√	√		√	√	√	√			
Superior Electric	B•1308					√	√		√		
Synektron Corp.	B•1310	√			√						
Telco Interconnection	B•1311					√					

ROTATING COMPONENTS

SLIP RINGS

Manufacturer	Starting EEM Page No.	Capsule Slip Rings	Power Slip Rings	Pancake Slip Rings	Power Capsule Slip Rings	General Purpose Slip Rings	Flat Slip Ring Assemblies	Vehicle Slip Rings
Airflyte Electronics Corp.	**B**•1234	√	√	√	√	√	√	√
Fabricast	**B**•1254	√	√	√	√	√	√	√
Fifth Dimension	**B**•1260	√	√	√	√	√	√	√
Graphite Metallizing Corp.	**B**•1265		√	√		√	√	
Litton Poly-Scientific	**B**•1278	√	√	√	√	√	√	√

BRUSHES, ETC.

Manufacturer	Starting EEM Page No.	Rotary Switches	Separate Rotors & Brush Blocks	Encoders	Power Cartridge Type Brushes	Brush Holders	Tachometers	Motorized Potentiometers
Airflyte Electronics Corp.	**B**•1234	√	√	√	√	√		
Burgess-SAIA	**B**•1244	√	√		√			
CUI/Stack	**B**•1248	√		√				
Eastern Air Devices	**B**•1249		√				√	
Electro-Miniatures Corp.	**B**•1251		√			√		
Eltrol	**B**•1250						√	
Fabricast	**B**•1254	√	√		√	√		
Fifth Dimension	**B**•1260		√					
Graphite Metallizing Corp.	**B**•1265				√	√		
Kollmorgen Industrial and Commercial Products	**B**•1273			√			√	
Litton Poly-Scientific	**B**•1278		√					
Micro Mo Electronics	**B**•1294			√			√	
Motor Technology	**B**•1299						√	
Servo-Tek Products Co.	**B**•1306			√			√	
Shinano Kenshi Corp.	**B**•1307			√				

eem

MINIGLOSSARY
SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

mpedance: Specified as R + jX, where R is the AC resistive component and X s the reactive component. Important mpedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with he secondary open; (b) Z_{so}, which is he impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in he minimum coupling position.

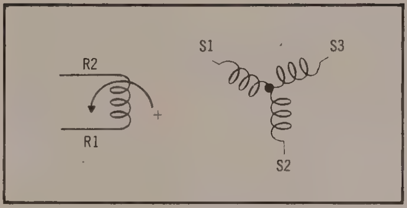
Accuracy: The error of the position of he rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of he unit, referenced to the starting point f the calibration (usually the electrical zero position). Error is commonly xpressed in minutes of arc (1/60 of a egree) or in seconds of arc.

oads: For a transmitting unit, the impedance that the output voltage signal aces. This can be a receiver, a differential with its load, a control transormer, an A/D converter, etc.

peration Temperature: The ambient emperature range over which the unit erforms its primary function.

UNCTIONS

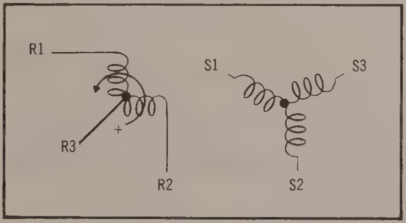
ransmitter: A unit with a Y-conected stator that outputs a signal proortional to the position of its singlehase excited rotor. High power units, alled "torque transmitters," are used o drive one or more receivers. Low ower transmitters are used to drive ontrol transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

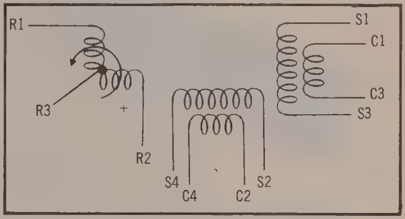
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

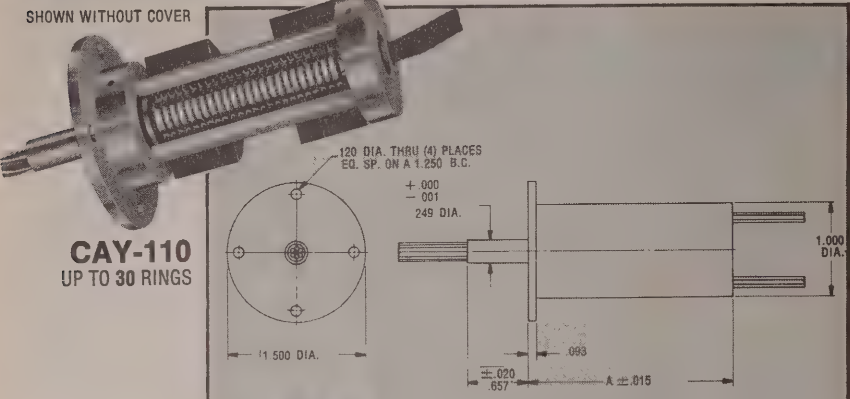
Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

airflyte ELECTRONICS CO.

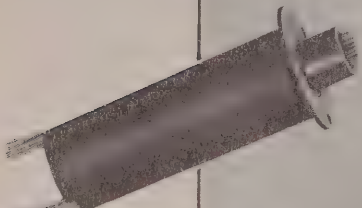
CAPSULE SLIP RING ASSEMBLIES

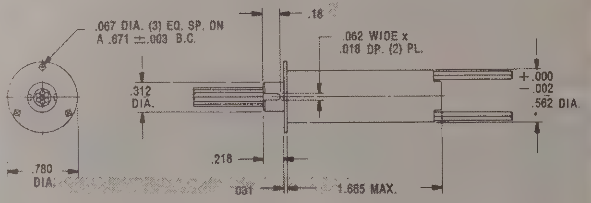
SHOWN WITHOUT COVER


.120 DIA. THRU (4) PLACES
EQ. SP. ON A 1.250 B.C.
+.000
−.001
.249 DIA.
1.000 DIA.
1.500 DIA.
.093
±.020
.657
A ±.015

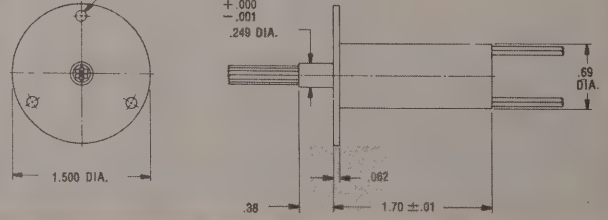
CAY-110
UP TO **30** RINGS

No. of Rings	Inches "A"	Milli-Meters
4-12	1.48	37.6
13-24	2.20	55.9
25-30	2.56	65.0




.067 DIA. (3) EQ. SP. ON
A .671 ±.003 B.C.
.18
.062 WIDE x
.018 DP. (2) PL.
.312 DIA.
+.000
−.002
.562 DIA.
.218
.780 DIA.
.031
1.665 MAX.

CAY-604
UP TO **40** RINGS


.120 DIA. THRU (3) PLACES
EQ. SP. ON A 1.250 B.C.
+.000
−.001
.249 DIA.
.69 DIA.
1.500 DIA.
.062
.38
1.70 ±.01

CAY-245
UP TO **20** RINGS

These Slip Ring Assemblies have found wide use in gyro gimbal and instrument applications. The fully enclosed and tested assemblies feature fine diameter gold alloy brushes mated to compatible gold alloy rings for excellent noise characteristics at low torque levels. Although miniature in size, the assemblies are surprisingly rugged and are able to withstand most military environmental specifications.

Units have been fully tested to the environmental parameters listed below, proving their ruggedness and reliability. All units are factory tested before shipment and a copy of the test data is available with each unit upon request.

The units shown here are only a sample of those available which include a 50 ring capsule of .685 diameter.

SPECIFICATIONS

MECHANICAL

1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Stainless steel
5. Housing: Anodized aluminum
6. Rotation: Bi-directional

ELECTRICAL

1. Current: Signal level to 1 amp maximum
2. Voltage: Micro-volts to 110 volts rms
3. Dielectric Strength: 500 volts rms (all combinations)
4. Leadwire: #30 AWG teflon insulated, 15″ long minimum
5. Noise: ±5 micro-volts per ma

ENVIRONMENTAL

1. Temperature Shock: +85°C for 1 hour and immediately transferred to −55°C for 1 hour
2. Shock: 18 shocks, 20 "g" with duration of 11 ±1 ms (MIL-E-5272C, Procedure V)
3. Vibration: MIL-STD-202B, Method 204, test condition B
4. Altitude: 50,000 ft. and −55°C
5. Humidity: MIL-E-5272C, Procedure III (95% R.H. @ 120°F for 360 hours)

ORDERING INFORMATION

CAY-☐☐☐ ☐☐

No. of Rings

Model

	CAY-110	CAY-604	CAY-245
MECHANICAL			
Torque	1.0 in.-oz. max. (24 rings)	1.0 in.-oz. max.	0.5 in.-oz. max. (20 ring assembly)
Speed	500 rpm max.	200 rpm max.	200 rpm max.
Life	10^8 revs. min.	5 x 10^6 revs. min.	10^7 revs. min.
ELECTRICAL			
Contact Resistance Variation	5 milliohms max. at max. speed	20 milliohms max. at max. speed	5 milliohms max. at max. speed
No. of Rings	30 max.	40 max.	20 max.

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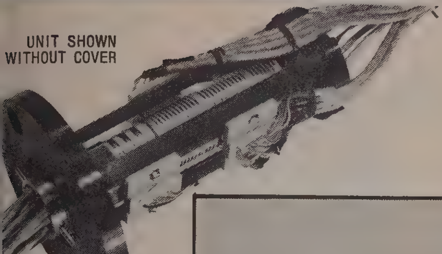
airflyte ELECTRONICS CO.

CAPSULE SLIP RING ASSEMBLIES


UNIT SHOWN
WITHOUT COVER

CAY-150
UP-TO **48** RINGS

These assemblies, specially designed for gyro-rate table and centrifuge applications, have found wide use because of their versatility and compact size. The standard assembly, can be supplied (at slight extra cost) with internally shorted rings for double and triple current ratings, and with single, double and triple shielded wire. Featuring gold alloy wire brushes and compatible gold alloy rings, these assemblies are manufactured from proven production tooling at a very nominal cost. Special assemblies with switching circuits and others with non-standard materials for use in severe environments are available.

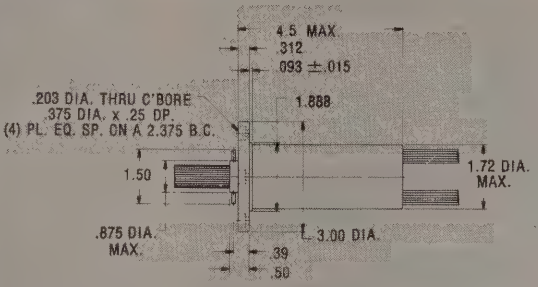
SPECIFICATIONS

MECHANICAL

1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel
4. Shaft: Stainless steel, type 303
5. Housing: Anodized aluminum
6. Rotation: Bi-directional
7. Torque: .125 in.-oz. per ring
8. Speed: 600 rpm max-intermittent
9. Life: 2000 hrs. @ 100 rpm

ELECTRICAL

1. Current: Signal level to 2.0 amps
   (Higher levels available)
2. Voltage: 400 vdc maximum
3. Dielectric Strengths: 1000 Volts rms
   (all combinations)
4. Contact Resistance:
   A. Less than 8 milliohms @ 200 rpm
   B. Less than 2 milliohms @ 10 rpm
5. Leadwire: #28 awg 18" long
   (Shielded cables available)



NOTE: THE TABLE BELOW SHOWS SIMILAR MODELS THAT ARE AVAILABLE.

Part No.	Dia.	Rings	Length
CAY-1117	1.72	72	6.0
CAY-1248	1.87	96	8.0
DAY-1481-1	2.75	80	4.29
DAY-1481-2	2.75	170	8.66
DAY-1481-3	2.75	235	11.50

MULTI-PURPOSE CAPSULE ASSEMBLIES

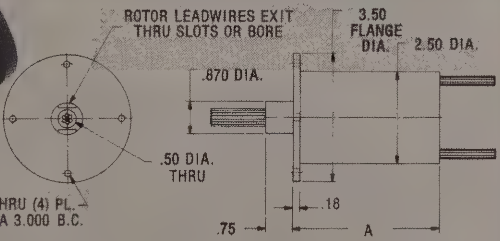
UNIT SHOWN
WITHOUT COVER
& MTG FLANGE

CAY-1030
UP TO **30** RINGS

- LONG LIFE • HIGH SPEED

SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite, two per ring
3. Ball bearings: Stinless steel, shielded
4. Shaft: aluminum
5. Housing: aluminum
6. Torque: .03 in.-lb. per ckt. approx.
7. Speed: Up to 5000 rpm
8. Life: 50 x 10⁶ revs. min.
9. Rotation: Bi-directional
10. Current: 0-5 amps per ring standard
    (15 amp available)
11. Voltage: 250 Volts DC max.
12. Dielectric Strengths: 500 VRMS
    (all combinations)
13. Noise: 10 milliohms @ max. speed
14. No. of Rings: 30 max.
15. Leadwire: #22 AWG, 24" lg., both ends



NO. OF RINGS	A
1 THRU 16	4.00
17 THRU 30	5.75

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airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES

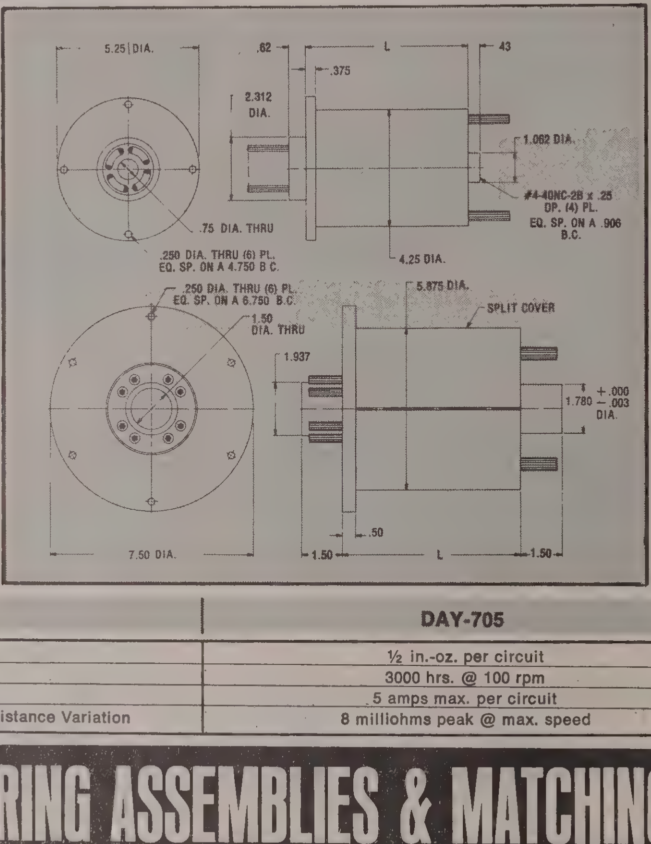
"THROUGH-BORE" DESIGN

UNIT SHOWN WITHOUT COVER

	DAY-705	DAY-710
No. of Rings	"L" ±.025"	"L"
10-20	5.375	4.725
21-40	8.187	6.700
41-60	11.000	8.675
61-80	13.812	10.650
81-100	16.625	12.625
101-120	19.437	14.600
121-140	22.250	
141-160	25.062	

DAY-705
UP TO 160 RINGS

DAY-710
UP TO 120 RINGS


5.25 DIA.
.62
L
43
.375
2.312 DIA.
1.062 DIA.
#4-40NC-2B x .25 DP. (4) PL. EQ. SP. ON A .906 B.C.
.75 DIA. THRU
.250 DIA. THRU (6) PL. EQ. SP. ON A 4.750 B C.
4.25 DIA.
.250 DIA. THRU (6) PL. EQ. SP. ON A 6.750 B.C.
5.875 DIA.
SPLIT COVER
1.50 DIA. THRU
1.937
1.780 +.000 −.003 DIA.
.50
7.50 DIA.
1.50
L
1.50

DAY-705

These slip-rings are built to your order using many standard components which have proven themselves over many years of reliable operation. The "platter-type" design includes one coin silver ring on each side of each molded sub-assembly; and, leaf type silver graphite brushes which are molded in an insulating block and perfectly matched to the face of each ring. Inasmuch as the assemblies are the stack-up type, we are able to custom build them to your specifications—using our standard components—with a very minimum lead time required.

DAY-710

Similar in construction to our DAY-705, this platter type unit features two coin silver rings on each side of each platter for greater package density, and a "through bore" design which can be used for the passage of fluid or gas lines.

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Silver graphite
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Anodized aluminum
5. Housing: Anodized aluminum
6. Speed: 500 rpm maximum
7. Rotation: Bi-directional

ELECTRICAL

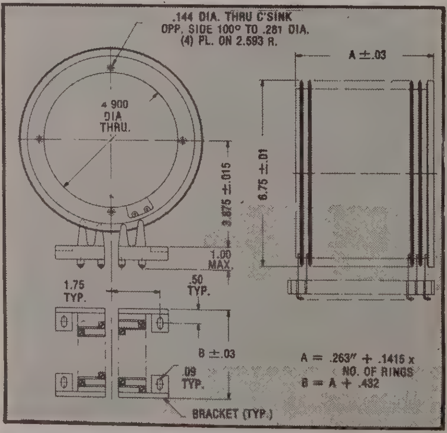
1. Voltage: 0 to 150 Volts AC or DC
2. Dielectric Strength: 500 Volts rms (all combinations)

	DAY-705	DAY-710
Torque	½ in.-oz. per circuit	¾ in.-oz. per circuit
Life	3000 hrs. @ 100 rpm	2500 hrs. @ 100 rpm
Current	5 amps max. per circuit	5 amps max. per circuit
Contact Resistance Variation	8 milliohms peak @ max. speed	10 milliohms max.

FLAT RING ASSEMBLIES & MATCHING BRUSH BLOCKS

CAY 94

- General purpose
- "Stack-up capability (up to 200 rings or more
- Low noise
- Long life


.144 DIA. THRU C'SINK OPP. SIDE 100° TO .281 DIA. (4) PL. ON 2.593 R.
A ±.03
4.900 DIA THRU.
3.875 ±.015
6.75 ±.01
1.00 MAX.
1.75 TYP.
.50 TYP.
B ±.03
.09 TYP.
A = .263" + .1415 x NO. OF RINGS
B = A + .432
BRACKET (TYP.)

SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite (two per ring)
3. Brush Leafs: Beryllium copper
4. Insulation: Phenolic
5. Leadwire: Available upon request
6. Speed: 750 rpm max.
7. Life: 1000 hours @ 100 rpm
8. Current: 5 amps per rings; 10 amps per rin when 4 brushes are used
9. Voltage: 300 VRMS
10. Dielectric Strength: 500 Volts rms (all combinations)
11. Insulation Resistance: 10 megohms minimum at 500 VDC
12. Noise: The contact resistance change i each circuit shall be less than .005 ohms a maximum speed
13. Units with less than 11 rings have one bracket per brush block

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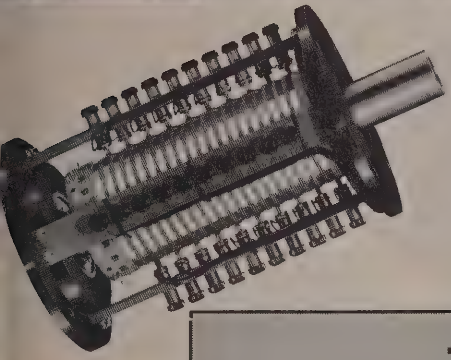
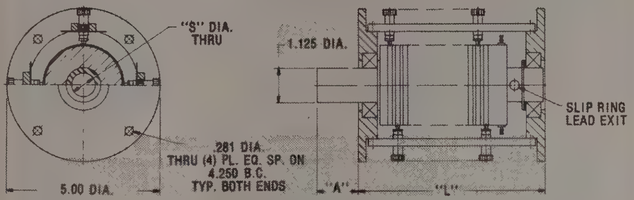
Airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES



. . . AS AN ASSEMBLY

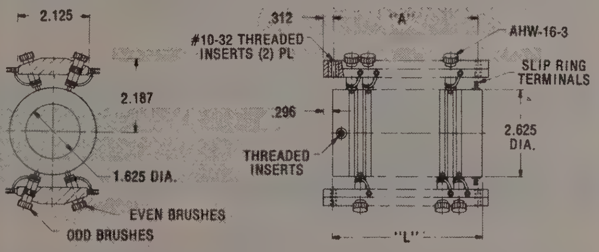
CAY-125
UP TO **30** RINGS


"S" DIA. THRU
1.125 DIA.
SLIP RING LEAD EXIT
.281 DIA. THRU (4) PL. EQ. SP. ON 4.250 B.C. TYP. BOTH ENDS
5.00 DIA.
"A"
"L"

NOTES:
To determine "L" dimention use the following formula:
$$\text{"L"} = \frac{\text{(NO. OF RINGS)}}{4} + 2.62''$$
"S" = .750" or 1.000"
"A" = .750" or 1.000"

. . . OR AS SEPARATES

CAY-755
UP TO **30** RINGS


2.125
2.187
1.625 DIA.
EVEN BRUSHES
ODD BRUSHES
.312
"A"
#10-32 THREADED INSERTS (2) PL
AHW-16-3
SLIP RING TERMINALS
.296
THREADED INSERTS
2.625 DIA.
"L"

NOTES:
To determine the "L" and "A" dimensions, use the following formulas:
$$\text{"L"} = \frac{\text{(NO. OF CIRCUITS)}}{4} + 1.093''$$
A = "L" – .218"

†Two identical brush blocks are supplied with each CAY-755 assembly.

†REPLACEMENT PARTS
Cartridge Assembly: AHW-16
Spring: AHW-15
Holder: AHW-14
Cap: AHW-13
Silver Graphite Brush: ABR-12-1

CAY-125

A general purpose, off-the-shelf slip ring assembly especially applicable for strain gage and thermocouple measurements where rotating detector circuits must be brought out to stationary measuring equipment.

CAY-755

The standard cartridge, (AHW-16), has been used for many years on our CAY-125 assembly and is now available with the CAY-755 which is also drawn, or individually, for use on any ring which is a minimum of ⅛" wide. The silver graphite brushes, coil springs, caps and holders may be purchased individually or as an assembly and are all available from stock.

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Spring loaded silver graphite, two per ring
3. Torque: 0.2 in-lbs. per ring
4. Speed: 5000 rpm maximum
5. Life: 1000 hours minimum @ 500 rpm
6. Rotation: Bi-directional

ELECTRICAL

1. Current: 10 amps per circuit with two brushes per ring
2. Voltage: 0-250 Volts AC or DC
3. Dielectric Strength: 500 Volts rms (all combinations)
4. Contact Resistance Variation: 10 milliohms maximum at maximum speed
5. No. of Rings: 30 maximum

ENVIRONMENTAL

1. Operating Temperature: 0° to 200°F
2. Humidity: 85%

ORDERING INFORMATION

CAY-☐☐☐ ☐☐ ☐
Model
No. of Rings
Special Variations

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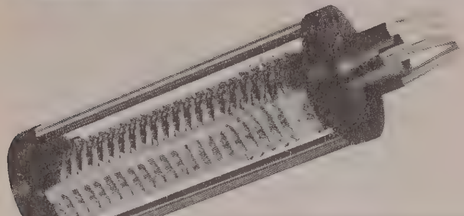
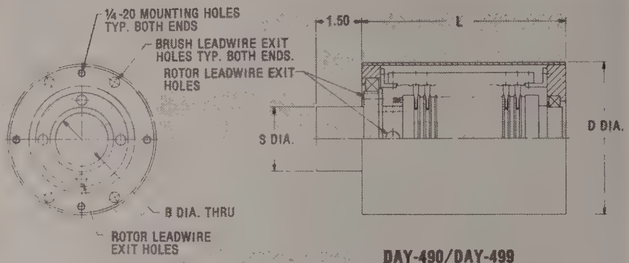
Airflyte ELECTRONICS CO.

MULTI-PURPOSE SLIP RING ASSEMBLIES



...AS AN ASSEMBLY

DAY-490/499
UP TO 50 RINGS



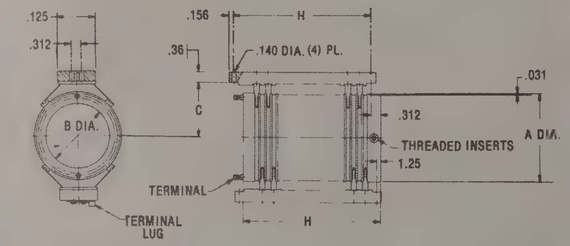
¼-20 MOUNTING HOLES TYP. BOTH ENDS
BRUSH LEADWIRE EXIT HOLES TYP. BOTH ENDS.
ROTOR LEADWIRE EXIT HOLES
B DIA. THRU
ROTOR LEADWIRE EXIT HOLES
1.50
L
S DIA.
D DIA.

DAY-490/DAY-499

No. of Rings	Inches "L"	Milli-Meters
6-10	4.88	123.95
11-20	6.75	171.45
21-30	8.63	219.2
31-40	10.50	266.7
41-50	12.38	314.45

...OR AS SEPARATES

CAY-731/740
UP TO 50 RINGS



To determine "H" dimension
use the following formula:
"H" = .750 + .1875 x (No. of Rings)

These assemblies, designed for use in commercial equipment, have been used in applications ranging from thermocouples to the transmission of medium power. They feature coin silver rings, silver graphite brushes, convenient terminals on both the slip ring and brush blocks, and a rotor design which allows the leadwires to be exited through the shaft bore, or under the bearing when a shaft clearance hole is required. The wide variety of sizes and configurations available, including "in-between" shaft diameters, allows the designer to select a standard assembly for his application, eliminating time consuming and costly design charges.

SPECIFICATIONS

MECHANICAL

1. Frame: Anodized aluminum (DAY-490/DAY-499 only)
2. Rings: Coin silver
3. Brushes: Silver graphite, two per ring
4. Leafs: Beryllium copper
5. Insulation: Epoxy or laminated plastic

ELECTRICAL

1. Current: 10 amperes per circuit (20 amperes available at extra cost)
2. Voltage: 250 Volts maximum AC or DC
3. Dielectric Strength: 750 Volts rms (all combinations)
4. Insulation Resistance: 50 megohms minimum at 500 VDC
5. Contact Resistance Variation: 10 milliohms maximum at maximum speed
6. No. of rings: 50 maximum

ENVIRONMENTAL

1. Operating Temperature: 0 to 250°F
2. Humidity: 95% maximum

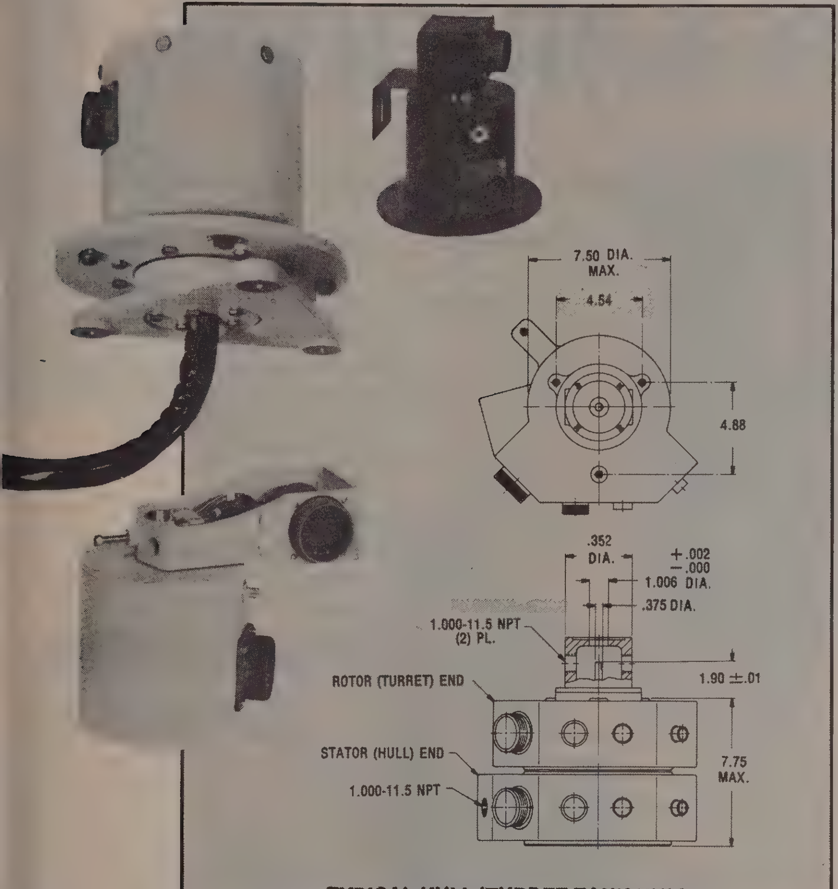
For use when bearing mounted assemblies ar not practical, the CAY-731/CAY-740 should b specified.

Part No.	Max. Speed RPM	Min. LIFE 10^6 Rev.	Max. Torque Per Ring		DAY-490/DAY-499						CAY-731/CAY-740					
					"B" Dia.		"D" Dia.		"S" Dia.		"A" Dia.		"B" Dia.		"C" Dia.	
			lb.-in.	gm-cm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
DAY-490/CAY-731	5000	50	.21	240	1.00	25.4	4.00	101.6	1.250	31.75	1.875	47.63	1.250	31.75	1.447	36.75
DAY-491/CAY-732	4000	40	.30	350	1.75	44.45	5.00	127.0	2.125	53.98	2.750	69.85	2.125	53.98	1.829	46.46
DAY-492/CAY-733	3000	30	.40	460	2.75	69.85	6.50	165.1	3.125	79.38	3.750	95.25	3.125	79.38	2.281	57.94
DAY-493/CAY-734	2500	25	.50	580	3.75	95.25	7.50	190.5	4.125	104.8	4.875	123.8	4.125	104.8	2.822	71.68
DAY-494/CAY-735	2000	20	.61	700	4.75	120.7	8.50	215.9	5.125	130.2	5.875	149.2	5.250	133.4	3.307	84.00
DAY-495/CAY-736	1500	15	.71	820	5.75	146.1	9.50	241.3	6.125	155.6	7.000	177.8	6.250	158.8	3.857	97.97
DAY-496/CAY-737	1500	15	.82	950	6.75	171.5	10.50	266.7	7.125	181.0	8.000	203.2	7.250	184.2	4.342	110.3
DAY-497/CAY-738	1000	10	.92	1060	7.75	196.9	11.50	292.1	8.125	206.4	9.000	228.6	8.250	209.6	4.837	122.9
DAY-498/CAY-739	1000	10	1.02	1180	8.75	222.3	13.00	330.2	9.125	231.8	10.000	254.0	9.250	235.0	5.332	135.4
DAY-499/CAY-740	750	7.5	1.12	1290	9.75	247.7	14.00	355.6	10.125	257.2	11.000	279.4	10.250	260.4	5.827	148.0

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 FAX 201-436-6024

Airflyte ELECTRONICS CO.

VEHICLE SLIP RING ASSEMBLIES



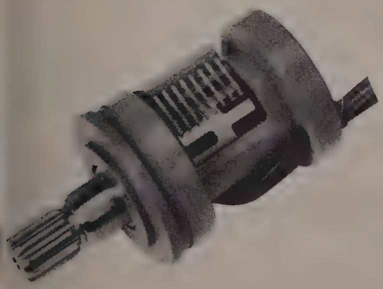
TYPICAL HULL/TURRET TANK UNIT

Airflyte Electronics has experience in the design and manufacture of assemblies for personnel carriers, tanks and other military vehicles. We have built slip rings for periscopes, turrets and commander stations. These assemblies range in size from 6″ or less in outside diameter to slip rings with clearance holes larger than 28″. This type of assembly is characterized by its rugged construction, usually has two high power rings, several low power and up to 50 signal rings. Illustrated are several of the configurations we have built in production quantities.

SPECIFICATIONS

1. Voltage: from 28 VDC to 208 VAC
2. Current: from 1 amp to 600 amps
3. Frequency: DC to 100 MHz
4. Speed: Usually about 20 rpm
5. Noise: Less than 10 mΩ peak to peak
6. Hydraulics: 3000 psi operating
7. Pneumatics: 1500 psi operating
8. Torque: 15 ft.-lb. max. (no hydraulics)
9. Life: 3000 hrs.
10. Environmental: Vibration, shock, etc. per MIL SPEC
11. Terminations: Connectors & fittings customer compatible

ENCODERS & SWITCHES



Airflyte encoders and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as ½″ diameter.

ENCODERS

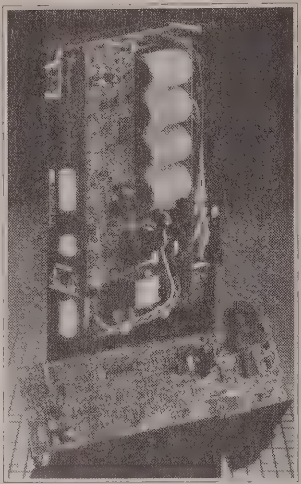
Special encoders with BCD, Gray, True Binary or non-standard codes are available. Units supplied with or without logic circuitry.

SWITCHES

When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning applications. Successfully replaces snap action switches and cams. Pre-set to eliminate installation time. Zero hysteresis.

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 FAX 201-436-6024

Embedded OEM Servo Solutions


ALC-CM Torque Mode Servo Amplifier

Faster Throughput, Higher Reliability, Lower Cost...

You've pushed your stepper solutions to the max, and now you need to close the "servo" loop for higher performance motion control.

Only two problems. With all their "features", the standard servo packages still don't meet your needs and your customers can't afford them!

Fortunately, Automotion has a solution. The new brushless **ALC-CM** torque mode servo-amplifier family. It's a modular, pre-engineered drive family, meaning you choose just the amount of capability and features you need to get the job done, and no more.

The Servo-Amplifier of the 90's

What's more, the ALC-CM, designed to mate with today's high bandwidth motion controllers, offers several advantages over traditional velocity compensated amps.

- **No Pots!** Factory-tuned to your motor characteristics so there are no pots to adjust on the driver, ever.
- **Velocity Loop Parameters in Software!** Variability due to manual field adjustment is history. Larger loads and load to inertia mismatches (100:1) are easily controlled.
- **Direct Torque Limiting & Monitoring** With software control, torque monitoring and profiling is direct, simple and more cost-effective than with velocity amps.

Speed, Peace of Mind and Savings...

Three good reasons to find out more about the performance and cost advantages of Automotion's new "off-the-shelf" embedded Servo-Amplifiers and torque mode control solutions. Contact your local Automotion representative or call us direct at 313/662-7771.

Custom & Semi-Custom Solutions

AUTOMOTION

Putting Brushless Into Motion®

P.O. Box 7746 • Ann Arbor, Michigan 48107 • Made In USA
313/662-7771 FAX 313/662-3707

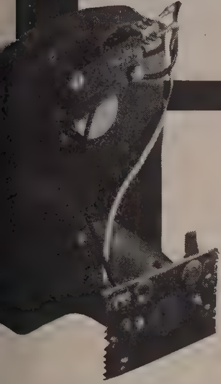
BARBER COLMAN COMPANY

a Siebe company

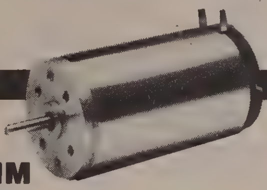
BARBER-COLMAN

subfractional motion control

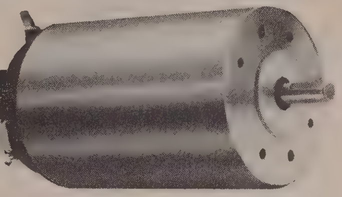
NEW PRODUCTS



D26
DC gearmotor
6–24 Volts
Low cost plastic gearbox
Torque to 7 lb-in.
Optional features:
- Control circuits
- Limit switches
- Many shaft configurations

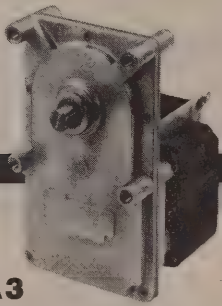


LYMM
1.56″ diameter DC motor
6 to 36 volts
18 Watts Output
Stall torque to 50 oz-in
- The LYMM offers superior magnetic circuit design and higher torque constants than motors of equal size and resistance.

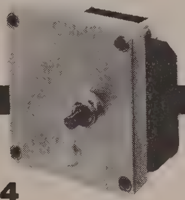


MYMM
Long life high torque DC motor
Stall torque to 125 oz-in.
EMI filtering
Optional features:
- Optical encoders
- Gear boxes

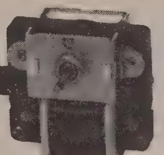
AC MOTORS



A3
Torque to 160 lb-in.
Speed 1-200 RPM

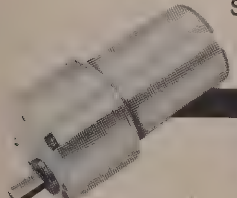


A4
Torque to 60 lb-in.
Speed 1–800 RPM

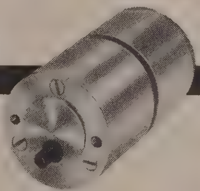


YAA
Rated HP to .005
Small and compact

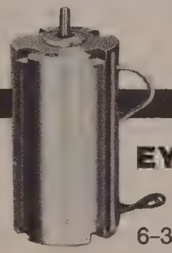
DC MOTORS



EYQE
Torque to 11 lb-in.
1.5″ max. dia.



CYHC
Torque to 15 lb-in.
2.0″ max. dia.



EYQM
6–32 VDC
1.18″ dia.
2.16″ max. length

CYHM
6–36 VDC
2.0″ dia.

Our manufacturing experience and engineering content assure consistent quality—from simple drive motors to sophisticated "motion control packages." Our motors are available with multiple types of companion gearheads and may be combined with options like magnetic tachs, optical encoders, ball bearings, and electrical filtering for exact start-stop and speed control. Barber-Colman now offers 43 standard products through a national network of stocking distributors, and a newly organized team of manufacturer's representatives who are available to serve you in 48 states across the U.S.

For ordering information, application assistance, or to receive the name of the nearest Barber-Colman representative or distributor nearest you, contact our office at the address below.

Barber-Colman Company

MOTOR DIVISION

P.O. Box 7040
555 Colman Center Drive
Rockford, IL U.S.A. 61125-7040

Toll Free: 1-800-237-2537
Phone: (815) 397-7400
FAX: (815) 398-3885

BERTSCH U.S. 1280 LIBERTY WAY, VISTA, CA 92083

PHONE (619) 727-7420 FAX (619) 727-4436

Series 20–08 • 0.2 Watts • 6500 RPM

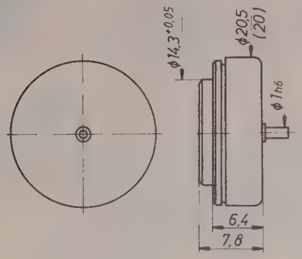
Dimensions — mm 1mm = 0.0394 in

Rotor	3 Flat Coils
Magnet	SeCo5
Commutator	AgCu3, 6 segments
Brushes	Gold alloy
Bearings	Oilite

Efficiency	up to 85%
Rotor Moment of Inertia	3 x 10^{-3} oz-in^2
Mechanical Time Const. appr.	25 ms
Weight	0.35 oz.

Recommended Operational Data

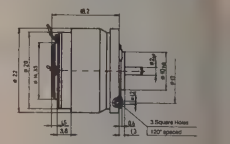
Speed	max. 6500 rpm
Torque	0.06 oz in
Temperature	−4° +140°F



Type	20-08-10	20-08-07	20-08-05	
Voltage	3	5	12	V
No load speed	7200	8500	8500	rpm
Resistance	7.7	26.5	94	Ohms
Stall torque	0.19	0.20	0.18	oz-in
No load current appr.	20	13	8	mA
Recommended current	100	50	30	mA
Torque constant	0.5	0.9	1.85	oz-in/A
Counter-EMF	0.24	0.65	1.3	mV/rpm
Speed/Torque Gradient	40,000	42,000	47,000	rpm/oz-in

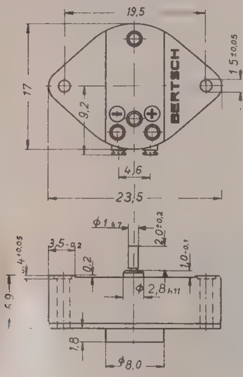
Gear Head

Max. Torque	
GBR = 43:1	1.5 oz-
GBR = 139:1	3.0 oz-
GBR = 449:1	5.0 oz-
GBR = 1443:1	7.0 oz-
Max. Motor Speed	7000 r
Max. Power	0.1 W
Max. Radial Load	6 oz
Max. Axial Load	2 oz
Weight with motor	0.5 oz



Series 00–30 • 0.05 Watts • 10,000 RPM

Dimensions — mm 1 mm = 0.0394 in



Rotor	3 Flat Coils
Magnet	Ferrite
Commutator	Flat, 3 Segments Gold Plated
Brushes	AgCu3
Bearings	Brass
Weight	0.3 oz

Recommended Operational Data

Speed	10,000 rpm
Torque	0.005 oz-in
Temperature	−4° to +140°F

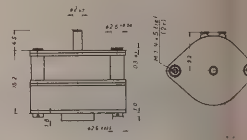
Type	00-30-07	00-30-06	00-30-05	00-30-04	
Voltage	2	2,5	4	6	V
No load speed	11,500	11,500	13,500	13,500	rpm
Resistance	16	26	54	133	Ohms
Stall torque	0.018	0.018	0.018	0.016	oz-in
No load current appr.	28	23	13	10	mA
Recommended current	50	40	30	22	mA
Counter-EMF	0.15	0.20	0.25	0.40	mV/rpm
Speed/Torque Gradient	624,000	624,000	733,000	834,000	rpm/oz-in

Gear Head

Max. Torque	3 oz-in
Max Motor Speed	10,000 rp
Max. Power	0.04W
Weight with motor	0.55 oz

Standard Gear Ratios

16.6:1	96.4:1	17
249 :1	487:1	91
	4629:1	



Series 16–24 • 0.4 Watts • 7500 RPM

Dimensions — mm 1 mm = 0.0394 in

Magnet	AlNiCo
Commutator	AgCu5, 5 segments
Brushes	Gold alloy
Bearings	Oilite

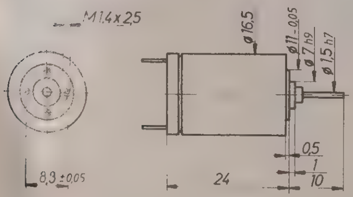
Possible Combinations

Gear Head M20

Efficiency	up to 75%
Rotor Moment of Inertia appr.	3 x 10^{-3} oz-in^2
Mechanical Time Const. appr.	25 ms
Weight	0.7 oz

Recommended Operational Data

Speed	max. 7500 rpm
Torque	0.07 oz-in
Temperature	−4° to +148°F



Type	16-24-12	16-24-08	16-24-06	
Voltage	3	6	12	V
No load speed	10,000	8,000	9,000	rpm
Resistance	4.0	22	60	Ohms
Stall torque	0.30	0.25	0.34	oz-in
No load current appr.	35	20	15	mA
Recommended current	200	90	50	mA
Torque constant	0.38	0.93	1.87	Oz-in/A
Counter-EMF	0.3	0.7	1.4	mV/rpm
Speed/Torque Gradient	32,100	31,400	21,700	rpm/oz-in

Gear Head

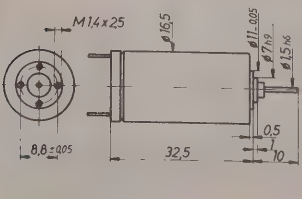
Max. short time torque	12 oz-in
Max. Motor Speed	6000 rpm
Max. Power	0.4 W
Weight with motor 16-34	1.3 oz

Standard Gear Ratios

10.2:1	32.7:1	105
20.5:1	65.5:1	210
335:1	1073:1	
671:1	2147:1	

Series 16–34 and 16–35 • 0.8 Watts • 8000 RPM

Dimensions — mm 1 mm = 0.0394 in



Magnet	AlNiCo
Commutator	AgCu3, 5 segments
Brushes	Gold alloy
Bearings	Oilite

Recommended Operational Data

Speed	max. 8000 rpm
Torque	0.15 oz-in
Temperature	−4° to +175°F

Efficiency	up to 75%
Rotor Moment of Inertia appr.	4 x 10^{-3} oz-in^2
Mechanical Time Const. appr.	25 ms
Weight	1 oz.

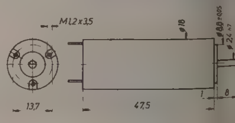
Possible Combinations

Gear Head M20

Gear Head M 20

G Series 16-24, 6-34, 16-35

16-34 with Gear Head M



Type	16-35-14	16-35-12	16-34-10	16-34-09	16-34-08	16-34-07	
Voltage	3	4	6	9	12	15	V
No load speed	8100	8800	7000	8000	8500	9200	rpm
Resistance	2.5	3.9	11	19.5	31	47	Ohms
Stall torque	0.55	0.58	0.62	0.62	0.64	0.64	oz-in
No load current appr.	50	40	30	25	20	15	mA

Type	16-35-14	16-35-12	16-34-10	16-34-09	16-34-08	16-34-07	
Recommended current	300	250	175	125	100	75	mA
Torque constant	0.48	0.59	1.09	1.43	1.73	2.10	pz-in/A
Counter-EMF	0.33	0.41	0.85	1.0	1.2	1.5	mV/rpm
Speed/torque Gradient	14,700	15,100	11,200	12,800	14,000	14,000	rpm/oz-
Mechanical Time	16	17	15	17	18	18	ms

BERTSCH U.S. 1280 LIBERTY WAY, VISTA, CA 92083
PHONE (619) 727-7420 FAX (619) 727-4436

Series 22–45 • 6 Watts • 10,000 RPM

Dimensions — mm 1 mm = 0.0394 in

Magnet	AlNiCo
Commutator	CuAg 0.1, 5 segments
Brushes	Graphite
Bearings	Oilite

Efficiency	up to 85%
Rotor Moment of Inertia	20 x 10^{-3} oz-in^2
Mechanical Time Const. appr	20 ms
Weight	2.7 oz

Possible Combinations

Gear Heads	H 30, H 40, P 24
Tacho	20-08
Encoder	HEDS-5500

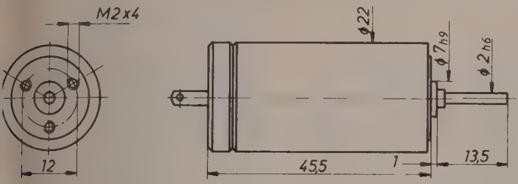
Recommended Operational Data

Speed	max. 10,000 rpm
Torque	0.7 oz-in
Temperature	−4° to +175°F

Torque 1 stage	7 oz-in
2 stages	25 oz-in
3 stages	50 oz-in
Max. Motor Speed	7000 rpm
Max. Radial Load	2.5 lbs
Max. Axial load	1 lb
Axial Play max.	0.012 in
Max. Gear Play	3°

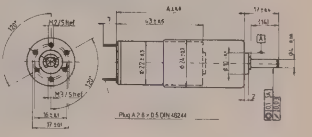
Standard Gear Ratios

6:1			1-stage
19:1	46:1		2-stages
81:1	199:1	353:1	3-stages



Type	22-45-30	22-45-20	22-45-16	22-45-14	22-45-12	22-45-10	22-45-08	
Voltage	3	6	9	12	18	24	36	V
No load speed	7,500	10,000	10,100	10,000	9,700	9,900	9,700	rpm
Resistance	0.8	2.5	4.5	6	14	28	65	Ohms
Stall torque	1.89	1.80	2.19	3.07	2.95	2.63	2.12	oz-in
No load current appr.	65	55	45	35	25	20	18	mA
Recommended current	1000	800	600	450	300	250	150	mA
Counter-EMF	0.51	0.77	1.15	1.56	2.34	3.15	4.78	mV/rpm
Speed/Torque Gradient	3980	5560	4510	3270	3420	3780	4740	rpm/oz-in

Planetary Gear Head P 24
Series 22-45



Series 25–51 • 25 Watts • 25,000 RPM

Dimensions — mm 1 mm = 0.0394 in

Magnet	SeCo5
Commutator	CuAg 0.1, 5 segments
Brushes	Graphite
Bearings	Ball Bearings

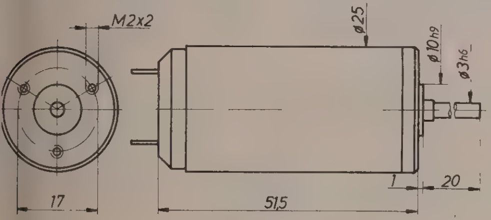
Efficiency	up to 85%
Rotor Moment of Inertia	20 x 10^{-3}oz-in^2
Mechanical Time Const.	8.5 ms
Weight	4.4 oz

Recommended Operational Data

Speed	25,000 rpm
Torque	2 oz-in
Temperature	−4° to +140°F
Max. Rotor Temperature	250°F

Recommended Operational Data

Speed	10,000 rpm
short time operation	20,000 rpm
Torque	1.5 oz-in
Temperature	−4° to +250°F
Max. Rotor Temperature	250°F



Type	25-51-24	25-50-30	25-50-20	25-50-16	25-50-14	
Voltage	24	6	12	15	24	V
No load speed	30,000	8,800	11,800	13,100	11,700	rpm
Resistance	1.5	0.8	2.5	3.5	6	Ohms
Stall torque	19	6.7	6.7	6.6	11.1	oz-in
No load current appr.	200	100	60	50	30	mA
Recommended current	1.2	1.5	1.0	0.8	0.5	mA
Torque constant	1.04	0.87	1.39	1.50	2.80	oz-in/A
Counter-EMF	1.2	0.65	0.95	1.1	1.9	mV/rpm
Speed/Torque Gradient	1610	1320	1770	2050	1060	rpm/oz-in

Series 28–52 • 15 Watts • 4000 RPM

Dimensions — mm 1 mm = 0.0394 in

lagnet	SeCo5
ommutator	CuAg 0.1, 7 segments
rushes	Graphite
earings	Oilite

Efficiency	up to 85%
Rotor Moment of Inertia	0.14 oz-in^2
Mechanical Time Const. appr.	20 ms
Weight	5.8 oz

Recommended Operational Data

Speed	4000 rpm
Torque	4.5 oz-in
Temperature	−4° to +175°F
Max. Rotor Temp.	250°F

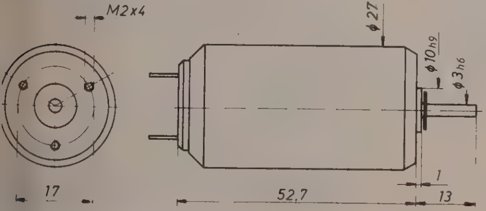
Standard Gear Ratios

4:1	7:1		1-stage
25:1	46:1		2-stage
93:1	169:1	308:1	3-stage

Possible Combinations:

Gear Head	P 32
Encoder	HEDS-5500

Max. Torque oz-in	Efficiency	Stages	Length in
100	0.8	1	1.3
300	0.75	2	1.7
600	0.7	3	2.0

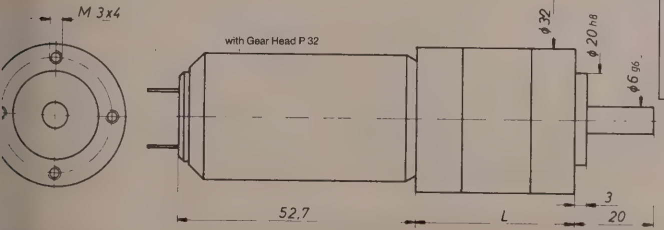


lanetary Gear Head P 32 for
eries 28-52

lax Motor Speed	5000 rpm
emperature	5°F to 140°F

fe at specified torque appr. 3000 hrs

Type	28-52-30	28-52-20	
Voltage	12	24	V
No load speed	5600	5800	rpm
Resistance	2.3	10	Ohms
Stall torque	16.2	13.9	oz-in
No load current appr.	120	80	mA
Recommended current	1.2	0.6	mA
Torque constant	3.18	6.0	oz-in/A
Counter-EMF	2.0	4.0	mV/rpm
Speed/Torque Gradient	347	417	rpm/oz-in



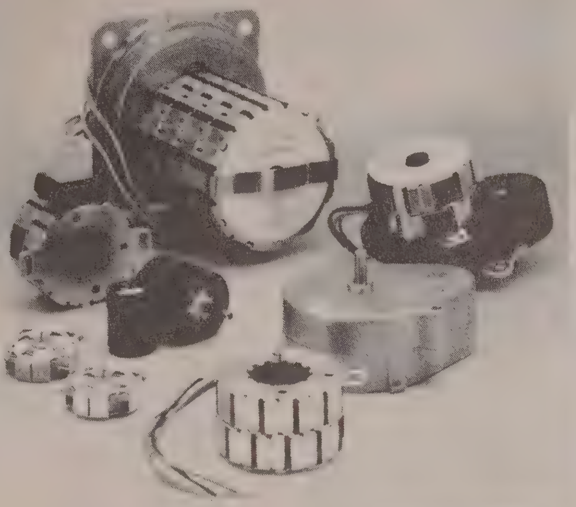
Burgess SAIA, INC.

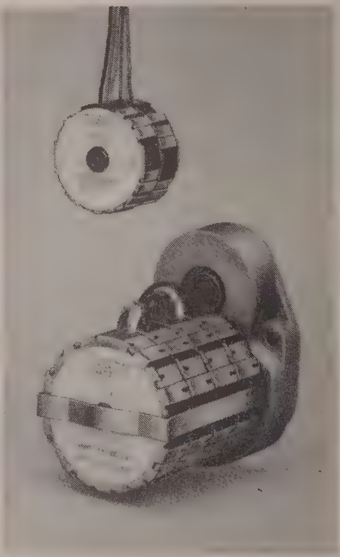
Motor Division

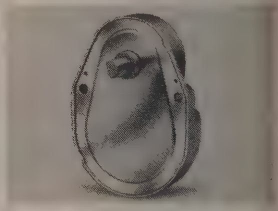
1335 Barclay Boulevard
Buffalo Grove, IL 60089
Tel (1-708) 215-9600
Fax (1-708) 215-9606

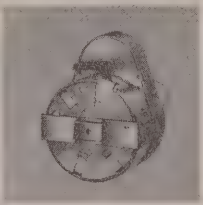
BURGESS-SAIA PRODUCTS MEET **ISO 9001** STANDARD

PRECISION MOTORS









Burgess-SAIA is an international supplier of ultra-high quality OEM products. Motor fabrication and assembly of millions of electrical motors, timers, and switches takes place in our Murten, Switzerland facilities, offering complete customer support worldwide.

UNIDIRECTIONAL SYNCHRONOUS MOTOR – SERIES UDS 1, For single phase AC and with permanent magnet rotor, the direction of rotation is not given by the supply system, so that starting in the correct direction is predetermined by the design.

A wide selection of rated voltages and gear boxes including heavyduty are available. Approved by all major national and international testing authorities UL, CSA, VDE.

REVERSING SYNCHRONOUS MOTORS – SERIES UAT, UBR, UDR 1, UFR 1, UFM 1, UFR 4, UHM 1, Single-phase AC with permanent magnet rotor require at least two stators or stator windings. The electrical reversal of the direction of rotation is performed by a single-pole changeover switch. Reversing synchronous motor with four stators are available and it consist of two series or parallel connected synchronous motors with two stator windings.

REDUCTION GEARS – SERIES A, D, M, B, F, V, and J, The ruggedly designed reduction gears consists of hardened, polished steel. Gears are maintenance-free permanently lubricated in an enclosed housing.

Torque range 32 cNm (45.3 oz in) to 1500 cNm (2126 oz in), speed range 5/12 s to 100 days, motor and gear combined by means of a snap-on clip, heat-treated gear-wheels in gears where T>250 cNm (354 oz in), various single-way and two-way slipping clutches, special output shafts available.

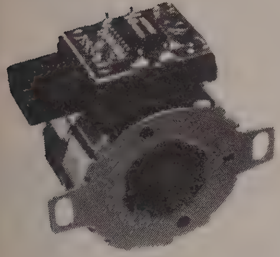
STEPPER MOTORS – Series UBB / UBD, UDB, UFB / UFD, UFB 3 and 4, URD, UKD, UAF 1, UAG The principal advantage of the step motor lies in the fact that its rotational position can be constantly monitored without need for a position feedback system. It is also possible for a step motor to be accelerated without loss of its positional accuracy. It is eminently suited as a digital actuator in conventional hydraulic, pneumatic, and mechanical applications. Burgess-SAIA STEP MOTORS are simple in design, have a remarkable power capacity and they are competitively priced. Custom windings are available upon request and engineering support for any OEM designs.

Burgess SAIA, INC.

Motor Division

1335 Barclay Boulevard
Buffalo Grove, IL 60089
Tel (1-708) 215-9600
Fax (1-708) 215-9606

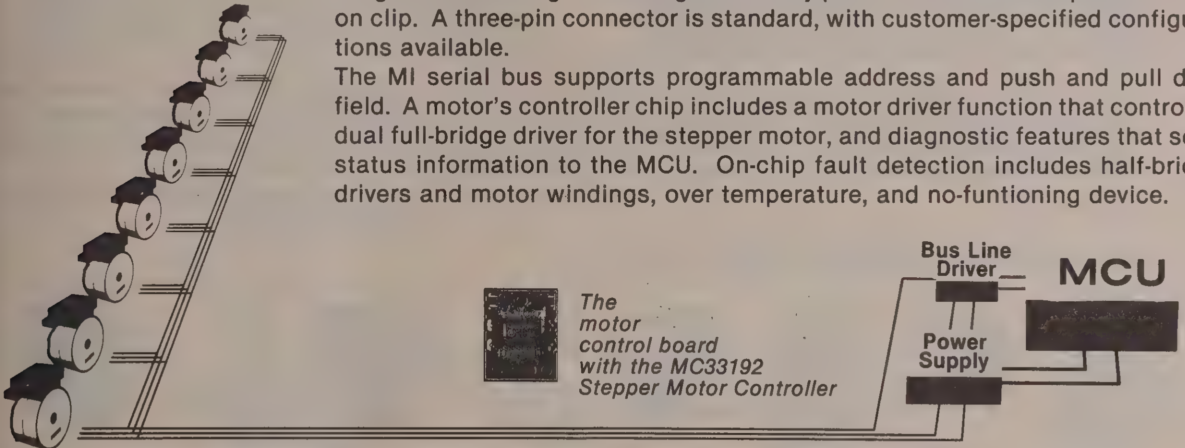
BURGESS-SAIA PRODUCTS MEET **ISO 9001** STANDARDS



Intelligent Stepper Motor – Up to eight intelligent stepper motors, with integrated controller chips, can be operated on a single, three-wire, serial Motorola Interconnect Bus (MI BUS). Two wires of the MI bus carry power to the motors, while one wire carries coded control data between a master control unit (MCU) and the controllers in each motor. Use of a serial bus, with integrated motor controllers, eliminates the bulky and expensive wiring looms, and the possibility of electromagnetic interference, associated with the conventional approach of housing a motor's control circuits in a separate module. The intelligent, two-phase stepper motor has reversible direction of rotation, with a step angle of 15°, or 24 step per revolution. Rated voltage is 12V DC. Output power, with 100 ohms/phase per winding, ranges from 85 mW to 260 mW, and torque from 7 mNm to 3.3 mNm, over the frequency rang 50 Hz to 300 Hz. Operating temperature range is –40° C to +85° C.

Dimensions of the motor are 36 mm diameter and 21 mm thickness. The weight is about 75 g. Mounting can be any position with a screw plate or snap-on clip. A three-pin connector is standard, with customer-specified configurations available.

The MI serial bus supports programmable address and push and pull data field. A motor's controller chip includes a motor driver function that controls a dual full-bridge driver for the stepper motor, and diagnostic features that send status information to the MCU. On-chip fault detection includes half-bridge drivers and motor windings, over temperature, and no-funtioning device.



The motor control board with the MC33192 Stepper Motor Controller

Stepper and Synchronous Motor – Series UAG 1, 2, 3, 4, and UAT1 – A tin-can type 20 mm motor is available in two operational modes. There is a stepper series (UAG) and a reversing synchronous series (UAT). External dimensions of the UAG/UAT motor are 20 mm diameter and 17.2mm thickness. The weight is 25 grams.

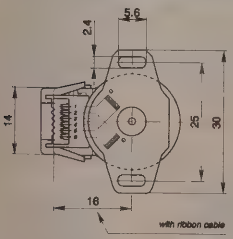
Stepper units have holding torques from 4.2 mNm (UAG 2, 4-phase) to 7.0 mNm (UAG 3, 2-phase) at rated voltage of 6V, 12V, or 24V. The step angle is 18°. Synchronous units (UAT) develop running torque of 2 mNm at speeds of 600 rpm or 720 rpm. Rated supply voltage is 24V or 48V, 50 Hz or 60 Hz.

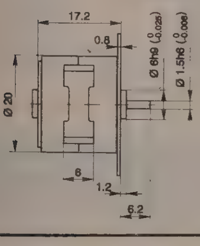
Ambient temperature rating for operation of the synchronous version is –15° C to +65°, with continuous running permitted. Steppers are rated for ambient temperature of –40° C to +85° C.

In addition to units with a standard rotor, versions are also available with a reinforced rotor made of neodymium, a high-quality magnetic material. Hardened, ground and polished steel is used for the rotor spindle. The rotor-spindle bearings are self-lubricating, sintered bronze.

Assembly of this motor into equipment is simplified by the use of a self-stripping ribbon cable for interconnection of the motor with its power source. Connections to all the wires in the cable are made with one step in a press-fit action that pierces the cable's insulation and terminates the wires. A complete assembly with ribbon cable and an AMP Micro-Match plug is available. The motors can be mounted in any position with a screw plate.

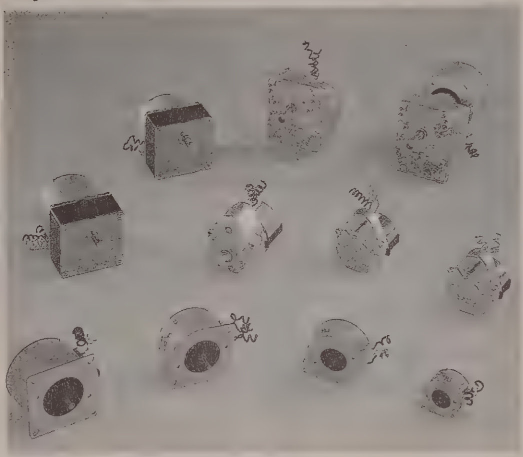
This 20 mm motor has the small dimension, low weight, and high performance-to-volume ratio needed for use in smaller, thinner, and lighter end products.



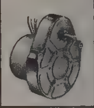


Crouzet® Sub-Fractional Motors

Synchronous Motors and Gear Motors



STANDARD PEAR-SHAPED GEAR MOTORS

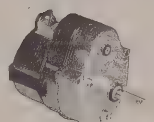
Rotation	Uni-Directional		Reversible	
Torque	Standard Torque	High Torque	Standard Torque	High Torque
Part Number	82 344	82 334	82 514	82 524
Synchronous Gear Motors				
Static Torque Dynamic Torque Running Torque @ 1 RPM Power Input	300 in.oz. 75 in.oz. 155 in.oz. 2.7 w	300 in.oz. 75 in.oz. 580 in.oz. 2.8 w	300 in.oz. 75 in.oz. 420 in.oz. 2.7 w	300 in.oz. 75 in.oz. 1200 in.oz. 3.5 w
Range of Speed	1/24 RPH - 150 RPM		1/24 RPH - 96 RPM	

- High Torque, instant stop
- Uni-directional or reversible
- Precision double bushing
- Standard round, flatted, or knurled shaft
- UL, CSA, VDE, and other European approvals
- Optional: Dual Voltage, friction or one-way clutch, low-temperature lubrication, etc.

Typical applications include medical and office automation equipment, instrumentation, peristaltic pumps, displays, and export items. (See "Assembly Capabilities" at bottom of next page.)

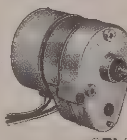
OTHER GEAR MOTOR CONFIGURATIONS

Heavy-Duty Unidirectional Gear Motors
Gear Train
Dynamic Torque: 300 in. oz.



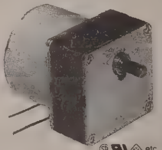
Types
82 304 Std. Torque
82 305 Hi-Torque
etc

Heavy-Duty Reversible Gear Motors
Gear Train
Dynamic Torque: 300 in. oz.



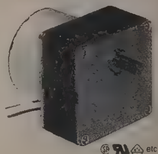
Types
82 519
82 529
etc

High-Torque Reversible Gear Motors
Gear Train
Dynamic Torque 45 in lbs



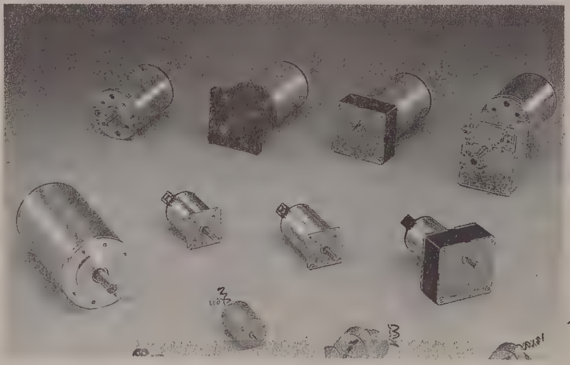
Types
80 537
80 547
etc

High-Torque Reversible Gear Motors
Gear Train
Dynamic Torque: 25 in lbs.



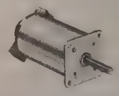
Types
80 536
80 546
etc

DC Motors - Permanent Magnet

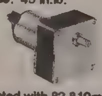
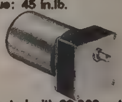


Permanent magnet DC motors feature interchangeable brushes. Series 82 810 and 82 800 are built with sintered bronze sleeve bearings as standard. Front ball bearing is optional on the fore-mentioned series and standard on the 82 830 series.

DIRECT-DRIVE MOTORS

			
82 810 Series 12/24/48V		**82 800 Series** 12/24/48V	**82 830 Series** 12/24/48V
Diameter	1.65 in.	1.65 in.	2.45 in.
Nominal Output Pwr.	9 w	15 w	27 w
No Load Speed	3100RPM	3100 RPM	2100 RPM

GEAR MOTORS

Geartrain Dynamic Torque: 45 in.lb.  Mounted with 82 810motor **80 817 Series**	Geartrain Dynamic Torque: 45 in.lb. Mounted with 82 800motor **80 807 Series**	Geartrain Dynamic Torque: 45 in.lb.  Mounted with 82 830motor **80 837 Series**
Speed Range	.6 RPH to 620 RPM	

Crouzet *Motors - Switches - Timers - Counters - Pneumatic Controls*

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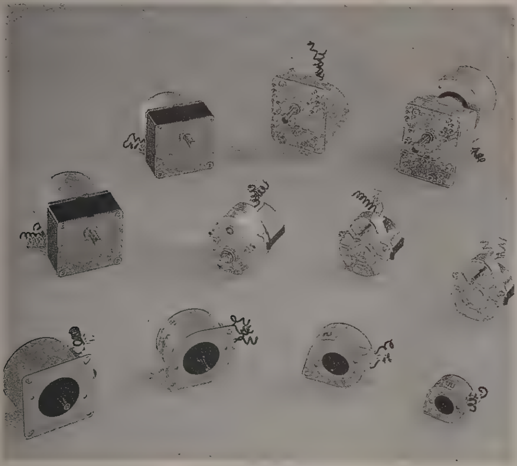
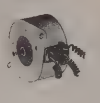
Crouzet® Sub-Fractional Motors (cont.)

Stepping Motors



STEPPING MOTORS
7.5° - 2 PHASE AND 4 PHASE

PART NUMBER	82 910.0	82 920.0	82 930.0	82 940.0
STEPPING MOTORS				
Diameter	1.4" (35.5mm)	2" (51mm)	2.25" (57.5mm)	2.55" (65mm)

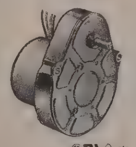
All Crouzet direct-drive stepping motors are available with an optional gearhead, as shown in examples below.
Custom modifications are available upon request for quantity orders.

Typical applications include medical equipment, printers, card readers, chart recorders and export items.
(See "Assembly Capabilities" below.)

Motor	Holding Torque In. oz. (mN.m)		Step Angle	Steps/ Turn	Operating Voltage	Resistance Per Phase						Specs Page
						2 Phase			4 Phase			
	2 Phase	4 Phase				5V DC	12V DC	24V DC	5V DC	12V DC	24V DC	
82 910	3.5 (25)	2.8 (20)	7.5	48	5, 12, 24	12.9	66	286	15.5	66	286	10
82 920	9.9 (70)	8.07 (57)	7.5	48	5, 12, 24	10.7	46	198	10.7	46	238	12
82 930	25.5 (180)	21.9 (155)	7.5	48	5, 12, 24	9	22.3	115	7.4	32	138	14
82 940	42.5 (300)	42.5 (300)	7.5	48	5, 12, 24	5.2	26.7	96	7.4	26.7	115	16

GEARHEAD OPTIONS

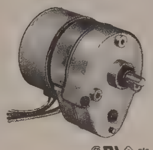
Pear-Shaped Gear Motors
Gear Train
Dynamic Torque:
75 in. oz.



Types
82 914
82 924

etc

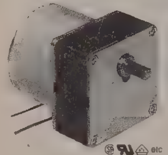
Heavy-Duty Gear Motors
Gear Train
Dynamic Torque
300 in. oz



Types
82 919
82 929

etc

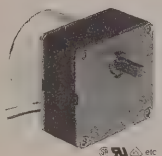
High-Torque Gear Motors
Gear Train
Dynamic Torque
45 in lbs



Types
80 936
80 946

etc

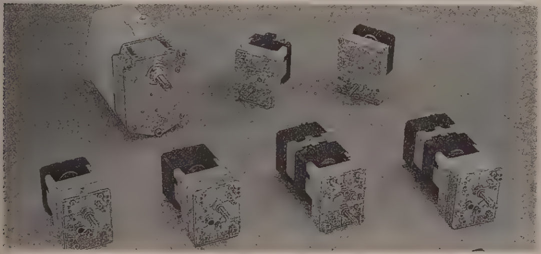
High-Torque Gear Motors
Gear Train
Dynamic Torque
25 in lbs



Types
80 937
80 947

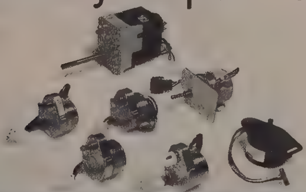
etc

Shaded Pole Gearmotors



Instrument-grade shaded pole gearmotors are designed for exceptionally low noise operation and long life. Features of this high quality line include rugged die-cast gear case, optional fast stopping brake, and choice of metal or delrin gears. Output speeds range from 5 to 120 RPM and dynamic torque ratings range from 5 to 50 in.lbs.

Assembly Capabilities



One of Crouzet's specialties is creating and supplying motor "packages". Our ability to supply motors complete with connectors, capacitors, protective sleeves, various shaft attachments, special mounting plates, and even switches, allows us to meet virtually any application requirement.

Crouzet will help you save time, money, and aggravation, with a complete motor package.

Crouzet *Motors - Switches - Timers - Counters - Pneumatic Controls*

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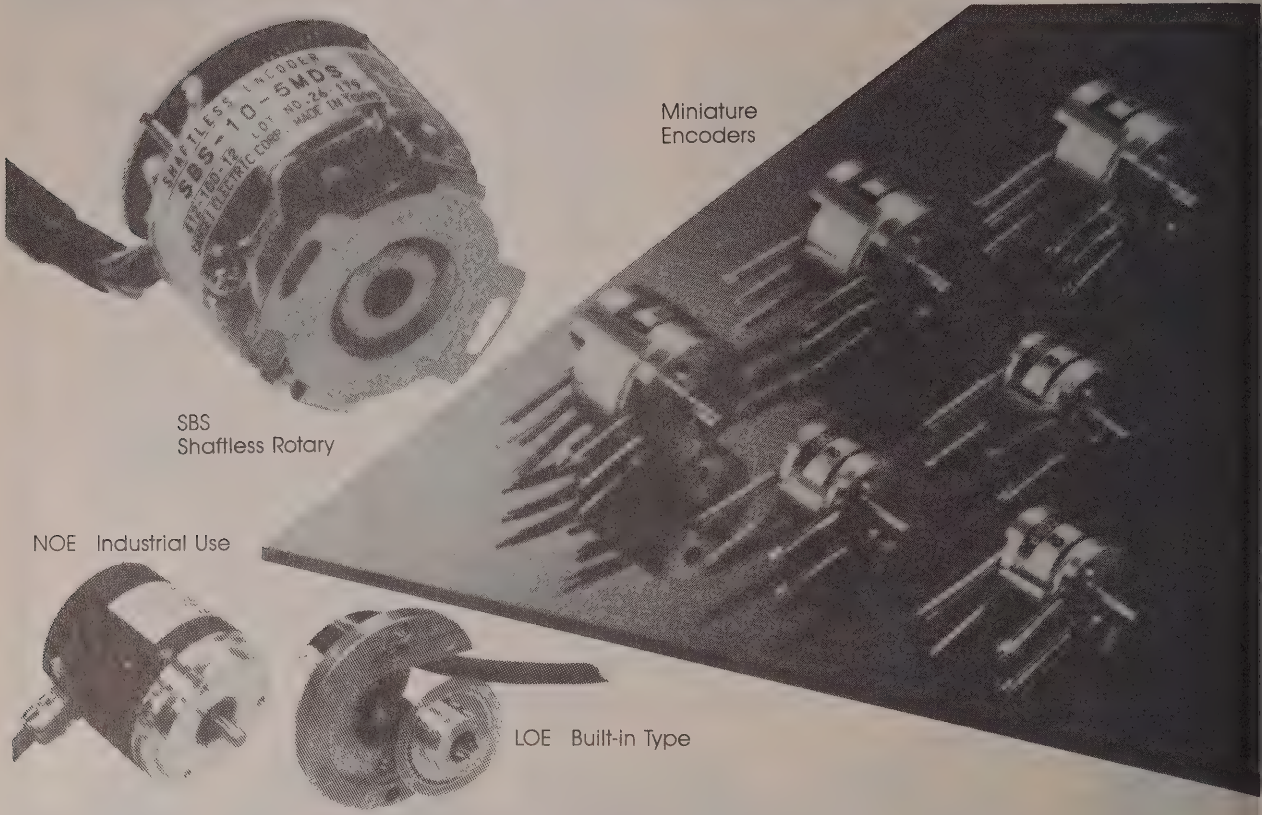
ENCODERS

Rotary and Shaftless Rotary

CUi STACK



TYPE AVAILABLE	Output Waveform	Shaft Diameter	Response Speed KHz	Pulse per Revolution
Miniature Type 1 **OMS**	a/a,b	1.5	10	50-125
Miniature Type 2 **OME**	a/a,b/a,b,m	2.5	10	100-360
Small Standard Type **OSS**	A/A,B/ABM	4	50-60	60-500
Economical Plastic Type **OSE**	A	4	50	60-300
Small Industrial Use **OES**	ABM	5	50	100-1000
Small Heavy Duty Type **FES**	ABM	5	50	100-1200
Advanced Small Industrial **OEW**	A,B/ABM	6	20-200	100-2500
Standard Type **OEL**	A,B/ABM	5	60	100-1200
Industrial Use **NOE**	ABM	6	20-150	100-2500
Heavy Duty Type **OPN**	ABM	10	100	100-2500
Water Proof Type **OPP**	A,B/ABM	10	60	100-1200
Small Number Pulses **OEK**	A,B	8	10	5-360
Super Heavy Duty Type **NE**	ABM	15	150	1000-2500
Manual Pulse Generator **OGM/OSM/HP/OVM**	A,B		1	25-100
Motor Mounting **SBRN**	ABM/ABMUVW	8*	100	100-2500
Small Motor Mounting **SBS**	ABM/ABMUVW	8*	100	100-3000
Motor Mounting **SBG**	ABM	26*	60	100-1000
Shaftless Rotary **SBS**	ABMUVW	8*	200	100-3000
Shaftless Rotary **SBW**	ABMUVW	6*	200	100-2000
Shaftless Rotary **SBZ**	ABMUVW	4*	200	100-1000
ABSOLUTE				

All capital letters = Square Wave Signals
* = Hole Diameter
All lower case letters = Near Sine Wave

The CUI STACK
DIFFERENCE

You get the best value for your hard-earned money. We have over 20 years of world-wide electronic sourcing experience. Our service-oriented staff and highly qualified sources are committed to making you a satisfied customer.

CUI Stack also carries adaptors, speakers, switches, oscilloscope probes, din connectors, molded assemblies, jacks and plugs, relays, meters, capacitors, PC boards and small DC motors.

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Beaverton, OR 97005

The more demanding your motion application, the more you need to talk to us.

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EAD

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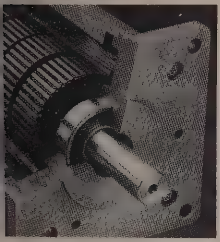
STEPPING MOTORS

hese permanent magnet
and variable reluctance
notors are made in a
broad range of configu-
ations and step angles
rom 1.8° to 90°, with
igh positioning accuracy
f ±3% noncumulative.
These units will pro-
luce exceptionally high
orque/size ratios, are
asily controlled by dig-
tal commands and oper-
te at slewing rates of
0,000 steps/second
nd higher.
izes: 8, 11, 15, 18,
0, 23, 34, and 42
idirectional.



LINEAR ACTUATORS

Based on our 1.8° permanent magnet stepping motors, these linear actuators transform rotary motion of the rotor into linear motion of the lead screw.

Units operate over a wide temperature range and offer extremely fine resolution and high linear force up to 1 ton.

The threaded shaft does not rotate, therefore critical speed problems associated with rotating a long shaft are eliminated. Standard units feature a CRS rolled thread shaft and a bronze rotating nut.

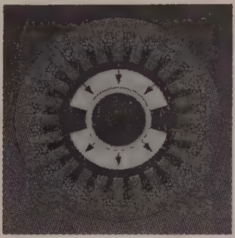
Sizes: 23, 34, and 42.

BRUSHLESS DC MOTORS

When life, EMI generation, maintenance costs, efficiency, and output-per-cubic-inch are important factors, brushless DC motors offer an attractive solution. New electronic components and rare earth magnets increase the growing popularity of these motors.

Sizes: 8, 10, 15, 18, 23, 31, 34, and 39.

Drives: Unipolar and bipolar to 20 amps and 350 VDC.



SYNCHRONOUS MOTORS

EAD is the North American leader in the design and manufacture of hysteresis/synchronous motors.

Sizes: 10 to 56, to ½ HP.

Synchronous (hysteresis and reluctance) motors produce smooth operation and precise speed which will not vary with load or voltage.

Hysteresis-synchronous motors develop smooth, constant starting and accelerating torque. They synchronize any load within their torque rating regardless of inertia.

Available in 1-, 2- and 3-speed designs.

BLOWERS, FANS

Move air from 3 to 2000 cfm quietly. From 1½″ to 10″ in diameter.

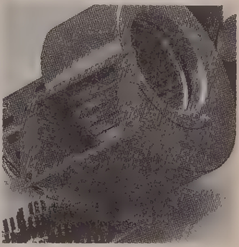
Centrifugal blowers: Deliver air at relatively high static pressure.

Tubeaxial fans: Move air through a wide range of volumes at medium pressure.

Vaneaxial fans: Move air axially over a wide range of volumes at relatively high pressure.

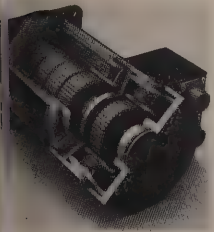
Propeller fans: Move air in large volumes at low pressure.

Mixed flow fans: Move air where it needs to be dispersed radially.



LOSED-LOOP TEPPING MOTORS

/hen improved perfor-
ıance and load varying
quirements are beyond
ie range of a standard
epping motor, the
osed-loop stepping
otor will supply the
tra control, power, and
erformance needed to
eet the requirements.
zes: 23, 34, and 42
directional. Maximum
eeds 3000 RPM con-
ıuous, 4500 peak.

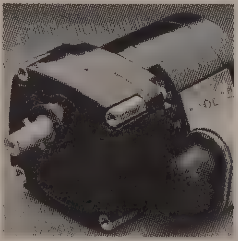


INSTRUMENT MOTORS AND GEARMOTORS

Our compact, permanent split capacitor motors and gearmotors are made in induction, torque, and synchronous versions.

Sizes: 25 and 29.

Available with 2, 4, or 8 poles, single or 2-phase, 50 and 60 Hz, gear ratios to 1800:1, output to 150 oz. in. Motors up to 1/100 HP.



SERVO MOTORS AND GEARMOTORS

Servo motors are 2-phase AC induction motors with permanently lubricated and shielded ball bearings. They can be controlled by solid state amplifiers, offer precise control, fast response, and are inherently impedance protected. Servo gearmotors have a high torque-to-inertia ratio. Reductions from 3:1 to 3600:1.

Sizes: 8 thru 23 for 50/60 or 400 Hz operation.

Gearmotors offer smooth, low-speed operation at moderate output torques. Lubricated motor ball bearings for maintenance-free operation. Outputs 1/500 to 1/20 HP AC.

TORQUE MOTORS

Torque motors offer smooth, moderate accelerating torque and low speed, with speed ranges from near zero to near synchronous. Options include shaft styles and extensions, nonstandard voltage and frequency, various mounting styles.

Sizes: 25, 34, and 44 open or totally-enclosed construction.

INDUCTION MOTORS

1-phase and 3-phase models and both high and low slip.

Single-phase motors available in permanent split capacitor and capacitor start versions.

Sizes: 10, 18, 25, 31, 34, 39, and 44.

Outputs to ½ HP. Available in both 50/60 Hz and 400 Hz versions.

OTHER PRODUCTS

Alternators, all frame sizes.

Precision military motor tachometers, sizes 11, 15, 18.

Rotor/stator sets, all frame sizes.

ELTROL
ELTROL CORPORATION

DC SERVO SYSTEMS

For applications requiring closed servo loop performance

MODEL 7-300-030-00
BRUSHLESS D.C. VELOCITY SERVO SYSTEM

The basic system includes the following:

- Brushless DC servo controller
- Brushless DC motor
- Commutation position encoder
- Incremental optical encoder

The system provides precise velocity control in a complete package: Internal D.C. power supplies, crystal reference, controls for bidirectional rotation and variable speed, digital speed readout, operating controls and status indicators.

Instantaneous speed regulation to ±.001%

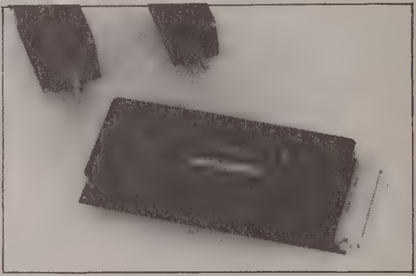
Fault protection: Overtemperature, shorts to ground, shorts across motor

Current loop: High bandwidth with current limiting

Input power: 115/220VAC, 1 ϕ, 50–60 Hz

The Eurocard Phase Lock Servo Controller included in Model 7-300-030-00 is available as a separate item.

MODEL 5-156-028-00
BRUSH OR BRUSHLESS D.C. SERVO CONTROLLER

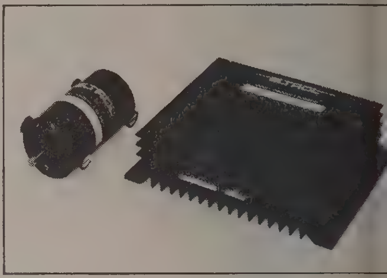


This EUROCARD provides closed loop four quadrant PWM control of motor velocity or torque. It offers maximum flexibility. Many operating features are set by pluggable jumpers. Variable compensation and gain by plug-in component carrier and trim pots simplify set up of closed loop operation.

FEATURES

- Single 24–60 volt P.S.
- Adjustable current 5–15 amps
- High efficiency 24KHZ PWM drive scheme minimizes EMI in noise sensitive applications
- Fault protection for excess temperature, speed, voltage, current, and motor stall
- Digital inputs command enable/reset, brake, and ± travel limits
- Differential amplifier for ± 10V input command
- Velocity F/B from commutation sensors, encoder, or DC tachometer

MODEL 6-120-024-00
BRUSH-TYPE LINEAR D.C. SERVO CONTROLLER



Motion control of position, velocity, c torque.

Simple adjustments for application adaptation

Peak output current: 2–10 amps

Linear operating mode: No switching EMI, high servo stiffness, no torque dead zone

Fault protection: Shorts across moto shorts to ground, peak and time dependent continuous foldback curren limits, external fault indication and reset.

The Eltrol motor-tach shown above is ideally suited to take full advantage of the servo controller's capabilities.

Eltrol Corporation is an engineering oriented firm specializing in D.C. servo systems. We provide standard, modif standard or custom designed systems to your electrical and mechanical specifications.

Write or call us today for additional information.

ELTROL
ELTROL CORPORATION

20942 Osborne Street
Canoga Park, CA 91304-1846
(818) 709-0131 FAX # (818) 709-0132

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68 West Commercial Avenue • Moonachie, New Jersey 07074
Tel: (201) 460-0510 • Fax: (201) 935-8153

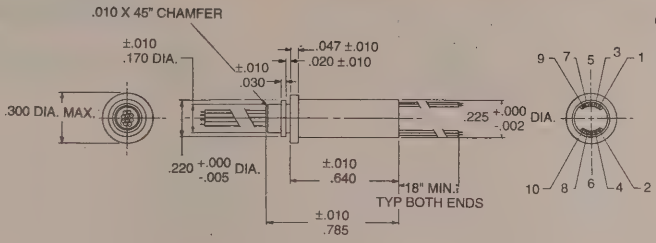
Go Ahead Challenge Us!

MULTI PURPOSE SLIP RING CAPSULES

ow Cost "Standards"
PECIAL DESIGNS AVAILABLE

P/N	No. Circuits	Current
C-2040	1-10	.5 Amp per Circuit

ings and Brushes: Gold Alloy per MIL-G-45204
eadwire: #28 AWG 18" Long
lousing: Aluminum
haft and Bearings: ST STL
urrent: Signal to .5 Amps
ielectric Strength: 500 Volts
ontact Resistance: 10 Milliohms
PM: 225 Max Bi-direction
oise: .75 Millivolts @ 50 Milli Amps

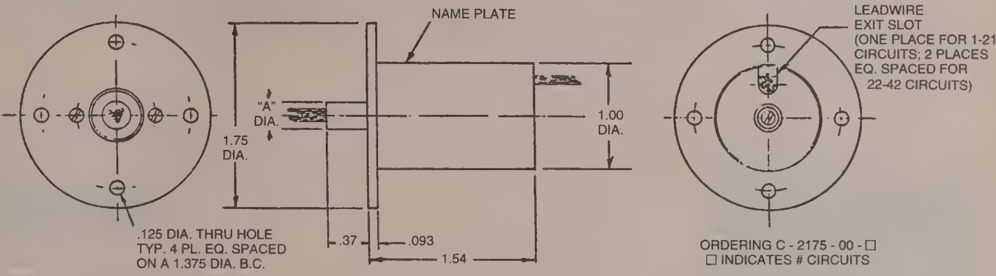

.010 X 45° CHAMFER
±.010
.170 DIA.
±.010
.030
.047 ±.010
.020 ±.010
.300 DIA. MAX.
.225 +.000 -.002 DIA.
.220 +.000 -.005 DIA.
±.010
.640
18" MIN. TYP BOTH ENDS
±.010
.785
9 7 5 3 1
10 8 6 4 2

ORDERING C - 2040 - 00 - ☐
☐ INDICATES # CIRCUITS

/N	No. Circuits	Current
-2175	1-42	1 Amp per Circuit

ings and Brushes: Gold Alloy per MIL-G-45204
eadwire: #28 AWG 18" Long
ousing: Aluminum
haft and Bearings: ST STL
urrent: Signal to 1 Amp
ielectric Strength: 500 Volts
ontact Resistance: 10 Milliohms

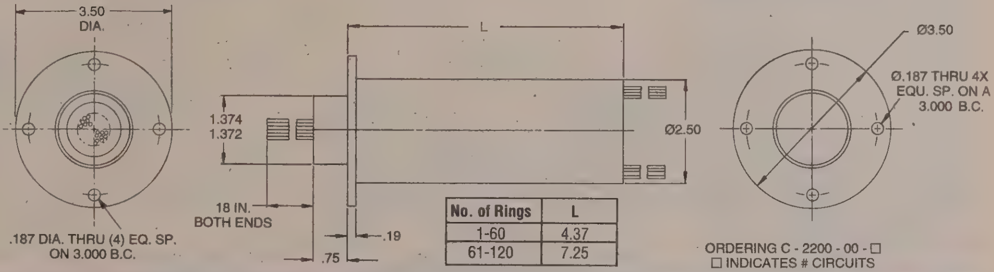
A Dia.	No. of Circuits
.249	1 thru 21
.374	22 thru 42


NAME PLATE
"A" DIA.
1.75 DIA.
1.00 DIA.
.125 DIA. THRU HOLE TYP. 4 PL. EQ. SPACED ON A 1.375 DIA. B.C.
.37
.093
1.54
LEADWIRE EXIT SLOT (ONE PLACE FOR 1-21 CIRCUITS; 2 PLACES EQ. SPACED FOR 22-42 CIRCUITS)

ORDERING C - 2175 - 00 - ☐
☐ INDICATES # CIRCUITS

/N	No. Circuits	Current
-2200-00-1	1-60	3 Amps per Circuit
-2200-00-2	61-120	Optional 5 Amps

ings and Brushes: Gold Alloy per MIL-G-45204
adwire: #26 Gauge Wire 18" Long
ousing: Aluminum
aft and Bearings: ST STL
rrent: 3 Amps/Optimal 5 Amps
electric Strength: 500 Volts
ntact Resistance: 10 Milliohms

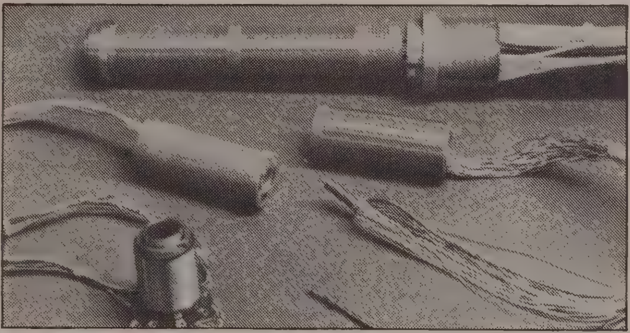

3.50 DIA.
.187 DIA. THRU (4) EQ. SP. ON 3.000 B.C.
L
1.374
1.372
Ø2.50
18 IN. BOTH ENDS
.19
.75
Ø3.50
Ø.187 THRU 4X EQU. SP. ON A 3.000 B.C.

No. of Rings	L
1-60	4.37
61-120	7.25

ORDERING C - 2200 - 00 - ☐
☐ INDICATES # CIRCUITS

SLIP RING SEPARATES

/hen a "capsule" slip ıg is not practical due to ystem size constraints or ɔst limitations. We will rovide a slip ring (rotor) nd brush block (stator) s separate components be mated by the cus- mer. The rotor will be upplied in a drum onfiguration. The drum pproach features con- ecutive individual rings ong the axis of rotation.



Number of Circuits	Part Number	Mating Brush Block	Ring O.D.	Ring Pitch	Back Shaft Diameter	Back Shaft Length	Flange Diameter	Special Features
1-10	2690	259	.081	.040	.125	.250	.150	FB, RB, VG
1-12	2170	2170-B	.060	.100	—	—	—	FB
1-15	2138	2162	.130	.045	.130	.343	.205	FB
1-17	2317	2317-1	.442	.035	.475	.040	N/A	RB, FB, VG
3, 5, 6	2248	2248-B	.067	.025	.061/.060	.070/.142	.115/.109	Double V-Groove
6	2143	2145	.093	.030	.093	.125	.156	FB, RB
10	2318	2319	.060	.040	.110	.220	.156	RB, VG
19-60	2180	2180	1.220	.045	N/A	N/A	N/A	.500 Bore, VG

ɔreviations Used: FB - Flat Barrier VG - V-Groove RB - Raised Barrier

Capsules For Every Application

Part No.	No. of Rings	Fig.	A	B	C
C2321-00	10	A	.372	.532	.372
C2040-00	10	A	.300	.593	225
C2161-00	16	A	1.250	1.400	1.250
C2322-00	17	B	.565	1.200	.350
D2199-00	18	B	.625	1.010	.351
C2175-00-1	21	A	1.75	1.447	1.000
D2066-00	28	B	.680	.720	.680
C2175-00-2	42	A	1.75	1.447	1.000
C1963-00	42	B	.730	1.520	.624
D2292-00	44	B	2.300	2.500	2.380
D1690-00	46	B	.500	1.09	.623
D1700-00	48	B	.623	1.160	.623
D2227-00	48	B	1.300	1.580	1.120
D1988-00	66	B	.650	1.050	.593
D2246-00	72	B	2.380	3.500	1.63
E2285-00	126	B	3.200	5.000	2.700
D2180-00-1	136	A	3.500	7.887	2.400
D2180-00-2	187	A	3.500	10.531	2.400
D2180-00-3	240	A	3.500	12.843	2.400
D2180-00-4	300	A	3.500	15.848	2.400

FIG. A

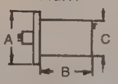
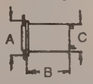


FIG. B



CAPSULES

Typical capsule characteristics include Low Noise, Low Torque, Precious Alloy Contacts, Current Carrying Capacity to 5 AMPS, Dielectrics to 750VAC. Consult factory for specific capsule characteristics.

ectro-Miniatures – The Leader In Slip Rings And Slip Ring Technology.

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Tel: (201) 460-0510 • Fax: (201) 935-8153

Go Ahead
Challenge Us!

STANDARD SLIP RING ASSEMBLIES

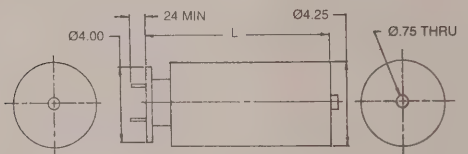
2235 Series

1. Material: **Rings:** Coin Silver
Brushes: Silver Graphite
Housing and Shaft: Aluminum

2. Electrical: **Current:** All rings 5 Amps max.
Wire: All wire 22 gauge Teflon-E,
Noise: 8 Milliohms peak/ring at max. speed
Hi-Pot: 500 VAC between all conductors
Insulation Resistance: 200 Megohms min. at 500V DC
Static Resistance: .40 Ohms max/ring
Voltage: 0-115 VAC or VDC

3. Mechanical: **Speed:** 1500 RPM max
Torque: 1/2 in.-oz. per circuit max.

Part No.	No. of Circuits	"L" Dim.
D2235-00-1	20	5.56
D2235-00-2	40	8.37
D2235-00-3	60	11.18
D2235-00-4	80	13.99
D2235-00-5	100	16.80
D2235-00-6	120	19.61
D2235-00-7	140	22.42
D2235-00-8	160	25.23
D2235-00-9	180	28.04
D2235-00-10	200	30.85



ENCLOSED BORE TYPE DESIGNS
MK Series 1.25 I.O. to 2-750 I.O.

Part No.	No. of Circuits
MK-1250-00-☐	1-40
MK-1500-00-☐	1-40
MK-1750-00-☐	1-40
MK-2250-00-☐	1-40
MK-2500-00-☐	1-40
MK-2750-00-☐	1-40

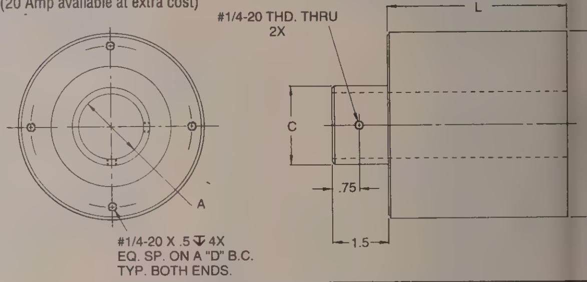
A I.D.	B O.D.	C	D
1.250	5.00	1.625	4.37
1.500	5.00	1.875	4.37
1.750	5.00	2.125	4.37
2.250	6.00	2.625	5.37
2.500	6.00	2.875	5.37
2.750	6.00	3.125	5.37

No. of Rings Max.	
10	4
20	6
30	8
40	10

Frame: Treated Aluminum
Rings: Coin Silver
Brushes: Silver Graphite
Leafs: Beryllium Copper
Current: 10 Amp per circuit (20 Amp available at extra cost)

Voltage: 250V max. AC or DC
Dielectric Strength: 750 Vrms
Insulation Resistance: 50 meg. min.

Contact Resistance Variati
10 Milliohms max. at max. s
Operating Temp.: 0 to 250
Humidity: 95%° max.



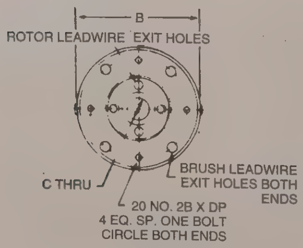
STANDARD BORE TYPE DESIGNS
DO 4000 Series

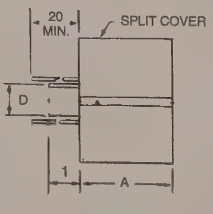
Part No.	B	C	D	E
DO4003	6.625	.500	.750	5.000
DO4004	7.625	1.375	1.750	6.000
DO4005	8.750	2.250	2.750	7.125
DO4007	11.000	3.500	4.000	9.375
DO4010	13.500	6.000	6.500	11.875
DO4011	14.500	7.000	7.500	12.875

No. of Circuits	A
2-10	3.923
12-20	5.316
22-30	6.709

OPEN & ENCLOSED UNITS AVAILABLE 2-30 CHTS.

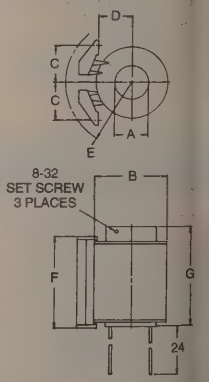
Rings: Hard Silver plated Copper
Brushes: Silver Graphite two per ring
Leafs: Plated Beryllium Copper
Leadwire: 16 AWG type E Teflon rotor only
Insulation: Laminated phenolic
Brush Termination: Screw type
Current: 10 Amps per circuit (20 Amps with 4 brushes per circuit)
Voltage: 250 Volts AC or DC
Dielectric Strength: 1500 Volts RMS
Insulation Resistance: 100 Megohms min.
Contact Resistance: 10 Milliohms max.
Noise: One Millivolt at a current of 50 Milliamperes
Speed: To 1500 RPM
Coin Silver rings available if required for your application AJ8000 Series


B
ROTOR LEADWIRE EXIT HOLES
C THRU
BRUSH LEADWIRE EXIT HOLES BOTH ENDS
20 NO. 2B X DP
4 EQ. SP. ONE BOLT
CIRCLE BOTH ENDS



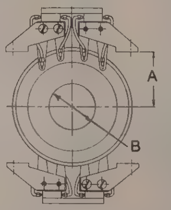
ALL PURPOSE OPEN DESIGN
MP Series/AJ 20000 Series

1. **Ring Material:** Laminated Copper, Silver plated
2. **Brush Material:** Silver Graphite on a Beryllium Copper leaf 2 contacts per circuit. (4 contacts MP Series)
3. **Insulation Material:** Glass base epoxy resin, fungus treated or paper base phenolic, fungus treated.
4. Wire per MIL-W-16878-4 Teflon #16AWG on rotor (brush block has #4-40 screw type terminals for hook-up)
5. **Electrical Characteristics:**
   Voltage: 220 RMS
   Current: 10 Amps continuous (20 Amps 4 Contacts-MP Series, 50 Amps)
   Hi-Pot: 1500 Volts RMS, 60 cps
   Insulation Resistance: 100 Megohms min.
   Brush Noise: .5 Millivolts at 50 Milliamps
6. **Speed of Rotation:** to 1500 RPM
7. Four brush contacts designated by "A" preceding number of circuits (i.e. AJ20005-A20). Add additional blocks 180° from position of blocks shown.
8. For eight rings or less, one mounting bracket is used per brush block.



Part No.	A	B	C	D	E
AJ20003	.750	2.625	2.000	1.312	3.0 R
AJ20004	1.752	3.750	1.973	1.854	3.5 R
AJ20005	2.760	4.875	2.215	2.338	4.0 R
AJ20007	4.000	7.250	2.735	3.380	5.25R
AJ20010	6.500	9.687	3.032	4.609	6.5 R
AJ20011	7.500	10.625	3.500	4.890	7.0 R

No. of Rings	L
2	2.29
4	3.25
6	4.21
8	5.17
10	6.13



HIGH CURRENT MP 50 Amp/Circui
Size and Configuration

Part No.	I.D.
MP-1375-00-☐	1.375
MP-1500-00-☐	1.50
MP-1750-00-☐	1.75
MP-2000-00-☐	2.00
MP-2500-00-☐	2.50
MP-3000-00-☐	3.00
MP-4000-00-☐	4.00

A	B
1.83	1.375
1.83	1.500
2.20	1.750
2.45	2.00
2.95	2.50
3.45	3.00
4.45	4.00

No. of Rings	L
2	2.29
4	3.25
6	4.21
8	5.17
10	6.13

Electro-Miniatures – The Leader In Slip Rings And Slip Ring Technology.

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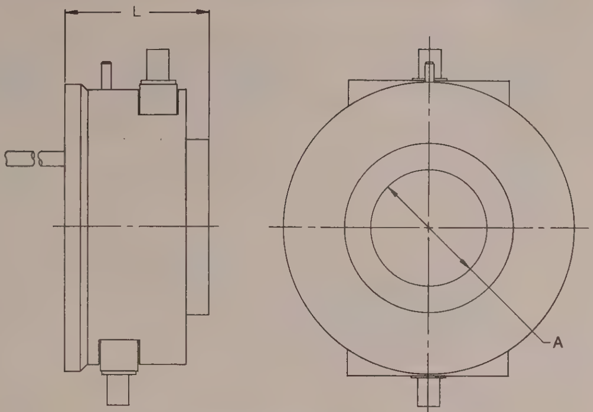
SPECIAL APPLICATION SLIP RING

igh Frequency Slip Rings

Your Requirement Includes Frequency
rn To Electro-Miniatures

art No.	A I.D.	No. of Coax Rings	L	Max. Freq.	I/L	Isolation	Cable RG
30000-1	2.375	4	4.280	30MHz	<1db	>30db	179
30000-2	2.375	5	5.125	174MHz	<1.5db	40/50	142
30000-3	2.375	9	8.5	50MHz	<1db	>30db	179
30000-4	3.875	7	7.25	200MHz	<1.75db	>50/30	142
30000-5	4.00	1	1.38	20MHz	<1db	>40db	59 or 179
30000-6	4.00	2	2.00	20MHz	<1db	>40db	59



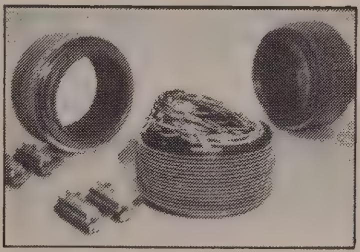
her Frequencys Upon Request

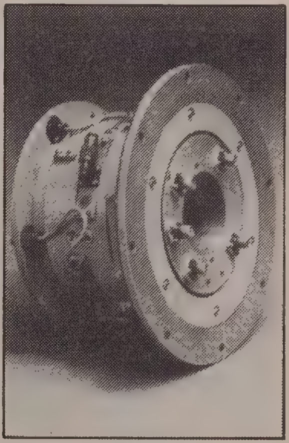
ehicular Slip Rings

rent applications include: M48 & M60 Tanks

	Power			Signal		
art No.	Number of Circuits	Cont. Current Rating	Voltage Rating	Number of Circuits	Gauge or Type	Intended Signal
5-00-1	1 1	150A 150A	150V Ground	12	Control	5A, 150V
5-00-2	1 1	150A 150A	150V Ground	24	Control	5A, 150V

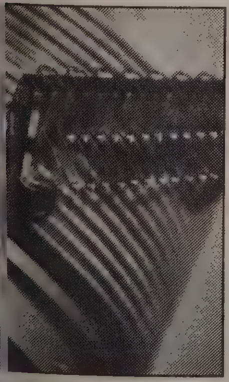
cial Features Include CBR Air Channel

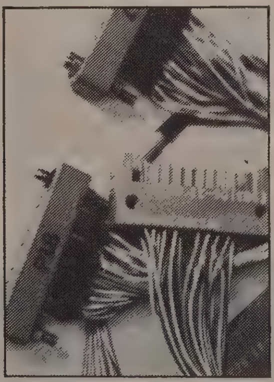




pace Applications

pace is your Application, Electro-Miniature can help. EM-C
ufactures a line of Space Application Slip Rings. From no I.D.
inch I.D., lubricated or unlubricated.





Electro-Miniatures Corp.

Electro-Miniatures Corporation has been in business for more than thirty-five years. We design and manufacture slip ring assemblies for all branches of the US Armed Forces, a large number of primary defense contractors, and many commercial/industrial concerns.

Over the years, EMC has designed and built thousands of slip ring assemblies ranging from economical "off-the-shelf" assemblies to the most sophisticated slip rings available. Most units are designed to meet rigid and detailed customer specification where high reliability in a hostile environment is a requirement. Whether the end use be ground based, ground mobile, shipboard, airborne or space, we can meet your production, reliability and workmanship needs.

Slip ring assemblies provide a means of transferring electrical energy from stationary to rotating structures. Slip rings may also contain pneumatic couplings and hydraulic joints accomodating a large range of operating pressures and flow rates.

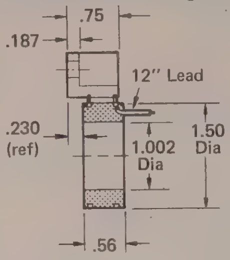
ctro-Miniatures – The Leader In Slip Rings And Slip Ring Technology.

SLIP RING ASSEMBLIES BEST DELIVERY

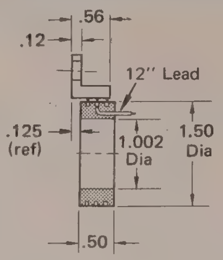
1

SEPARATE ROTOR AND BRUSH BLOCK ASSEMBLY — STOCK DELIVERY

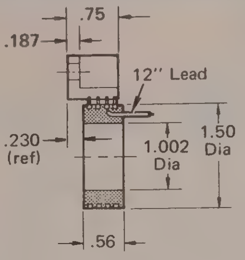
TYPE 1201 – 2 Ring


.75
.187
12″ Lead
.230 (ref)
1.002 Dia
1.50 Dia
.56

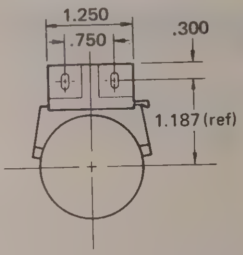
TYPE 1301 – 3 Ring


.56
.12
12″ Lead
.125 (ref)
1.002 Dia
1.50 Dia
.50

TYPE 1401 – 4 Ring


.75
.187
12″ Lead
.230 (ref)
1.002 Dia
1.50 Dia
.56

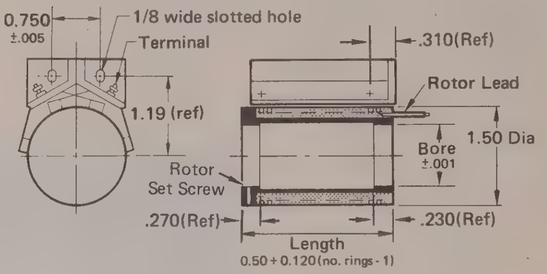
TYPICAL END VIEW


1.250
.750
.300
1.187 (ref)

TYPE 1401

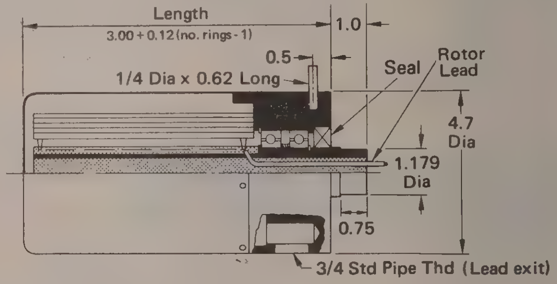
Slip Ring Assembly Type **1057**
Separate Rotor and Brush Block

5 amp — 30 rings max — Bore 1.002 dia max


0.750 ±.005
1/8 wide slotted hole
Terminal
1.19 (ref)
Rotor Set Screw
.310(Ref)
Rotor Lead
1.50 Dia
Bore ±.001
.270(Ref)
.230(Ref)
Length
0.50 + 0.120 (no. rings - 1)

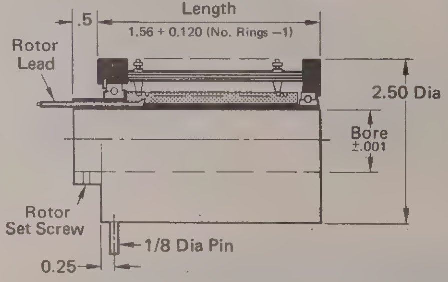
Slip Ring Assembly Type **1302**
Sealed Housing

5 amp — 50 rings max — Solid Bore


Length
3.00 + 0.12 (no. rings - 1)
1.0
0.5
1/4 Dia x 0.62 Long
Seal
Rotor Lead
4.7 Dia
1.179 Dia
0.75
3/4 Std Pipe Thd (Lead exit)

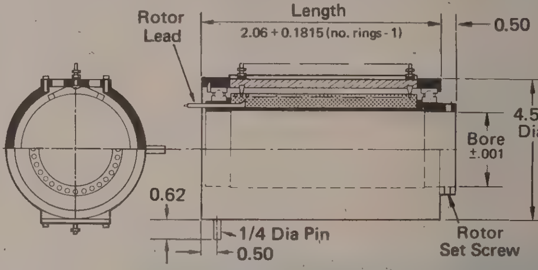
Slip Ring Assembly Type **1186**
Rigid Tube Housing — Exposed Stator Terminals

5 amp – 100 rings max – Bore 1.002 dia max


.5
Length
1.56 + 0.120 (No. Rings –1)
Rotor Lead
2.50 Dia
Bore ±.001
Rotor Set Screw
1/8 Dia Pin
0.25

Slip Ring Assembly Type **1067**
Rigid Tube Housing — Exposed Stator Terminals

5 amp — 100 rings max — Bore 2.252 dia max


Rotor Lead
Length
2.06 + 0.1815 (no. rings - 1)
0.50
4.50 Dia
Bore ±.001
0.62
1/4 Dia Pin
0.50
Rotor Set Screw

CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Coin Silver Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring (5 AMP)
Four brushes per ring (10 AMP)
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds.

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

COVER: Easily removable for brush and ring inspection

BEARINGS: Shielded or sealed ball bearings

PART NUMBER CODING – Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S / Unshielded - U)
X—	—X—	—X—	—X—	—X

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733
Phone (818) 443-3247 FAX (818) 443-5594

BRUSH ASSEMBLIES

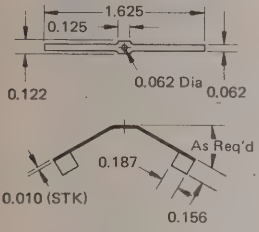
2

LEAF TYPE

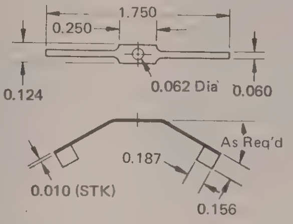
(BRUSH MATERIAL - FAG 180 OR FAG 150 LEAF MATERIAL - BeCu)

STOCK DELIVERY

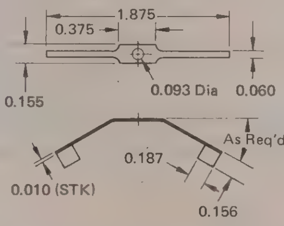
5.0 AMP DOUBLE BRUSH
P/N 1103004 BRUSH .040 WIDE


1.625
0.125
0.122
0.062 Dia
0.062
As Req'd
0.187
0.010 (STK)
0.156

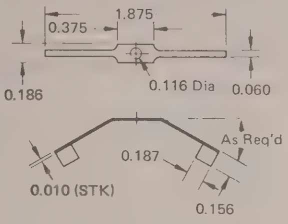
5.0 AMP DOUBLE BRUSH
P/N 1050006-13 BRUSH .040 WIDE


1.750
0.250
0.124
0.062 Dia
0.060
As Req'd
0.187
0.010 (STK)
0.156

5.0 AMP DOUBLE BRUSH
P/N 1050006-5 BRUSH .040 WIDE

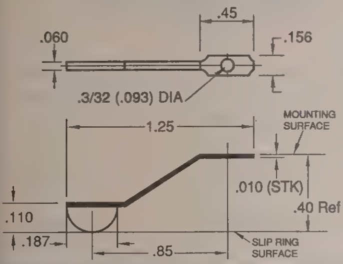

1.875
0.375
0.155
0.093 Dia
0.060
As Req'd
0.187
0.010 (STK)
0.156

5.0 AMP DOUBLE BRUSH
P/N 1050006-2 BRUSH .040 WIDE

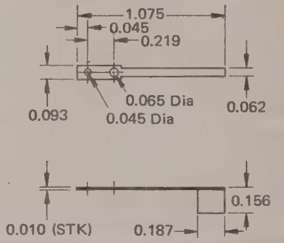

1.875
0.375
0.186
0.116 Dia
0.060
As Req'd
0.187
0.010 (STK)
0.156

"AS REQ'D" ANGLE IN FREE STATE — LEAF WITHOUT BRUSH WOULD TOUCH RING SURFACE

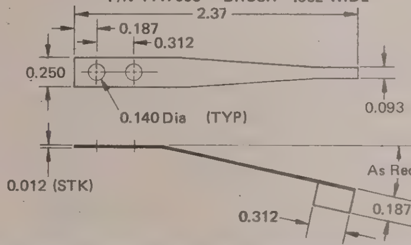
2.0 AMP SINGLE BRUSH
P/N 1799001 BRUSH - .050 WIDE


.45
.060
.156
3/32 (.093) DIA
1.25
MOUNTING SURFACE
.010 (STK)
.40 Ref
.110
.187
.85
SLIP RING SURFACE

2.0 AMP SINGLE BRUSH
P/N 1120051 BRUSH - .040 WIDE


1.075
0.045
0.219
0.093
0.065 Dia
0.045 Dia
0.062
0.156
0.010 (STK)
0.187

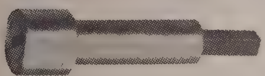
5.0 AMP SINGLE BRUSH
P/N 1117003 BRUSH - .062 WIDE

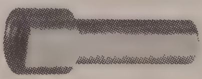

2.37
0.187
0.312
0.250
0.140 Dia (TYP)
0.093
0.012 (STK)
As Req'd
0.312
0.187

PLUNGER TYPE

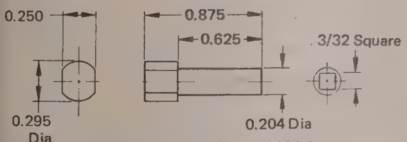
(BRUSH MATERIAL - FAG 180 OR FAG 150 HOLDER - BRASS)

STOCK DELIVERY

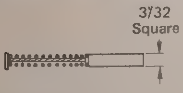




2.5 AMP CAPACITY
3/32" SQUARE BRUSH

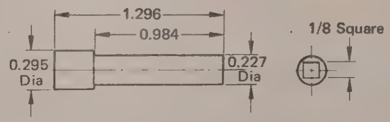

0.250
0.875
0.625
3/32 Square
0.295 Dia
0.204 Dia

HOLDER ASSY P/N 1070004-1
CAP ASSY P/N 1070004-2

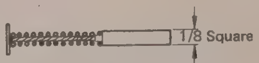


BRUSH ASSY P/N 1072-1

4.0 AMP CAPACITY
1/8" SQUARE BRUSH

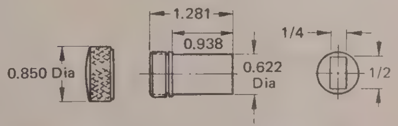

1.296
0.984
0.295 Dia
0.227 Dia
1/8 Square

HOLDER ASSY P/N 1051032-1
CAP ASSY P/N 1051032-2

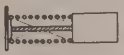


BRUSH ASSY P/N 1072-2

25 AMP CAPACITY
1/4" x 1/2" RECTANGULAR BRUSH


1.281
0.938
0.850 Dia
0.622 Dia
1/4
1/2

HOLDER ASSY P/N 1092006-1
CAP ASSY P/N 1092006-2



BRUSH ASSY P/N 1092003

BRUSH MATERIAL

- Fabricast grade Fag 180, the universal low noise level grade used for all standard brush assembles.
- Fabricast grade FAG 193, the lowest noise level grade, however, the ring surface speed is limited to 250 SFM.
- Fabricast grade FAG 150, the highest surface speed grade, however, noise levels are compromised.

Grade No.	Composition	Recommended Surface Speed	Carrying Capacity
FAG150	50% silver, 50% graphite	Over 3500 ft. per min.	100 Amps per sq. in.
FAG180	80% silver, 20% graphite	Up to 3500 ft. per min.	250 Amps per sq. in.
FAG193	93% silver, 7% graphite	Up to 250 ft. per min.	300 Amps per sq. in.

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

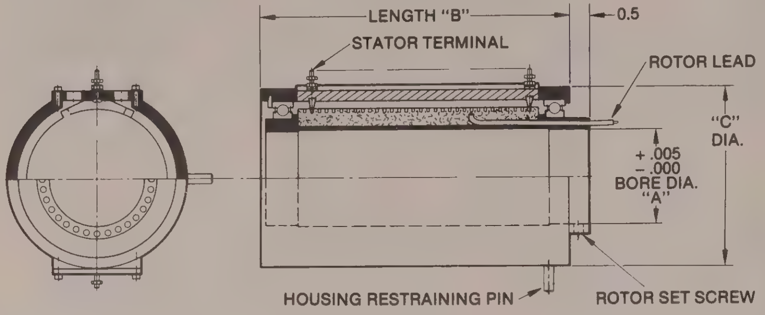
P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 FAX (818) 443-5594

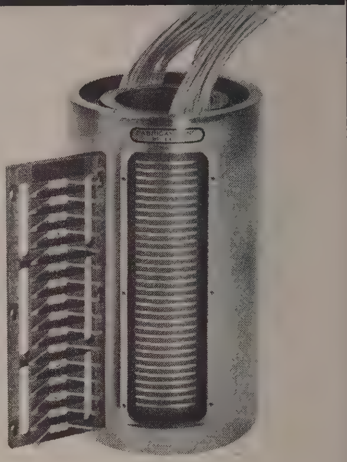
SLIP RING ASSEMBLIES SELF—CONTAINED RIGID TUBE HOUSING

3

DISTINGUISHING CHARACTERISTICS

Rigid one piece housing eliminates bearing alignment problems. Larger section bearings are generally used in these units for a more rugged unit.





TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
1230	Solid	–	100	5 amp std 2 brushes per ring OR 10 amp std or lo noise 4 brushes per ring	3.50 + .120 (no. rings -1)	2.50
1186	1.000	0 - 1.002	100		1.56 + .120 (no. rings -1)	2.50
1197	1.250	1.0 - 1.252	70		1.56 + .130 (no. rings -1)	3.50
1289	1.500	1.25 - 1.502	100		1.56 + .150 (no. rings -1)	4.00
1067	2.000	1.5 - 2.252	100		2.06 + .181 (no. rings -1)	4.50
1420	3.000	2.25 - 3.002	100		1.38 + .181 (no. rings -1)	4.75
1506	3.500	3.0 - 3.502	100		2.88 + .200 (no. rings -1)	6.50
1390	4.000	3.5 - 4.252	100		2.00 + .187 (no. rings -1)	5.75

* RING COMPLEMENT MAY BE LIMITED BY ABILITY TO PASS ROTOR LEADS UNDER BEARINGS.
* FOR 50 AMP STANDARD POWER ASSEMBLIES SEE POWER ASSEMBLY SECTION.
* INSTRUMENT AND 50 AMP POWER CIRCUITS MAY BE CAST ON COMMON SLEEVE.

CHARACTERISTICS

RPM:	Rigid one piece housing eliminates bearing alignment problems
RINGS:	Coin Silver Rings
BRUSHES:	Silver Graphite Fabricast Grade FAG 180 (80% AG – 20% C) Two brushes per ring (standard) Brushes individually removable and replaceable
NOISE:	10 Milliohms dynamic resistance MAX 5 Milliohms MAX with 4 brushes per CKT
CURRENT:	Noted in tabulated block
HI-POT:	1000 VAC 60 CYCLE for 15 seconds
ROTOR:	One piece steel sleeve Ring complement vacuum cast on sleeve as unit with epoxy dielectric
ROTOR LEADS:	5 AMP Leads – 20 GA per MIL-W-16878 TYPE "E" Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.
HOUSING:	One piece tube construction
COVER:	Easily removable for brush and ring inspection
BEARINGS:	Shielded or sealed ball bearings

PART NUMBER CODING – Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S Unshielded - U)
X	X	X	X	X

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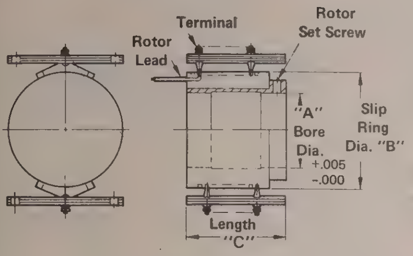
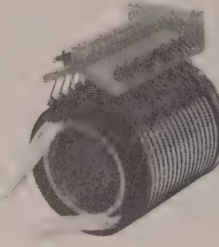
Phone (818) 443-3247 FAX (818) 443-5594

SLIP RING ASSEMBLIES SEPARATE ROTOR & BRUSH BLOCK

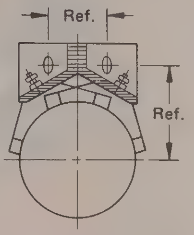
4

Brush Block Assy
5 AMP STD

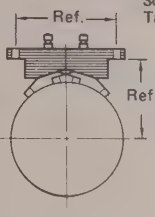




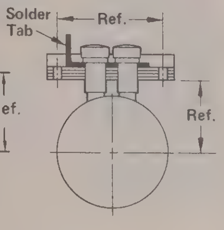
Brush Block Assy
TYPE "A"



Brush Block Assy
TYPE "E"



Brush Block Assy
50 AMP STD



TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	SLIP RING DIA "B"	LENGTH "C" INCHES
	NOMINAL	RANGE				
2050	SOLID	000 - .127	18	5 amp std 2 brushes per ring OR 10 amp std or lo noise 4 brushes per ring	.500	.625 + .125 (no. rings -1)
2087	SOLID	000 - .377	48		.875	.625 + .110 (no. rings -1)
2112	.375	000 - .627	52		1.125	.625 + .125 (no. rings -1)
2125	.500	000 - .750	25		1.250	.125 + .150 (no. rings -1)
2150	.750	.625 - 1.002	52		1.500	.625 + .120 (no. rings -1)
2187	1.000	.750 - 1.250	48		1.875	.625 + .125 (no. rings -1)
2200	1.125	.750 - 1.375	80		2.000	.750 + .125 (no. rings -1)
2237	1.250	1.000 - 1.502	78		2.375	.750 + .130 (no. rings -1)
2268	1.500	1.250 - 1.752	107		2.687	1.000 + .150 (no. rings -1)
2350	2.000	1.750 - 2.502	78		3.500	1.000 + .181 (no. rings -1)
2375	2.500	2.370 - 2.875	48		3.750	1.000 + .200 (no. rings -1)
2462	3.000	2.750 - 3.752	100		4.652	1.250 + .160 (no. rings -1)
2500	4.000	3.250 - 4.002	40		5.000	1.250 + .250 (no. rings -1)
2600	5.000	4.000 - 5.002	80		6.000	1.250 + .186 (no. rings -1)
2700	6.000	5.000 - 6.002	63		7.000	1.250 + .186 (no. rings -1)
2800	7.000	6.000 - 7.002	58		8.000	1.250 + .187 (no. rings -1)
2900	8.000	7.000 - 9.002	58		10.000	1.250 + .187 (no. rings -1)
3268	1.000	.750 - 1.187	16	50 amp std 2 brushes per ring OR 100 amp 4 brushes per ring	2.687	2.000 + 1.050 (no. rings -1)
3300	1.500	1.187 - 1.500	6		3.000	2.000 + 1.000 (no. rings -1)
3350	2.000	1.500 - 2.000	16		3.500	2.000 + 1.050 (no. rings -1)
3462	3.000	2.000 - 3.125	9		4.625	2.000 + 1.120 (no. rings -1)
3600	4.000	3.125 - 4.500	8		6.000	2.000 + 1.116 (no. rings -1)
3700	5.000	4.500 - 5.500	10		7.000	2.000 + 1.116 (no. rings -1)
3800	6.000	5.500 - 6.500	10		8.000	2.000 + 1,125 (no. rings -1)
3900	7.000	6.500 - 8.500	10		10.000	2.000 + 1.125 (no. rings -1)

CHARACTERISTICS

RINGS: Coin Silver Instrumentation Rings
Copper Power Rings

BRUSHES: Silver Graphite.
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring (standard)
Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance MAX.
5 Milliohms max with 4 brushes per CKT.

CURRENT: Noted in tabulated block.

HI-POT: 1000 VAC 60 cycle for 15 seconds.

ROTOR: One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

ROTOR LEADS: 5 AMP Leads – 20 GA per MIL-W-16878 TYPE "E"
50 AMP Leads – 8 GA – Teflon
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.

BRUSH BLOCK: Glass epoxy laminate.
Optional mounting methods shown.

PART NUMBER CODING – Specify fully when ordering.

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

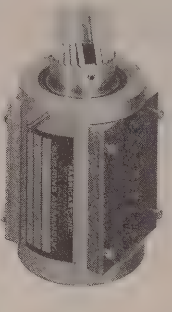
WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

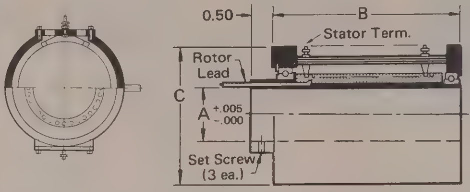
P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733
Phone (818) 443-3247 FAX (818) 443-5594

SLIP RING ASSEMBLIES SELF-CONTAINED

SELF CONTAINED RIGID HOUSING SLIP RING ASSEMBLIES



DISTINGUISHING CHARACTERISTICS
Rigid one piece housing eliminates bearing alignment problems. Bearings are thin section aircraft torque tube type or Kaydon KA series.



REPLACEABLE BRUSH ASSEMBLIES —1000 VAC HYPOT

TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
4050	SOLID	–	18	5 amp std 2 brushes per ring OR 10 amp std or lo noise 4 brushes per ring	1.19 + .125 (no. rings - 1)	1.87
4100	.500	.250 - .502	48		1.19 + .125 (no. rings - 1)	2.00
4150	1.000	.000 - 1.002	64		1.19 + .120 (no. rings - 1)	2.50
4200	1.312	1.000 - 1.312	100		1.19 + .125 (no. rings - 1)	3.00
4237	1.750	1.312 - 1.752	78		1.19 + .130 (no. rings - 1)	3.37
4240	1.900	1.750 - 1.902	50		1.00 + .100 (no. rings - 1)	3.50
4268	2.187	1.900 - 2.189	100		1.28 + .150 (no. rings - 1)	3.62
4350	2.750	2.187 - 2.752	100		1.75 + .150 (no. rings - 1)	4.50
4400	3.250	2.750 - 3.252	100		1.75 + .187 (no. rings - 1)	5.00
4462	3.750	3.250 - 3.752	100		1.75 + .160 (no. rings - 1)	5.50
4500	4.250	3.750 - 4.252	100		1.75 + .187 (no. rings - 1)	6.00
4600	5.250	4.250 - 5.252	79		1.75 + .186 (no. rings - 1)	7.00
4700	6.250	5.250 - 6.252	63		1.75 + .186 (no. rings - 1)	8.00
4800	7.250	6.250 - 7.252	58		1.75 + .187 (no. rings - 1)	9.00
4900	8.750	7.250 - 8.750	58		1.75 + .187 (no. rings - 1)	11.00

NON-REPLACEABLE BRUSH ASSEMBLIES — 500 VAC HYPOT

4087	.250	.250 - .502	50	3 amp std 2 brushes per ring	.875 + .080 (no. rings - 1)	1.56
4125	.500	.250 - .752	50		.875 + .100 (no. rings - 1)	2.00
4230	2.000	1.500 - 2.002	50		.875 + .080 (no. rings - 1)	3.50

PART NUMBER CODING — Specify fully when ordering

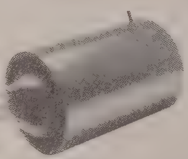
Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

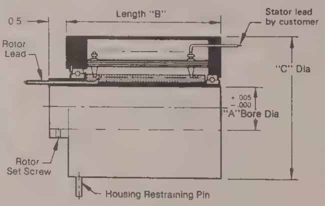
CHARACTERISTICS

RPM: **Rigid one piece housing eliminates bearing alignment problems.**
RINGS: Coin Silver rings.
BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring (standard)
Brushes individually removable and replaceable.
NOISE: 10 Milliohms dynamic resistance max
5 Milliohms max with 4 brushes per ckt.
CURRENT: Noted in tabulated block.
HI-POT: See table on left.
ROTOR: One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.
ROTOR LEADS: 5 amp Leads – 20 ga per MIL-W-16878 type "E"
50 amp Leads – 8 ga – Teflon.
HOUSING: One piece tube construction.
COVER: Easily removable for brush and ring inspection.
BEARINGS: Shielded or sealed ball bearings.

SELF-CONTAINED ASSEMBLIES Covered – Minimum Size

DISTINGUISHING CHARACTERISTICS
Rigid one piece housing eliminates bearing alignment problems.
One piece tube type removable cover.
Sealed bearings.





PART NUMBER CODING — Specify fully when ordering

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
7100	.500	.250- .502	48	5 amp std 2 brushes per ring OR 10 amp std or lo noise 4 brushes per ring	1.56 + .125 (no. rings-1)	2.50
7150	1.000	.500-1.002	100		1.56 + .120 (no. rings-1)	3.25
7200	1.312	1.000-1.312	100		1.56 + .125 (no. rings-1)	3.75
7237	1.750	1.312-1.752	78		1.75 + .130 (no. rings-1)	4.25
7268	2.000	1.750-2.002	100		1.75 + .150 (no. rings-1)	4.63
7350	2.750	2.002+2.752	100		2.06 + .181 (no. rings-1)	5.50
7462	3.750	3.250-3.752	100		2.25 + .160 (no. rings-1)	6.50
7500	4.250	3.750-4.252	100		2.25 + .187 (no. rings-1)	7.25
7600	5.250	4.250-5.252	48		2.25 + .186 (no. rings-1)	8.00
7800	7.250	6.250-7.252	58		2.25 + .187 (no. rings-1)	10.00
7900	8.750	7.250-8.750	58		2.31 + .187 (no. rings-1)	12.00

CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems
RINGS: Coin Silver Rings
BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG–20% C)
Two brushes per ring (standard)
Brushes individually removable and replaceable
NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT
CURRENT: Noted in tabulated block
HI-POT: 1000 VAC 60 CYCLE for 15 seconds
ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric
ROTOR LEADS: 5 AMP Leads - 20 GA per MIL-W-16878 TYPE "E"
HOUSING: One piece tube construction
COVER: Easily removable one piece tube cover
BEARINGS: Sealed ball bearings

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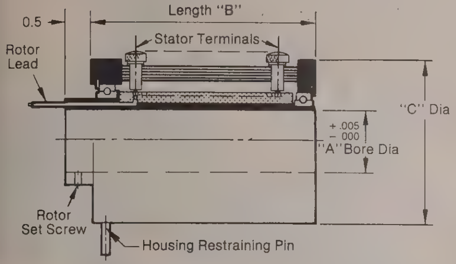
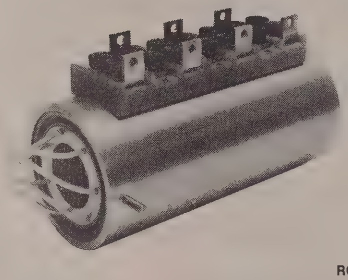
SLIP RING ASSEMBLIES

POWER ASSEMBLIES


0.5
Length "B"
Rotor Lead
Stator Terminals
"C" Dia
+.005
−.000
"A" Bore Dia
Rotor Set Screw
Housing Restraining Pin



TYPE	BORE DIA "A" INCHES		NO. RINGS MAX	CURRENT	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
5035	1.625	1.125 - 2.125	15	50 amp std 2 brushes per ring	3.25 + 1.089 (no. rings−1)	4.50
5043	2.625	2.000 - 3.250	8		3.25 + 1.100 (no. rings−1)	5.50
5050	3.375	2.750 - 4.000	10		3.25 + 1.125 (no. rings−1)	6.12
5060	4.062	3.125 - 5.000	10	OR	3.25 + 1.116 (no. rings−1)	7.25
5070	5.250	4.500 - 6.000	8	100 amp 4 brushes per ring	3.25 + 1.116 (no. rings−1)	8.00
5080	6.000	5.500 - 6.500	8		3.25 + 1.125 (no. rings−1)	9.00
5100	7.625	6.750 - 8.500	8		3.25 + 1.125 (no. rings−1)	11.00
5140	9.500	8.500 - 10.500	6		3.75 + 1.250 (no. rings−1)	15.75

CHARACTERISTICS

RPM:	Rigid one piece housing eliminates bearing alignment problems
RINGS:	Copper Rings
BRUSHES:	Silver Graphite Fabricast Grade FAG 180 (80% AG—20% C) Two brushes per ring Brushes individually removable and replaceable
CURRENT:	Noted in tabulated block Rating may be doubled with 4 brushes per CKT
HI-POT:	1000 VAC 60 CYCLE for 15 seconds
ROTOR:	One piece steel sleeve Ring complement vacuum cast on sleeve as unit with epoxy dielectric
ROTOR LEADS:	50 AMP Leads — 8 GA — Teflon Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends
BEARINGS:	Shielded or sealed ball bearings

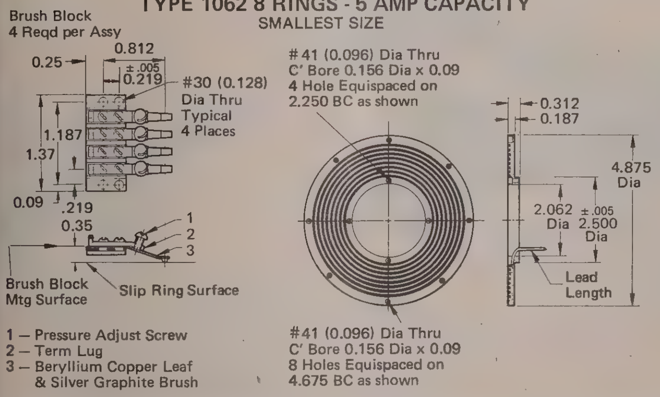
PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)
X—	—X—	—X—	—X

PANCAKE TYPE SLIP RING ASSEMBLIES

TYPE 1062 8 RINGS - 5 AMP CAPACITY

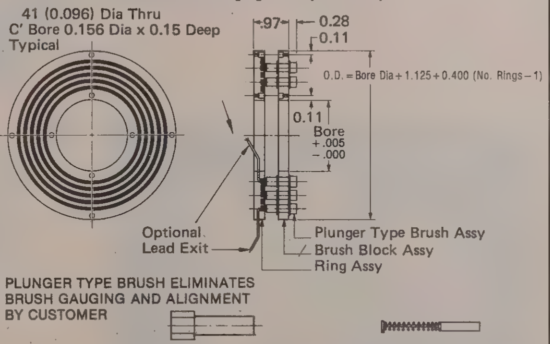
SMALLEST SIZE


Brush Block
4 Reqd per Assy
0.812
0.25
±.005
0.219
#30 (0.128) Dia Thru Typical 4 Places
1.187
1.37
0.09
.219
0.35
1
2
3
Brush Block Mtg Surface
Slip Ring Surface
#41 (0.096) Dia Thru
C' Bore 0.156 Dia x 0.09
4 Hole Equispaced on
2.250 BC as shown
0.312
0.187
4.875 Dia
2.062 Dia
±.005
2.500 Dia
Lead Length
#41 (0.096) Dia Thru
C' Bore 0.156 Dia x 0.09
8 Holes Equispaced on
4.675 BC as shown

1 — Pressure Adjust Screw
2 — Term Lug
3 — Beryllium Copper Leaf & Silver Graphite Brush

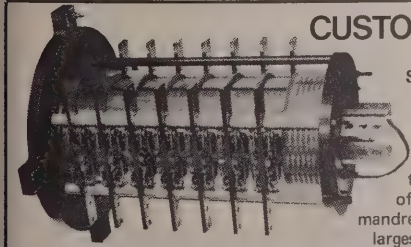
TYPE 1650 - 5 AMP CAPACITY

NO. OF RINGS PER CUSTOMER REQ'TS
No Brush Gauging — Easy Assembly


41 (0.096) Dia Thru
C' Bore 0.156 Dia x 0.15 Deep
Typical
.97
0.28
0.11
O.D. = Bore Dia + 1.125 + 0.400 (No. Rings − 1)
0.11
Bore
+.005
−.000
Optional Lead Exit
Plunger Type Brush Assy
Brush Block Assy
Ring Assy
PLUNGER TYPE BRUSH ELIMINATES
BRUSH GAUGING AND ALIGNMENT
BY CUSTOMER

HOLDER ASSY P/N 1070004 BRUSH ASSY P/N 1072-1

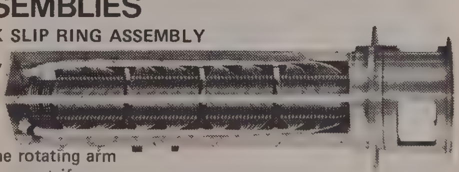
CUSTOM DESIGNED SLIP RING ASSEMBLIES



CUSTOM 7000 AMP SLIP RING ASSEMBLY

This slip ring assembly, as designed and manufactured by Fabricast, Inc., is used to supply 7000 amperes of current to the rotating mandrel of the world's second largest spin forging machine.

CUSTOM 222 TRACK SLIP RING ASSEMBLY



This slip ring assembly, as designed and manufactured by Fabricast, Inc. was used to complete the electrical circuits to the rotating arm of an astronaut carrying centrifuge.

The unit consists of 50 amp. power, 5 amp. instrumentation and 50 megacycle coaxial modules.

CONTACT FABRICAST WITH YOUR SPECIFIC APPLICATION, WE WILL MODIFY AN EXISTING DESIGN OR CUSTOM BUILD A SLIP RING TO YOUR SPECIFICATIONS.

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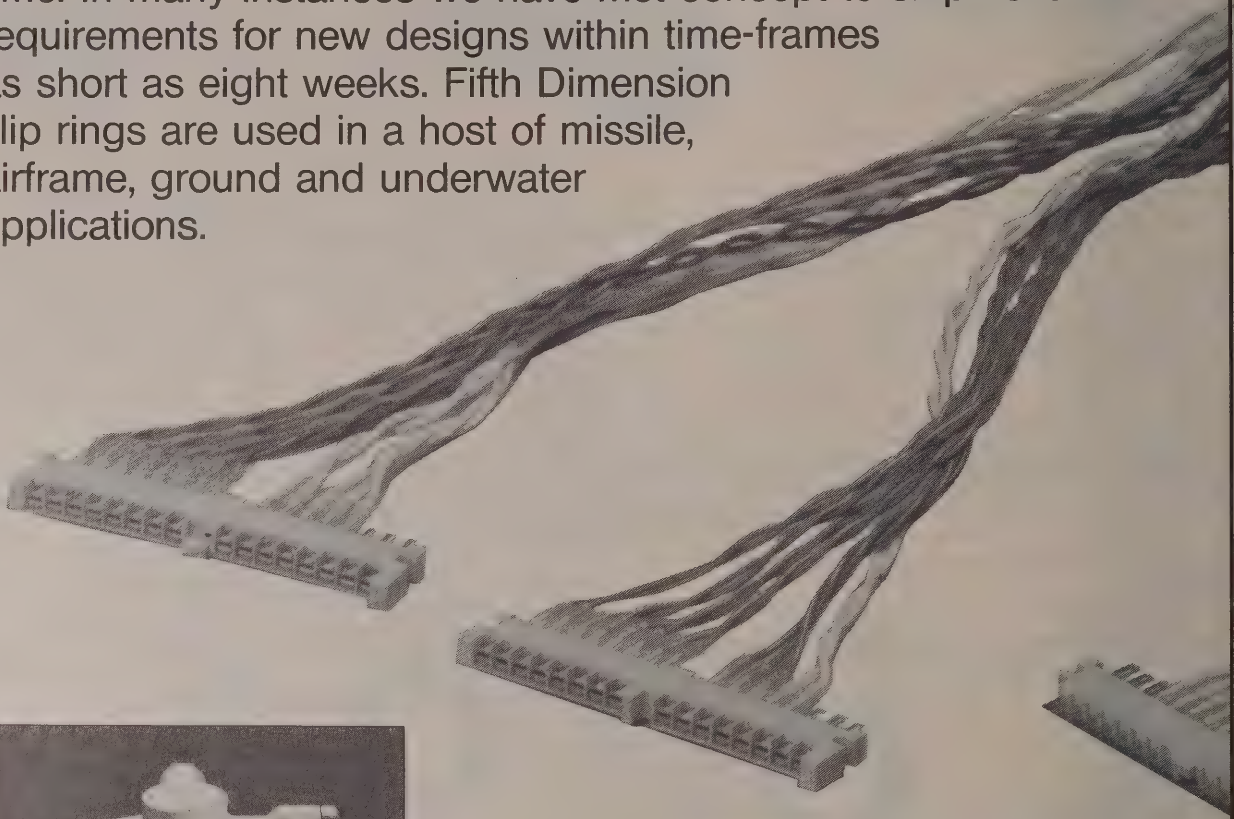
FIFTH
DIMENSION
INC.

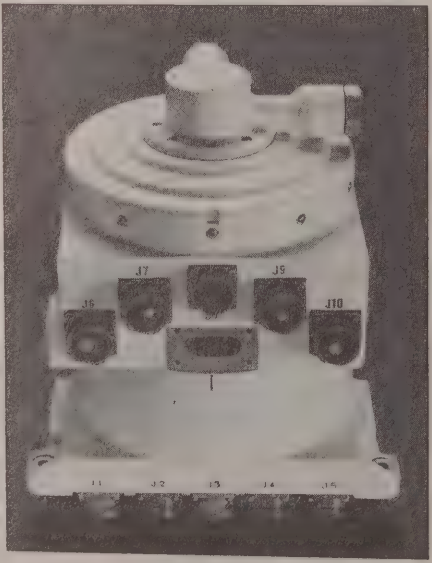
Slip Rings

High-Precision, Short Delivery Cycle

Look to Fifth Dimension Inc. for the development and production of high-precision, high reliability slip rings in remarkably short time. In many instances we have met concept-to-shipment requirements for new designs within time-frames as short as eight weeks. Fifth Dimension slip rings are used in a host of missile, airframe, ground and underwater applications.



Miniature slip ring capsule used in the gimballed pitch, roll and azimuth axes of the Trident II Mark VI Inertial Guidance System. Its small size was achieved without sacrificing reliability.



Electro-hydraulic/pneumatic vehicular slip ring assembly used in the gun turret of the M1A1 tank.

Fifth Dimension slip ring capabilities include:

- Miniature
- Helicopter
- Vehicular
- Pedestal
- Cable Reel
- Robotic
- Twist Capsules

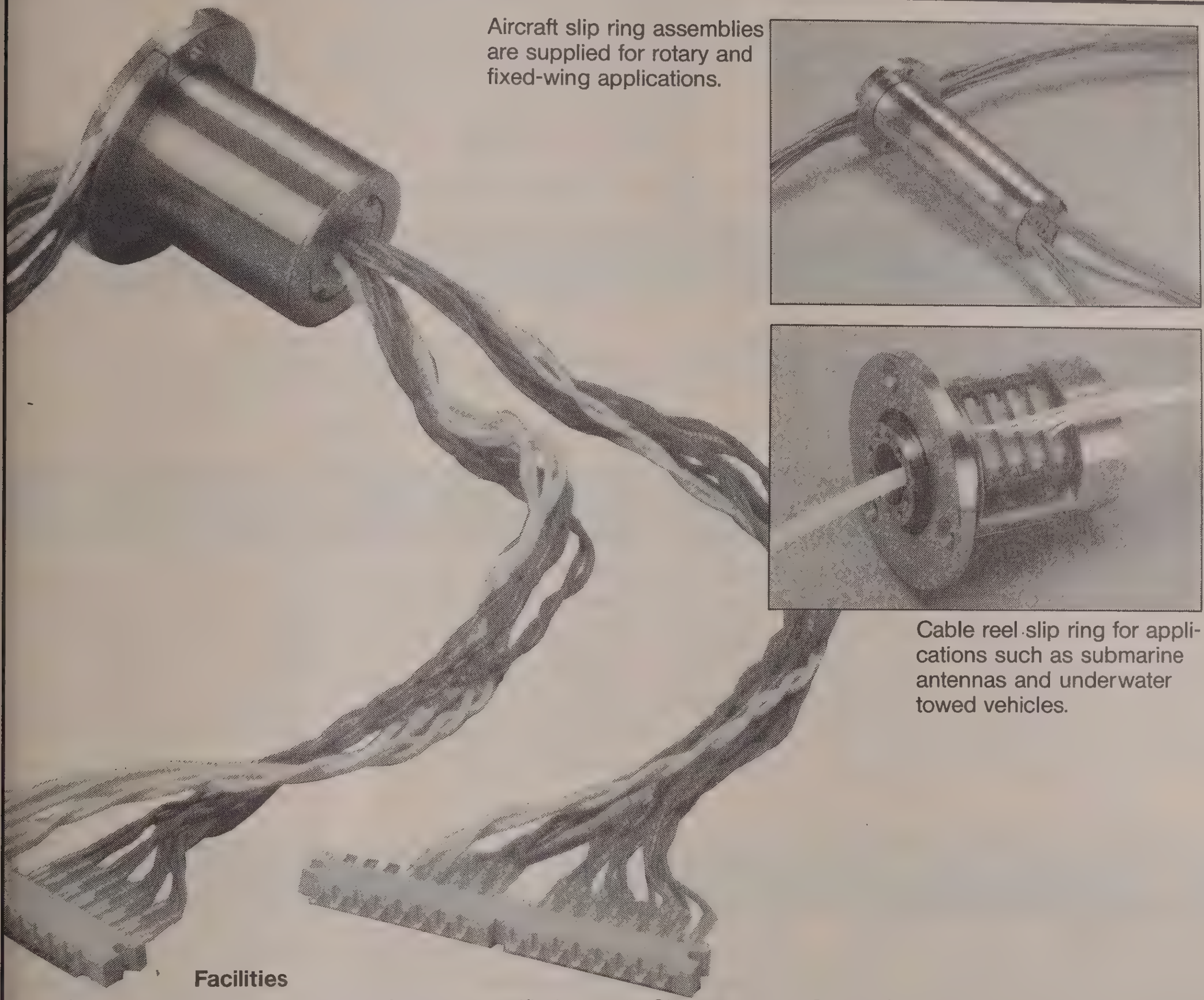
FIFTH DIMENSION INC.

801 New York Avenue, Trenton, NJ 08638-3982 • Tel: (609) 393-8350 • FAX: (609) 599-9508

FIFTH DIMENSION INC.

Slip Rings

High-Precision, Short Delivery Cycle



Aircraft slip ring assemblies are supplied for rotary and fixed-wing applications.

Cable reel slip ring for applications such as submarine antennas and underwater towed vehicles.

Facilities

- Clean rooms for slip rings manufacturing certified to meet Class 100,000. Critical final assembly takes place on laminar flow benches certified to Class 1.
- Complete machine shop
- Mold tool and die fabrication
- Extensive precious metal plating capabilities with laboratory-type control
- Epoxy casting and molding
- Automatic noise and torque test stations
- Comprehensive electrical, mechanical and environmental testing laboratory

Documentation

Where required, documentation can be as comprehensive as Class 1 wherein each manufacturing step requires operator sign-off and complete traceability of all component parts is maintained.

Short Delivery Cycle

At Fifth Dimension, project management is geared to short delivery cycles without compromising high quality. We invite you to write or call to discuss your slip ring requirements.

FIFTH DIMENSION INC.

801 New York Avenue, Trenton, NJ 08638-3982 • Tel: (609) 393-8350 • FAX: (609) 599-9508

GTK GLENTEK Motion Control Systems

TORQUE-LIN™ SERIES AMPLIFIERS

Linear Amplifiers For Use With Brush Type Servo Motors

Model	Output Voltage (Typical)	Output Current (RMS)	Output Current (Peak)	Package Configuration
GA4555P	40VDC	4 Amps	12 Amps	1, 2, 4 and 6 Axes
GA4562P	45VDC	8 Amps	20 Amps	1, 2, 3 and 6 Axes
GA4552-1	62VDC	10 Amps	18 Amps	1 Axis
GA4553-1	62VDC	15 Amps	25Amps	1 Axis

GTK GLENTEK Motion Control Systems

TORQUE-SWITCH™ SERIES AMPLIFIERS

Pulse Width Modulated Amplifiers For Use With Brush Type Servo Motors

Model	Output Voltage (Typical)	Output Current (RMS)	Output Current (Peak)	Carrier Frequency	Package Configuration
GA365	24-80VDC	4 Amps	8 Amps	20KHZ	1, 2, 4, 6 and 8 Axes
GA369	45-170VDC	6 Amps	12 Amps	20KHZ	1, 2, 4, 6 and 8 Axes
GA377	**45-170VDC**	**15 Amps**	**25 Amps**	**20KHZ**	**1, 2, 4 and 6 Axes**
GA4567EPC	**45-170VDC**	**15 Amps**	**25 Amps**	**20KHZ**	**1, 2, 4 and 6 Axes**
GA4568EPB	**45-170VDC**	**20 Amps**	**40 Amps**	**20KHZ**	**1, 2, 4 and 6 Axes**
GA4569EPA	45-170VDC	30 Amps	60 Amps	20KHZ	1, 2, and 4 Axes
GA4571P	120-200VDC	35 Amps	70 Amps	4KHZ	1 Axis
GA4576P	120-200VDC	50 Amps	90 Amps	4KHZ	1 Axis
GA4581P	120-200VDC	80 Amps	160 Amps	4KHZ	1 Axis
GA4582P	120-250VDC	100 Amps	200 Amps	4KHZ	1 Axis
GA4585P	120-350VDC	150 Amps	300 Amps	16KHZ	1 Axis

GTK GLENTEK Motion Control Systems

SINUSOIDAL BRUSHLESS (PWM) SERVO AMPLIFIERS

Description: Glentek's sine wave based brushless amplifiers and motors are used in appllications which require excessively high RPM and/or maintenance of standard brushtype servo motors is impossible. It should be noted that sine wave based amplifiers provide optimum performance at the high end with unsurpassed smoothneses at the low end.

Model	Output Voltage (Typical)	Output Current (RMS)	Output Current (Peak)	Carrier Frequency	Package Configuration
GA5505	24-80VDC	6 Amps	12 Amps	20KHZ	1, 2, 4, 6 and 8 Axes
GA5520	**45-170VDC**	**15 Amps**	**30 Amps**	**20KHZ**	**1, 2, 4 and 6 Axes**
GA5550	45-170VDC	30 Amps	60 Amps	20KHZ	1, 2, and 4 Axes
GA5570	45-170VDC	50 Amps	100 Amps	20KHZ	1 and 2 Axes

Note: All models listed above come standard with:

☐ Protection Circuits for the Amplifier ☐ Protection Circuits for the Motor ☐ End of Travel Limits ☐ Total Inhibit ☐ Complete LED Diagnostics

☐ Higher buss voltages available, consult Glentek.
☐ Glentek stocks a wide variety of inductors and isolation power transformers to accommodate all your servo system requirements.
☐ Models listed above in **Bold Print** are UL recognized.

GTK GLENTEK Motion Control Systems

TRAPEZOIDAL BRUSHLESS (PWM) SERVO AMPLIFIERS

Model	Output Voltage (Typical)	Output Current (RMS)	Output Current (Peak)	Carrier Frequency	Package Configuration
GA5500	24-80VDC	6 Amps	12 Amps	20KHZ	1, 2, 4, 6 and 8 Axes
GA5510	**45-170VDC**	**15 Amps**	**30 Amps**	**20KHZ**	**1, 2, 4 and 6 Axes**
GA5540	45-170VDC	30 Amps	60 Amps	20KHZ	1, 2, and 4 Axes
GA5560	45-170VDC	50 Amps	100 Amps	20KHZ	1 and 2 Axes

Note: All Models Listed Above Come Standard With:

☐ Protection Circuits for the Amplifier ☐ Protection Circuits for the Motor ☐ End of Travel Limits ☐ Total Inhibit ☐ Complete LED Diagnostics

☐ Higher buss voltages available, consult Glentek.

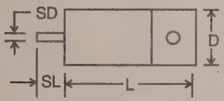
☐ Glentek stocks a wide variety of inductors and isolation power transformers to accommodate all your servo system requirements.

☐ Models listed above in **Bold Print** are UL recognized.

GTK GLENTEK Motion Control Systems

PERMANENT MAGNET BRUSHLESS SERVO MOTORS

Description: To accommodate your complete servo system needs Glentek stocks a wide range (.2 to 7 HP) of permanent magnet brushless servo motors. All models come standard with square flange mounts, integral brushless resolver, and thermostat protection. The GMB2600 series through GMB4500 series motors come wired with MS connector, mating connector, and strain relief. The GMB5600 series motors have a pipe thread with PCB temination. All motors are sealed to IP65. Motors can be supplied with hall sensors, brakes and gear reducers. Custom shafts and mounting flanges are also available. If you have any difficulty in locating a particular motor for your requirements please contact a Glentek Representative. Many specialty motors are stocked, however their specifications are not listed on this data sheet. Please feel free to contact a Glentek applications engineer to assist you in making the proper motor selections. Prototype quantities are immediately available from stock.

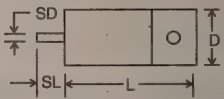


Model	Continuous Torque Lb. In.	Torque Constant Lb. In./ Amp	Continuous Current Amps	Winding Resistance Ohms	Winding Inductance mHY	B.E.M.F. Vrms/ 1000 RPM	Maximum RPM	Motor Inertia Ja Lb. In. Sec^2	Peak Torque Lb. In.	Weight Lbs.	Typical Dimensions in Inches			
											D	L	SD	SL
GMB2655	4.0	0.86	4.7	2.00	2.70	8	5000	.00009	12.0	3	2.60	5.48	.3150	1.181
GMB2667	8.0	0.85	9.4	0.71	1.20	7	5000	.00028	27.0	4	2.60	6.68	.3150	1.181
GMB3573	18.0	2.60	6.9	2.60	5.20	23	5000	.00050	36.0	9	3.50	7.24	.5510	1.181
GMB3588A	28.0	5.40	5.2	3.40	11.60	48	2500	.00090	56.0	12	3.50	8.74	.5510	1.181
GMB3588B	28.0	2.70	10.4	0.86	2.40	24	5000	.00090	56.0	12	3.50	8.74	.5510	1.181
GMB35103A	38.0	5.60	6.8	2.70	8.00	50	2500	.00140	76.0	15	3.50	10.24	.5510	1.181
GMB35103B	38.0	2.80	13.5	0.68	2.00	25	5000	.00140	76.0	15	3.50	10.24	.5510	1.181
GMB4586A	55.0	6.40	8.5	1.10	7.30	57	2100	.00260	165.0	18	4.50	8.59	.7480	1.967
GMB4586B	55.0	3.20	17.2	0.37	2.30	29	4200	.00260	165.0	18	4.50	8.59	.7480	1.967
GMB45111A	85.0	8.40	10.1	0.76	4.60	74	1600	.00510	255.0	28	4.50	11.09	.7480	1.967
GMB45111B	85.0	4.20	20.2	0.19	1.20	37	3200	.00510	255.0	28	4.50	11.09	.7480	1.967
GMB45136A	115.0	7.80	14.7	0.50	3.80	70	1750	.00740	345.0	38	4.50	13.59	.7480	1.967
GMB45136B	115.0	3.90	29.5	0.13	1.00	35	3400	.00740	345.0	38	4.50	13.59	.7480	1.967
GMB56134A	130.0	8.10	16.0	0.72	5.40	70	1800	.00960	390.0	36	5.59	13.35	.9450	1.967
GMB56134B	130.0	3.80	34.0	0.18	1.60	34	2700	.00960	390.0	36	5.59	13.35	.9450	1.967
GMB56161A	210.0	7.90	26.5	0.24	2.20	70	1800	.01920	630.0	51	5.59	16.05	.9450	1.967
GMB56161B	210.0	3.70	56.7	0.06	0.48	33	2700	.01920	630.0	51	5.59	16.05	.9450	1.967

GTK GLENTEK Motion Control Systems

PERMANENT MAGNET BRUSH TYPE SERVO MOTORS

Description: To accommodate your complete servo system needs Glentek stocks a wide range (1/16 to 15 HP) of permanent magnet servo motors. All models can be equipped with square flange mounts, shaft seals, amphenol connectors, and encoder or resolver feedback packages. If you have any difficulty in locating a particular motor for your requirements please contact a Glentek Representative. Many specialty motors are stocked, however their specifications are not listed on this data sheet. Please feel free to contact a Glentek applications engineer to assist you in making the proper motor selections. Prototype quantities are immediately available from stock.



Model	Continuous Torque Lb. In.	Torque Constant Lb. In./Amp	Continuous Current Amps	Winding Resistance Ohms	Winding Inductance mHY	B.E.M.F. Volts/-1000 RPM	Maximum RPM	Motor Inertia Ja Lb. In. Sec^2	Tachometer		Weight Lbs.	Typical Dimensions in Inches			
									Volts/-1000 RPM	% Ripple		D	L	SD	SL
GM1510	0.75	0.41	1.8	3.60	1.08	5	5800	0.00003	3.0	2	1	1.500	3.70	0.176	.68
GM2320	1.90	0.63	3.0	1.60	3.30	7	4000	0.00020	7.0	1	3	2.250	5.50	0.250	1.00
GM2340	3.10	0.94	3.3	1.00	2.70	11	4000	0.00040	7.0	1	4	2.250	7.20	0.250	1.00
GM2340R	6.25	1.27	4.9	1.40	1.20	15	4000	0.00080	7.0	1	4	2.250	6.30	0.250	1.00
GM3320	**7.50**	**1.70**	**4.5**	**2.10**	**4.00**	**22**	**3000**	**0.00200**	**7.0**	**1**	**7**	**3.250**	**7.30**	**0.500**	**1.50**
GM3340	**10.60**	**1.70**	**6.3**	**1.00**	**2.00**	**22**	**3000**	**0.00310**	**7.0**	**1**	**10**	**3.250**	**9.00**	**0.500**	**1.50**
GM3340R	**16.00**	**2.25**	**7.1**	**1.27**	**2.40**	**27**	**3500**	**0.00190**	**7.0**	**1**	**10**	**3.000**	**8.80**	**0.500**	**1.50**
GM4020	**23.60**	**3.50**	**6.6**	**1.30**	**7.40**	**39**	**2400**	**0.00920**	**7.0**	**1**	**12**	**4.000**	**8.60**	**0.625**	**1.90**
GM4040	**32.00**	**3.50**	**9.2**	**0.80**	**5.60**	**41**	**2400**	**0.01630**	**7.0**	**1**	**17**	**4.000**	**10.60**	**0.625**	**1.90**
GM4050	**41.00**	**3.20**	**12.8**	**0.60**	**4.40**	**38**	**2400**	**0.01980**	**7.0**	**1**	**20**	**4.000**	**11.60**	**0.625**	**1.90**
GM5065	60.00	4.00	15.0	1.60	1.70	45	2000	0.04000	7.0	1	27	4.625	13.00	0.875	1.90
GM5065A	60.00	3.20	18.8	1.70	1.30	37	3000	0.04000	7.0	1	27	4.625	13.00	0.875	1.90
GM6000B	**75.00**	**4.23**	**17.8**	**0.80**	**1.00**	**50**	**2500**	**0.05300**	**7.0**	**1**	**41**	**5.650**	**14.00**	**0.875**	**1.73**
GM4ZKS2	75.00	3.20	23.4	0.16	0.53	38	4000	0.02000	31.5	2	34	4.000	19.00	0.875	2.00
GM56PF4-12	120.00	5.70	21.0	0.24	0.88	67	3400	0.19000	31.5	2	59	7.500	13.00	1.250	2.00
GM56ZNF4	205.00	5.75	35.7	0.09	0.32	68	3400	0.39000	31.5	2	105	7.500	20.00	1.250	2.00
GM56ZPF4	335.00	6.50	51.5	0.15	1.03	77	1500	0.44000	31.5	2	116	7.500	21.00	1.250	2.00

Notes:
1. Motors can be supplied with:
   ☐ Square flange mounting faceplates ☐ Encoder or resolver feedback packages
   ☐ Oil seals ☐ Amphenol connectors ☐ Brakes ☐ Gear reducers
2. Motors come standard with ½" NPT for fluid tight connections.
3. Motor lengths shown avove include a tachometer mounted. For more detailed dimensions and data please refer to a Glentek installation drawing.
4. Models listed above in **Bold Print** are UL recognized.

For complete specifications, catalog, data sheets and pricing contact:

GTK GLENTEK

208 Standard Street • El Segundo, California 90245 • Phone: 310/322-3026 • Fax: 310/322-7709
Toll Free Out of State: (800) 232-4GTK

Specializing in High Bandwidth Brush Type (PWM) Servo Amplifiers, Linear Brush Type Servo Amplifiers,
Sinusoidal Brushless (PWM) Servo Amplifiers, Trapezoidal Brushless (PWM) Servo Amplifiers,
Permanent Magnet Brush Servo Motors, Brushless Servo Motors, Power Supplies, Transformers and Inductors

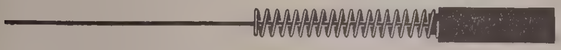
GRAPHALLOY®

SILVER GRAPHALLOY BRUSHES and BRUSH & SLIP-RING ASSEMBLIES...

USED IN MICROWAVE EQUIPMENT · SERVO SYSTEMS · SYNCHROS · INVERTERS · THERMOCOUPLE and STRAIN GAGE CIRCUITS · PULSE SYSTEMS · COMPUTER GROUNDING CONTACTS · TORQUE INDICATORS · MEDICAL EQUIPMENT · PACKING MACHINERY

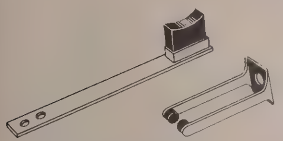
GRAPHALLOY® BRUSHES

Silver-Graphalloy Brushes have been widely used because of low *and* constant contact drop, extremely low electrical noise, *and* long life. Over 100 grades are now serving in a wide variety of applications. Silver-Graphalloy Brushes on ½-inch-diameter coin silver slip rings have operated successfully in highly critical electrical circuits at speeds up to 100,000 r.p.m.

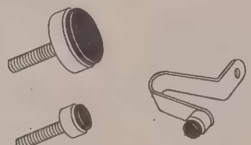


Standard sizes from ⅛"-square to ¾"-square. Many sizes in stock.

Our Engineering Department will assist you in determining the exact grade of GRAPHALLOY for your needs. *Ask for our Brush Inquiry Form 109.*

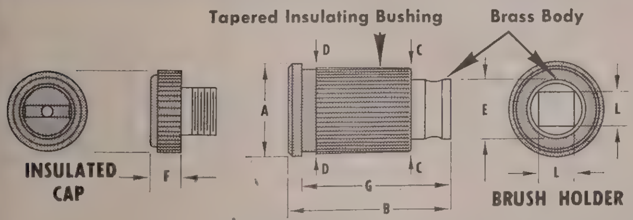


LEAF SPRINGS



CUP CONTACTS

GRAPHALLOY BRUSH HOLDERS



BRUSH HOLDER & CAP NO.	BRUSH SIZE	SUGGESTED MIN. SLIP-RING WIDTH	**MOUNTING HOLE DIAMETER	BRUSH HOLDER TO SLIP RING—MIN.	A	OVERALL LENGTH B	F	C	Other Sizes Available D	E	G	BROACHED HOLE L
14326	⅛" sq.	3/16"	13/32"	1/16"	.437"	⅞"	3/16"	.404"	.418"	.281"	25/32"	.129"
11509†	5/32" sq.	¼"	13/32"	1/16"	.437"	⅞"	3/16"	.404"	.418"	.281"	25/32"	.160"
11570†	3/16" sq.	¼"	7/16"	1/16"	.484"	⅞"	3/16"	.441"	.451"	.313"	25/32"	.193"
19011†	¼" x 3/16"	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256 x .193"
11527†	¼" sq.	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256"
14292†	⅜" x ¼"	7/16"	43/64"	⅛"	.718"	1 7/16"	¼"	.672"	.682"	.533"	1 5/16"	.382 x .256"
12166†	⅜" sq.	7/16"	13/16"	⅛"	.921"	1 13/16"	¼"	.813"	.828"	.628"	1⅝"	.382"
31392†	½" sq.	9/16"	1⅛"	⅛"	1.237"	1 13/16"	¼"	1.126"	1.141"	.878"	1 9/16"	.503"
35439†	¾" x ½"	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"
35440†	¾" sq.	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"

†Shunts are provided. **Mounting hole diameter for brush holder dimension D.

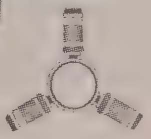
GRAPHALLOY® SLIP RINGS

We supply Coin Silver and Bronze Slip Rings, both *cylindrical* and *flat* types ...and recommend three brushes per ring...spaced at 120°...for best contact. The cylindrical type are designed for press fitting over standard steel shafting. The flat type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type, or slip-ring assemblies, can be furnished with leads attached.

No. 168 Series FLAT TYPE to 20" O.D.

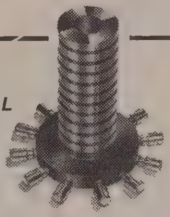
Standard FLAT Rings have ¼" radial contact surface and ⅛" radial spacing between adjacent rings.

No. 116 Series CYLINDRICAL TYPE to 36" O.D.



Typical Layout

Model 319 CYLINDRICAL SLIP-RING Assembly

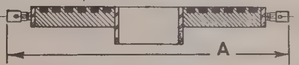


SOLID COIN SILVER RINGS

Model	Rings	Length
319-4	4	2 9/16"
319-6	6	3 5/16"
319-10	10	4 13/16"
319-14	14	6 5/16"

O.D. Slip Ring 1⅝"
Terminal 4"
Assembly I.D. .814/.813"

Model 409 FLAT SLIP-RING Assembly

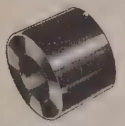


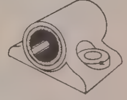
SOLID COIN SILVER RINGS

Model	Rings	O.D. "A"
409-2	2	5½"
409-4	4	7"
409-6	6	8½"
409-10	10	11½"

Hub O.D. 2" I.D. 1.753/1.751"
Length 1⅛" To 5 Amps., 125 V.
More rings on application.

GRAPHALLOY BUSHINGS and PILLOW BLOCKS





Survive unlubricated! Replace oil-lubricated bushings in synchros, instruments, timers and missiles. Advantages:

1. Lower friction at room temperatures;
2. No oil to solidify at low temperatures;
3. No oil to carbonize at prolonged elevated temperatures.
4. No oil or grease drag.

Ask for Data Sheets 270 and 277 on Miniature Bronze-Graphalloy Bushings.

Ask for the following Data Sheets

GRAPHALLOY BRUSHES, SLIP RINGS & ASSEMBLIES...DS-218

GRAPHALLOY BUSHINGS, PILLOW BLOCKS...DS-117 and DS-1001

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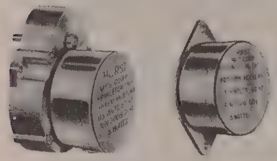
HURST HURST MANUFACTURING DIVISION,
EMERSON ELECTRIC COMPANY, BOX 326, PRINCETON, IN 47670. TELEPHONE (812) 385-2564. FAX (812) 386-7504

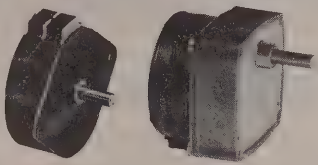
STEPPING AND SYNCHRONOUS MOTORS



A SERIES

Designed for long life at rated loads. Geared models have hardened steel gears and pinions running on steel studs. Hi-Torque rotors available; also voltages other than those shown may be specified. Widely used in applications requiring high quality components.

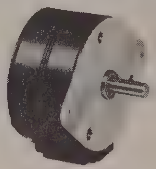
Dim. Geared: 2.81″ H x 1.63″ D
Direct Drive: 1.94″ H x 1.02″ D



S SERIES

Compact direct drive or geared motors for applications where space is limited and precise performance is required. Geared motors have typical torque ratings to 200 oz-in @ 200 p/s (max. gear train loading). Dual-stack motors featuring greater torque are now available. Call or write for complete specifications.

Dim. Geared: 2.45″ H x 1.78″ D
Direct Drive: 2.28″ H x .97″ D



SC SERIES

SC Series stepping motors have approximately 66% greater torque yet are only ⅔″ longer than the popular SAS Series motors. Dual sleeve bearings are standard but ball bearings as well as double ended shafts may be specified.

Dim. Direct Drive: 3.13″ H x 1.41″ D

BA SERIES

This exceptionally small stepping motor — a mere 0.895″ x 1.438″ — has a relatively high torque to inertia ratio. Its design recognizes the demand for small components to fit where space is severely limited. Applications are found in a wide range of medical and scientific instruments and robotics. These stepping motors are also recommended for low duty-cycle, battery operated equipment.

Dim. Direct Drive: .895″ H x 1.438″ D

DIRECT DRIVE STEPPING MOTORS

	AS and ABS	SAS and SBS	SCS	BAS
STEP ANGLE (degrees)	7.5 and 15	7.5 and 15	7.5	18
STEPS PER REVOLUTION	48 and 24	24 and 48	48	20
2-PHASE HOLDING TORQUE (oz-in)	3.8 and 4.3	8.0 and 11.9	18.5 and 20.5	1.10
RATED TORQUE @ 4-5 p/s (oz-in)	2.3 and 2.75	7.5 and 9.0	12.5 and 16.5	0.625
INPUT POWER (Watts)	3.5 and 4.5	8	8	2.5
NOMINAL VOLTAGE (Volts)	12	6, 12, 24	5, 6, 12, 24	5, 6, 12, 24
WINDING RESISTANCE (Ohms)	100 and 53	9, 36 and 144	6.1, 8.8, 35, 140	20, 29, 115, 461
ROTOR INERTIA (oz-in)	0.07	0.17	.29	1.19
TEMPERATURE RISE (°C)	30 and 48	65	58	46
WEIGHT (oz)	6.8	8	11.5	2.1

GEARED STEPPING MOTORS

	AS and ABS	SAS and SBS		
REDUCTION	300 to 4⅙	600 to 2		
STEP ANGLE (degrees)	0.025 to 3.6	0.025 to 7.50		
NOMINAL VOLTAGE (Volts)	12	12		
OUTPUT SPEED @ 200 p/s (rpm)	0.83 to 120	0.42 to 125.0		
TYPICAL TORQUE @ 200 p/s (oz-in)	150* to 5.3	200* to 3		
INPUT POWER (Watts)	3.5 and 4.5	8		
WINDING RESISTANCE (Ohms)	100 and 53	9, 36, 144		
WEIGHT (oz)	11	16		

*Maximum gear train loading

NOTES
1. Standard lead wire configuration is 6 leads.
2. All stepping motors shown here can be driven with Hurst Stepping Motor Controls.

DIRECT DRIVE SYNCHRONOUS MOTORS

	A and AB	SA and SB	SC	BA
SPEED @ OUTPUT SHAFT (rpm)	300 or 600	300 or 600	300	720
RATED TORQUE (oz-in)	2.0 to 3.75	6.0 to 9.0	8.75 to 11.5	0.625
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9	1.5
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85 ± 10%	0.15 ± 10% 400 VDC
FULL LOAD TEMPERATURE RISE (°C)	21 to 43	28 to 37	35 to 40	30
WEIGHT (oz)	6.8	8	10	2.1

GEARED SYNCHRONOUS MOTORS

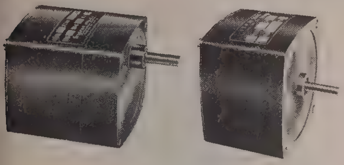
	A and AB	SA and SB	SC	
SPEED @ OUTPUT SHAFT (rpm)	1 to 120	1 to 360	15 to 150	
RATED TORQUE (oz-in)	150 to 4.0	200* to 7	116* to 13	
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9	
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85	
WEIGHT (oz)	11	16	18	

*Maximum gear train loading

NOTES
1. Capacitors furnished with most standard synchronous motors.
2. All synchronous motors shown on this page operate on 115 VAC, 60 Hz.

HURST HURST MANUFACTURING DIVISION,
EMERSON ELECTRIC COMPANY, BOX 326, PRINCETON, IN 47670. TELEPHONE (812) 385-2564. FAX (812) 386-7504

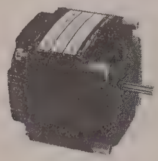
STEPPING AND SYNCHRONOUS MOTORS



T SERIES

Compact, rugged and efficient, TS Series motors are designed for heavy-duty applications. Geared models offer hardened steel gears and pinions with dynamic torque ratings up to 250 ounce-inches. Both geared and direct drive motors have machined die cast housings. Sleeve bearings are standard but ball bearings may be specified on the output shaft.

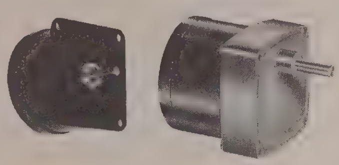
Dim. Geared: 2.38" H x 2.53"D
Direct Drive: 2.38" H x 1.75" D



KVS SERIES

KVS Series motors are hybrid permanent magnet types. The motors are constructed with multitoothed rotors and stators of unequal tooth number so that a vernier effect provides the equivalent of a large number of poles and small step angles without the necessity for gearing. Standard KVS motors are furnished with 6-lead bifilar windings for 12 VDC operation. Other voltages and 2-phase, bipolar windings may be specified.

Dim. Direct Drive: 2.38" H x 2.44" D

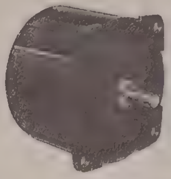


P SERIES

PAS and PBS Series motors provide users with a choice of direct drive or geared models, standard or Hi-Torque rotors and, for direct drive models, a choice of mounting plates. Voltages other than those shown may be specified.

Gearing is scaled to provide a maximum dynamic gear train loading of 200 ounce-inches.

Dim. PAS Geared: 2.38" H x 2.25" D
PAS Direct Drive: 2.28" H x 1.56" D
PBS Geared: 2.38" H x 2.13" D
PBS Direct Drive: 2.28" H x 1.41" D



R SERIES

Designed specifically to combine greater torque and small size, RAS and RBS stepping motors meet many industrial and instrument requirements. Standard 7.5° step angle motors have a torque rating at 4-5 p/s of 23 ounce-inches. The Hi-Torque model is rated at 29 ounce-inches. Models with 15° step angles are rated, respectively, 13 and 17 ounce-inches.

Dim. Direct Drive: 2.88" H x 1.84" D

DIRECT DRIVE STEPPING MOTORS

	TS	KVS	PAS and PBS	RAS and RBS
STEP ANGLE (degrees)	7.5	1.8 and 3.75	7.5 and 15	7.5 and 15
STEPS PER REVOLUTION	48	200 and 96	48 and 24	48 and 24
2-PHASE HOLDING TORQUE (oz-in)	14 and 15.5*	25 and 21	11, 12.3, 14, 16.5	24, 27, 33, 37
RATED TORQUE @ 4-5 p/s (oz-in)	8.5 and 10.4*	18.5 and 14	5.8, 7.3, 8.5, 11.5	13, 17, 23, 29
INPUT POWER (Watts)	8.5	12	8 and 8.5	12
NOMINAL VOLTAGE (Volts)	6, 12, 24	12	12	6, 12, 24
WINDING RESISTANCE (Ohms)	9.5, 31, 135	18	32 and 35	6, 24, 96
ROTOR INERTIA (oz-in)	0.34	0.82	0.19 and 0.34	0.92
TEMPERATURE RISE (°C)	40, 45, 52	56 and 50	50, 52	55 and 60
WEIGHT (oz)	20	30	13	26

*Hi-Torque rotor

GEARED STEPPING MOTORS

	TS	PAS and PBS
REDUCTION	300 to 2	300 to 2
STEP ANGLE (degrees)	0.025 to 0.375	0.025 to 3.75
STEP PER REVOLUTION	14,400 to 96	14,400 to 96
OUTPUT SPEEDS @ 200 p/s (rpm)	.83 to 125	.83 to 125
TYPICAL TORQUE @ 200 p/s (oz-in)	250* to 7.5	200* to 7.5
INPUT POWER (Watts)	8.5	8, 8.5
WINDING RESISTANCE (Ohms)	31	32 and 35
WEIGHT (oz)	27	18

NOTES
1. (PAS and PBS). Square mounting plate is standard for direct drive motors.
2. (TS, RAS and RBS). Standard motors have 4-phase bifilar windings (6 leads) for 6, 12, or 24 VDC operation.
3. All stepping motors shown here can be driven with Hurst Stepping Motor Controls.

DIRECT DRIVE SYNCHRONOUS MOTORS

	T and TA	PA and PB	RA
SPEED @ OUTPUT SHAFT (rpm)	300 or 360	300 or 600	300
RATED TORQUE (oz-in)	6.6 to 10.25	5.5 to 11	15 or 20
INPUT POWER (Watts)	6 to 9.5	7.5 to 11	11 or 14.5
CAPACITOR VALUE (mfd)	.68 to .85	.68 to 1	1.0 or 1.3
FULL LOAD TEMPERATURE RISE (°C)	27 to 38	31 to 45	37 or 46
WEIGHT (oz)	20	13	26

GEARED SYNCHRONOUS MOTORS

	T and TA	PA and PB
SPEED @ OUTPUT SHAFT (rpm)	1 to 150	1 to 360
RATED TORQUE (oz-in)	13-250*	6 to 200
INPUT POWER (Watts)	7 or 9.5	7.5 to 11
CAPACITOR VALUE (mfd)	.68 or .85	.68 to 1
WEIGHT (oz)	27	18

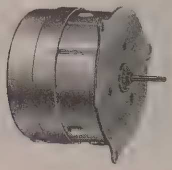
*Maximum gear train loading

NOTES
1. Capacitors furnished with most standard synchronous motors. (No capacitor furnished with TA or BA Series motors).
2. (PA and PB). Square mounting plate is standard for direct drive models.
3. All motors except some TA Series motors operate on 115 VAC, 60 Hz. Some TA models operate on 115 VAC. 50 Hz.

HURST

HURST MANUFACTURING DIVISION,
EMERSON ELECTRIC COMPANY, BOX 326, PRINCETON, IN 47670. TELEPHONE (812) 385-2564. FAX (812) 386-7504

HYSTERESIS SYNCHRONOUS, REVERSIBLE MOTORS



CA SERIES

Efficient, compact CA Series hysteresis synchronous motors have a range of standard speeds from 1200 rpm (direct drive) to ⅓ rpm (geared). Gear train materials include high quality bronze bearings, brass gears, hardened steel pinions and wheel shafts.

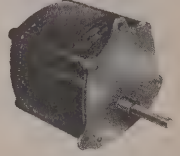
The gear torque rating is 100 ounce-inches at 1 rpm.

Dim. Geared: 2.13″ H x 2.5″ D
Direct Drive: 1.63″ H x 2.5″ D

DA/DB SERIES

Heavy duty DA and DB gear motors maintain timing accuracy and are offered in a broad range of shaft speeds 120 rpm through 24 rpd. They are recommended for applications requiring high gear torque ratings (100 oz-in max.) and small size.

Dim. DA 1.8″ H x 2.5″ D
DB 2.05″ H x 2.5″ D



GA SERIES

GA Series motors provide the highest torque ratings of all the Hurst gear motors — 600 oz-in at 1 rpm. A choice of 14 different speeds, from 1 to 300 rpm, are available as stock models for operation at 115 VAC, 60 Hz. Other speeds may be specified. High quality construction throughout assures dependable field performance.

Dim. Mounting holes: 2.99″ W x 2.37″ H x 3.06″ D

MB SERIES

MB Series motors have inverted rotors and at 60 Hz have a synchronous speed of 1800 rpm. The "fly wheel" effect of the increased rotor inertia provides smooth operation with more uniform angular velocity characteristics than other types. These motors are particularly suited to applications requiring low flutter, direct drive, synchronous operation.

Dim. 2.66″ H x 2.0″ D

DIRECT DRIVE OR GEARED MOTORS

	CA	DA/DB	GA	MB
SPEED @ OUTPUT SHAFT (rpm)	⅓ to 1200	1 to 120	1 to 300	1800
RATED PULL-OUT TORQUE (oz-in)	100 to 0.10	100 to 1.25	600 to 2	5.50$^{(C)}$ 5.25$^{(A)}$ 6.00$^{(B)}$
INPUT POWER (Watts)	5	5	10	30
CAPACITOR VALUE (mfd)	.50	.50	1.0	2.0
FULL LOAD TEMPERATURE RISE (°C)	40	40	50	40
WEIGHT (oz)	15	14	40	28

(A) Pull-in torque
(B) Locked rotor torque
(C) Pull-out

NOTES
1. Capacitors are furnished with most motors.
2. MB Series. Thermal protection available.

CUSTOM DESIGNED MOTORS
A HURST SPECIALTY

For more than 30 years we have been providing top-drawer companys with special purpose motors. Often they are adaptations of standard Hurst motors, thus costs are kept to a minimum. In other cases, completely new motors are designed to exacting specifications.

BRUSHLESS D.C. MOTOR CAPABILITIES

Over the past several years our design, engineering and production groups have become completely familiar with brushless D.C. motors. Sophisticated machine tools are in place and meeting production needs for these motors. We invite your inquiries.

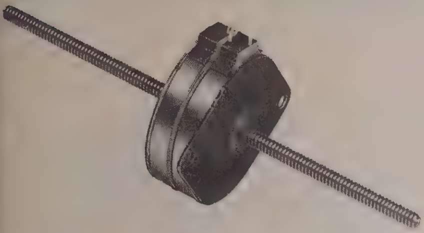
Virtually all piece parts of Hurst motors — rotors, shafts, gears, pinions, etc. — are produced in-house for stricter quality control. That is why all of our motors bear this symbol of precision:

hurst

HURST

HURST MANUFACTURING DIVISION,
EMERSON ELECTRIC COMPANY, BOX 326, PRINCETON, IN 47670. TELEPHONE (812) 385-2564. FAX (812) 386-7504

LINEAR ACTUATORS, Stepping or Synchronous



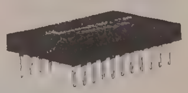
Stepping (SLS Series) or synchronous (SL Series) linear actuators are reversible, permanent magnet rotor types. An integral part of the rotor assembly is a sintered bronze nut for extended life. The nut accepts a ¼″ diameter, .048 pitch Acme screw that provides linear motion for pushing, pulling, lifting and positioning applications. Standard 8″ lead screws have a maximum travel of 6.75″ and a maximum thrust of 25 pounds. Screws of other lengths may be specified. Ball bearings are standard. SL (synchronous) Series motors provide travel of .24 inch per second. SLS (stepping) Series motors have a resolution of .001″ per step or 1000 steps per inch.

New 600 rpm versions of these motors are now available. They have all the quality features of the SL and SLS Series. The direct drive model has a linear travel rate of .48″/sec. The stepping version has 500 steps/in. Consult the factory for complete specifications.

CONTROLS FOR STEPPING MOTORS

MODEL 220001

The 220001 is a DIP package containing all the basic circuitry required for operation of a 4-phase, unipolar stepping motor: a pulse generator, bidirectional logic sequencer, and phase drivers. It is fabricated as a thick film hybrid circuit using CMOS and bipolar components for small size and low power consumption.

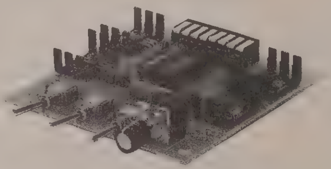


FEATURES:

- 5V logic level control of
  - — rotational direction
  - — run/hold
  - — single step (jog)
  - — phase driver disable
- 2-on, 2-off phase sequencing
- drivers rated at 500 ma per phase
- operation from single 6 to 24 VDC supply

MODEL EPC-016

The EPC-016 is a PC board assembly containing the 220001 hybrid, power drive transistors, and all external components needed for manual control of a stepping motor. A motor, DC power supply, and this board form a complete system.



FEATURES:

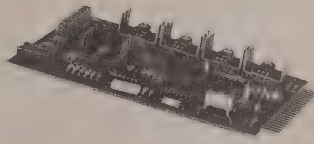
- 3 position switch for operation of motor in continuous step, jog, or hold mode
- CW/CCW rotation selection switch
- phase disable switch
- step frequency adjust potentiometer
- 2 amp per phase drive capability
- operation from single 6 to 24 VDC supply
- Dimensions: 4″ x 4″

MODEL EPC-013

The EPC-013 is a PC board assembly with additional stepping motor control capabilities.

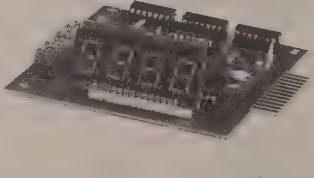
FEATURES:

- sequencing and drivers for 3 or 4 phase unipolar motors
- 3 modes of excitation
  - — full step, 2 phases on
  - — full step, 1 phase on
  - — half step, alternating 1-2 phases
- ramping oscillator for step rate control
- adjustable ramp rates
- linear or exponential ramp profile
- single step (jog) input
- gating for external control of input pulses
- manual or digital interface to control functions
- 2 amps per phase drive capability
- operation from single 6 to 30 volt supply
- 5V regulator output available for external use
- Dimensions: 6.5″ x 4.5″



MODEL EPC-014

The EPC-014 is a general purpose presettable counter/display PC board assembly suitable for use with most stepping motor drive systems. In a typical application, it is preset with a number of motor steps, counts and displays the steps as executed, and provides a control signal when the preset count is reached. It is also suitable for count and control applications using input pulses derived from sources other than step commands, e.g., from an external encoder or other sensor.

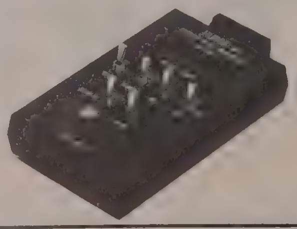


FEATURES:

- 4 decade counter/display
- manual count preset via BCD switches
- optional remote location of count preset switches and display
- manual or digital control of enable input
- 5V logic level output latch
- operation from 5VDC supply
- Dimensions: 4.0″ x 4.5″

MODEL EPC-015

The EPC-015 is a totally encased, hand-held driver containing all the control features of the EPC-016 plus selectable display of step frequency or step count. A motor, DC powder supply, and this controller form a complete control system.



FEATURES:

- 4 decade frequency/count display
- all control features of EPC-016
- 1 amp per phase motor drive capability
- operation from a single 6 to 24 VDC supply
- compact size: 1″ x 3.5″ x 6″

NEW! FOUR SIZES OF HIGH TORQUE BRUSHLESS DC MOTORS

These small brushless DC motors are virtually maintenance-free. They have outstanding torque/size ratios (see chart below). Easily controlled, they are reversible and start and stop precisely. They are engineered for intermittent or continuous duty.

Hurst's BLDC motors may be applied wherever brush servo motors are used. A leader in brushless motor technology, we fabricate in-house many of the component parts. The result: stricter quality control.

A recently completed expansion of our manufacturing facilities is devoted soley to the production of brushless DC motors. Special equipment has been installed that let us design to tolerances which were impractical to specify only a decade ago.

Designing sub-fractional motors for specific applications has been a Hurst specialty for many years. Brushless DC motors are no exception. Your inquiries will receive immediate attention.

Today, get complete specifications including performance curves. Call, write or FAX Hurst Manufacturing Division, Emerson Electric Co., Box 326, Princeton, IN 47670. Telephone 812-385-2564. FAX 812-386-7504.

SPECIFICATIONS

MODEL	TORQUE CONTINUOUS/ PEAK (oz-in)	SPEED RPM (max)	ROTOR INERTIA oz-in-sec^2 ± 10%	INPUT VOLTAGE DC (max)	K_e Volts RRPM ± 10%	K_t oz-in/Amp. ± 10%	SIZE WEIGHT
BLDC 4811-003	7.0/4.0	6000	0.0006	40	6.14	8.3	1.73" sq x 3" L 18 oz
BLDC 4821-003	15/85	6000	0.0015	40	6.14	8.3	2.12" sq x 3.13" L 25 oz
BLDC 4822-003	25/165	6000	0.003	40	6.14	8.3	2.12" sq x 4.19" L 35 oz
BLDC 4823-003	35/250	6000	0.0045	40	9.75	13.2	2.12" sq x 5.25" L 45 oz

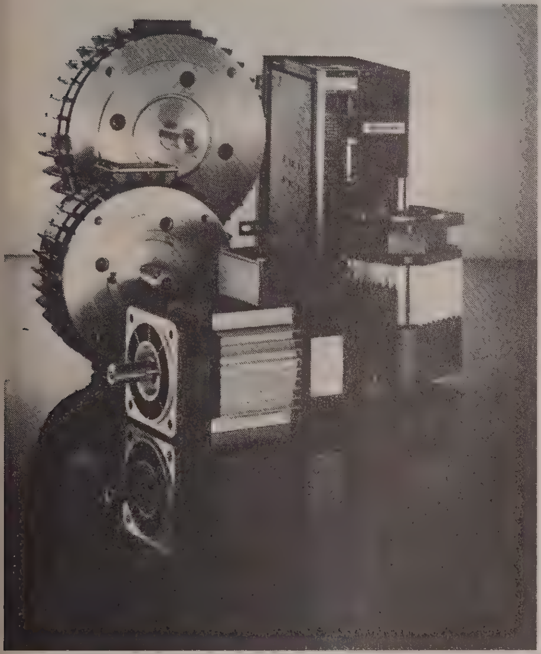
hurst

INFRANOR AUTOMATION TECHNOLOGIES

Toll-Free
800-237-3786

Specialists in Flexible, Integrated Automation

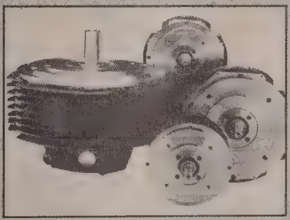
- Engineer to Engineer application support
- Servo and Stepper engineering specialists
- Pancake, cylindrical and linear servo systems
- Brush and Brushless systems



- Zero cogging to 0.1 RPM
- Speeds to 10,000 RPM
- Torques to 3,000 IN-LB
- Internal tachs, brakes encoders, resolvers
- Complete line of matched amplifiers and positioning controls
- New equipment & retrofits

SERVING U.S.A. & CANADA WITH FACTORY DIRECT SUPPORT.
WE CAN HELP YOU AUTOMATE!

COMPACT DC SERVOS

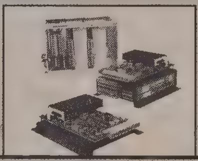


- Compact, Pancake Design
- Speeds to 10,000 RPM
- Torques to 3,000 in-lb.
- 15,000 hour brush life
- Cog-free to 0.1 RPM
- Efficiencies to 91%
- UL Recognized
- Ironless, wire-wound industrial strength rotor handles 10X overcurrent

COMPACT BRUSHLESS SERVOS

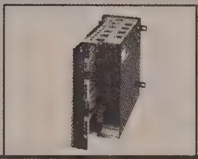
- Compact, pancake design
- Speeds to 6,000 RPM
- Torques to 1363 in-lb.
- Low inertia disc rotor
- Ceramic rare earth magnets
- 3 Ms mech. time constant
- Compact resolvers
- Built-in brakes

DC AMPLIFIERS



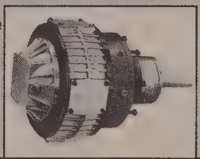
- Compact design
- Power outputs to 15 kW
- Peak currents to 120 A
- Non-audible switching
- I^2t overcurrent protection
- 8 axes fit 19" rack
- Efficiency to 96%

BRUSHLESS AMPLIFIERS



- Drive any AC or DC brushless motor
- 6 axes fit 19" rack
- Power outputs to 12 kW
- Peak currents to 80 A
- 220 VAC single power source
- I^2t overcurrent protection
- Four quadrant operation

PRECISION SPEED REDUCERS



- Zero backlash models available
- Input speeds to 6,000 RPM
- Torques to 51,000 in-lb.
- Low input inertia
- Efficiencies to 94%
- Variety of ratios
- 200% overload capability

Movinor DC SERVOS

- Sizes 23,34 and 42
- Torques from 10 oz-in. to 335 in-lbs.
- Ceramic or rare earth magnets
- Square flanges match stepper mounts
- Ideal for use with PWM drives

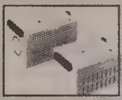
BL BRUSHLESS SERVOS

- Low inertia, high response
- 3" to 6" frame sizes
- Torques to 345 in-lbs.
- Low ripple brushless tachometers
- Matched amplifiers
- High bandwidth system performance

STEPPING MOTORS

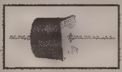
- Sizes 23,34 and 42
- Standard 1.8 degree step angle
- Dynamic torques to 840 oz-in.
- Holding torques to 1125 oz-in.
- Single and double-ended shafts
- Matching drives for optimum performance

STEPPER CONTROLS



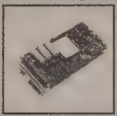
- Bi-level drive outperforms other drives
- Complete control in a single package
- Single and multi-axis control
- Translators and preset indexers
- Full, half and microstep operation
- RS232, RS422, PLC and switch inputs

LINEAR ACTUATORS



- 1.8° step motor with internal conversion to linear output
- Microstepped for smoothness and resolutions to 20 micro-inches/step
- Linear forces to 200 pounds
- Variety of leadscrew pitches and number of starts, motor sizes 23 and 34

AC INVERTER DRIVES



- Cost effective, adjustable speed, board level inverter card
- Drives 3-phase motors rated up to 1 HP
- Constant motor torque to 60 Hz
- Frequency range 0 to 400 Hz

DATA CONVERTERS

- Change RS232 data streams to RS422
- Changes RS422 to RS232 signal levels
- Enhances communications with step motor controllers
- 3 models, variety of pin configurations
- Allows RS232 devices to communicate with RS422 devices

The INFRANOR ADVANTAGE:

You deal DIRECT, ENGINEER TO ENGINEER, for unparalleled technical support and customer service!

For Literature, Application Assistance, call

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IN-HOUSE SEMINARS:

If your company is involved in a project requiring either servo or stepper control, Infranor can provide an in-house engineering level seminar tailored to your technology and time schedule. Please call for details.

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Fax 203-729-6969

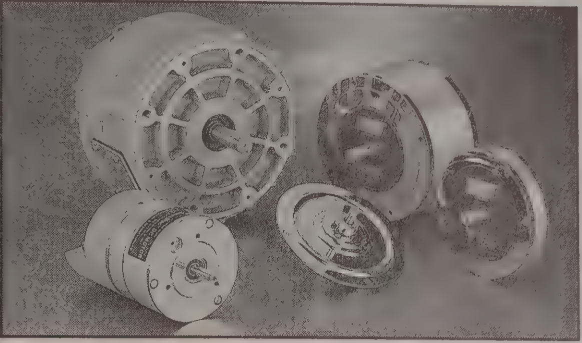
Boston Office:
INFRANOR, INC.
33 Jewel St. # 469
Mansfield, MA 02048
508-339-0401
1-800-237-3786

Los Angeles: 213-988-6570

THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

Motion Control Components



DC Servomotors

High performance disc armature design
Full torque from 0 to 4000 rpm
Zero cogging at all speeds
Unique flat package

The ServoDisc™ line offers the design engineer a wide range of high performance DC servomotors employing the unique PMI flat disc armature. This ironless, low inertia armature delivers high acceleration and zero cogging in an exceptionally compact package. Power outputs range from 1/30 to 10 hp. These motors are offered in a wide range of configurations from flat "pancakes" to heavy-duty industrial designs. They are available as complete actuator packages that can include tachometers, encoders, brakes, gearboxes and matching amplifiers.

* UL Recognized Versions Available

Servo Amplifiers

Matched to PMI's disc armature servomotors
Single and multi-axis designs
Extensive fault protection
Low form factor to 1.005

PMI's PWM (pulse-width modulated) servo amplifiers are designed specifically to match the ServoDisc™ motor lines. Voltage and current ratings guarantee maximum motor performance with complete protection from accidental motor overload. Packaging options accommodate both single and multi-axis applications. The exceptionally low form factor contributes to high efficiency motor operation. Extensive fault protection, self-diagnostics and electronic current limiting protect the complete system for fail-safe operation.

* UL Recognized Versions Available

Put yourself in motion! Call 1.800.77.SERVO.

Motor Type	Series	Torque Stall		Rated Speed range		Diameter		Length		Weight		HP	
		(oz-in)		(rpm)		(in)		(in)		(lbs)		(@ rated n)	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Servo	Ferrite	16	49	-	3,000	4.72	5.98	0.75	0.80	1.20	2.20	0.05	0.14
Disc	Ferrite Kit	16	96	-	3,000	4.72	8.47	0.75	0.80	0.89	2.07	0.05	0.30
	Neo Kit	-	89	-	3,000	-	4.78	-	0.80	-	2.20	-	0.25
(Brush Type)	S	20	85	-	3,000	3.39	4.37	1.60	2.28	2.10	5.42	0.06	0.26
	U	31	280	-	3,000	4.37	7.37	1.84	2.78	4.50	18.50	0.12	0.96
	N	62	142	-	3,000	4.37	5.50	0.94	1.10	3.10	6.30	0.17	0.50
	JR	173	1,770	-	3,000	5.50	11.00	3.94	7.75	8.00	195.00	0.55	5.70
	JR33	-	4,060	-	3,000	-	16.25	-	7.75	-	195.00	-	14.00
Conventional	L & LS	20	548	2700	3,000	1.54	3.86	3.11	10.47	0.99	19.18	0.10	1.50

KOLLMORGEN
Motion Technologies Group
Industrial and Commercial Products

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Radford, VA 24141-4099
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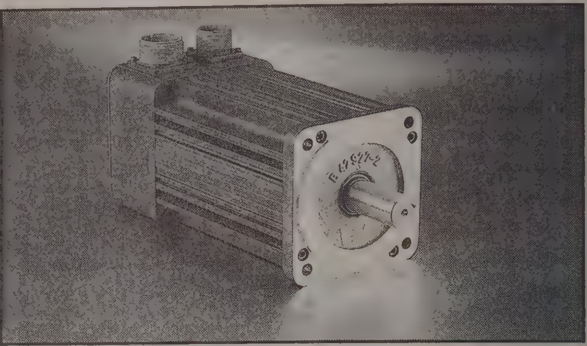
Servo System Performance



Brushless servomotors incorporate highest rare earth neodymium-iron-boron magnets and excellent thermal design, providing high acceleration and torque in an extremely compact package. Its rugged design, without brushes, means extremely low maintenance. We offer both conventional and pancake designs to meet your machine's unique space requirements. Many of our brushless servomotor amplifiers are micro-processor controlled with wide bandwidths and extensive diagnostics for long-term reliable operation.

GOLDLINE Motors

Three series of **GOLDLINE** motors offer the following features:

- Long life
- Class H insulation
- Continuous torque ranges from 0.62 to 82.0 lb-ft
- Small package
- Rugged resolver feedback
- Encoder

Available options include:

- Fail-safe brakes
- IP-67 sealing, MS connectors
- Analog tachometer
- Special mechanical modifications to meet customer requirements
- Precision gearheads

B-Series

- Extremely low inertia for quicker indexes
- Greater throughput from your machine
- UL recognized

M-Series

- Medium inertia motors to maximize performance on large inertia compliant loads
- UL recognized

EB-Series

- Explosion-proof motors rated for Class Group I, Division C & D environments
- UL listed

PWM Servo Amplifiers

Kollmorgen Servo Amplifiers offer built-in overload protection circuitry and high bandwidth in a complete family of products.

BDS4 Amplifier Series

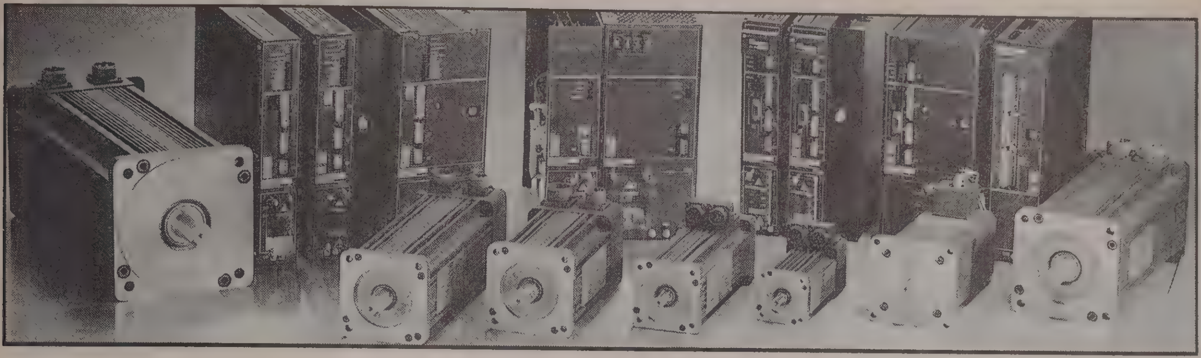
- Available in 7 module sizes
- Power ratings to 22 KVA continuous (44 KVA peak)
- Current ratings from 3 to 55 amps RMS continuous and up to 110 amps peak
- Patented torque angle control for increased motor performance
- Optical encoder card, eliminating the need for an additional encoder
- UL Listed

BDS5 Amplifier/Positioner

- Full-featured, high performance brushless positioning servo in one compact enclosure
- Combines a positioner, a servo amplifier and I/O interface in one unit
- Simple programming language
- Advanced motion control moves
- Electronic gearbox
- Motion rating and registration
- Self-turning
- Digital servo loops
- 32 I/O sections
- Serial communications including RS-232 for typical terminals or RS-422/RS-485 for multidrop communication
- Powerful PC-based programming and start-up environment

Available options include:

- DEP-01 data entry panel
- Hand-held terminal
- I/O32-OPTO interface



Motor	Amplifier X=4 BDS4 X=5 BDS5	Cont. Torque at Stall Tc lb-ft (N•m)	Peak Torque at Stall Tp lb-ft (N•m)	Cont. Power HP (kw)	Max. Speed RPM	Motor Inertia Jm x 10^4 lb-ft-sec^2(kg-m^2)	Motor Length mm (inches)
115-Volt Systems							
B-102-A	BDSX-103	0.62 (0.84)	1.50 (2.03)	0.39 (0.29)	3,750	.228 (.309)	183.20 (7.21)
B-106-B	BDSX-106	1.64 (2.22)	3.08 (4.18)	1.10 (0.81)	3,750	.564 (.765)	244.40 (9.61)
230-Volt Systems							
B-102-A	BDSX-203	0.62 (0.84)	1.50 (2.03)	0.73 (0.54)	7,500	.228 (.309)	183.20 (7.21)
B-106-B	BDSX-206	1.64 (2.22)	3.08 (4.19)	2.00 (1.49)	7,500	.564 (.765)	244.40 (9.61)
115-Volt Systems							
B-202-A	BDSX-103	1.66 (2.25)	5.05 (6.85)	0.40 (0.30)	1,250	.735 (.996)	236.20 (9.30)
B-206-C	BDSX-110	4.75 (6.44)	9.05 (12.3)	1.94 (1.45)	2,450	1.853 (2.512)	315.40 (12.42)
230-Volt Systems							
B-202-A	BDSX-203	1.66 (2.25)	5.05 (8.85)	0.80 (0.60)	2,500	.735 (.996)	236.20 (9.30)
B-206-C	BDSX-210	4.75 (6.44)	9.05 (12.3)	3.80 (2.83)	4,900	1.853 (2.512)	315.40 (12.42)
B-402-A	BDSX-203	5.00 (6.80)	9.60 (13.00)	1.30 (0.97)	1,500	.238 (.323)	265.50 (10.45)
B-406-C	BDSX-230	12.50 (17.00)	27.70 (37.60)	9.60 (7.20)	5,000	.685 (.929)	372.10 (14.65)
B-602-A	BDSX-210	13.00 (17.60)	23.50 (31.90)	4.40 (3.30)	2,000	.758 (1.028)	299.20 (11.78)
B-606-D	BDS X-230	31.00 (42.00)	66.00 (89.50)	11.00 (8.20)	2,300	.224 (.304)	436.40 (17.18)
B-802-A	BDSX-230	31.00 (42.00)	69.50 (94.20)	10.60 (7.91)	2,000	.360 (.488)	360.40 (14.19)
B-806-B*	BDSX-230/100	82.00 (111.20)	154.00 (208.80)	24.50 (18.30)	3,000	.093 (.126)	539.4 (21.24)

* A high-current BDS5 is not available to drive these motors.

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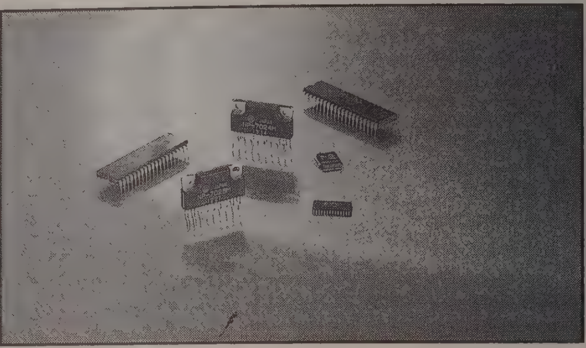
Step Motor Controllers



Low Cost Imaginative OEM Solutions and Quick-start Development Tools.

Pulse & Direction Controls:

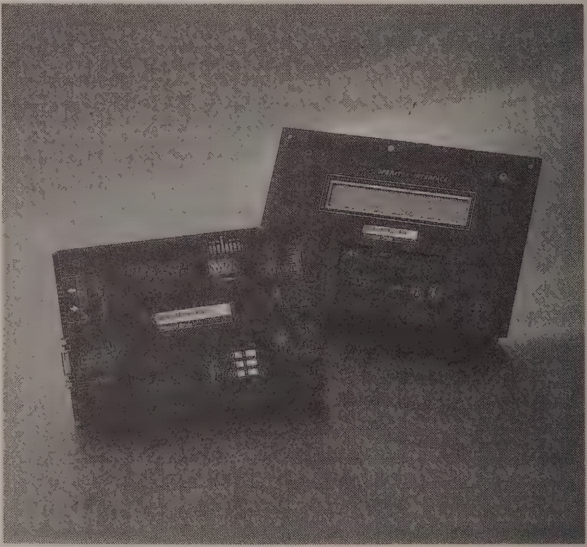
SMC-100 (unipolar, full/half stepping) and SMC-150 (bipolar chopper, full/half stepping) and SMC-155 (bipolar chopper, microstepping). Single power supply, simple operation. 12-32 Volts DC. 2 amp and 4 amp models.

Programmable Motion Controllers for Step Motors:

SMC-400 (full/half stepping) and SMC-500 (microstepping) programmable motion controllers have built-in bipolar chopper drivers, built-in nonvolatile RAM for program storage, four each programmable inputs and outputs, in addition to the dedicated inputs (CW & CCW home limits, E stop), and an extremely powerful English-like command set. RS232 serial interface to a PC. Multidrop pollable software – up to eight units can be daisy-chained and individually or collectively addressed. Single power supply operation. Cable kits and program development kits are provided for quick start-up. 32 Volts DC, 2 amp or 4 amp models. Higher power units (SMC-1502/1402, 100 Volts DC, 8 amps) are available with or without encoder based closed loop operation.

Intelligent Operator Panels with Built-in Nonvolatile Memory or Removable Data Cartridge:

OP-1 & OP-2 are designed to be used as operator panels for the SMC series programmable motion controllers. OP-1 has built-in 8K bytes of nonvolatile memory, and OP-2 has 8K bytes of removable memory in a data cartridge. A powerful command set enables the user to program up to 16 variables. The values of these variables can be entered with the front panel push-button switches. Built-in intelligence enables the programs to be written in plain English, making the operator interface exceedingly simple. Eight programmable inputs add to the versatility of these devices.



Step Motors

PF Series Canned Stack Step Motors

25, 35, 42 and 55 mm OD. 3.75°, 7.5° and 15° step angles. 96, 48 or 24 steps per revolution. Choice of four magnet materials (including Neodymium) with or without gear heads. Wide variety of gear ratios. Sleeve bearings are standard, ball bearings are optional. Unipolar or bipolar windings. "T" thin versions with narrow profile available on the 35 and 42 mm sizes.

Model	Dia (mm/in)	Length (mm/in)	Step angle	Max (oz-in)
PF25	25/0.98	15/.59	7.5° or 15°	2.5
PF35	35/1.37	31.8/1.25	7.5° or 15°	3.0
PF35T	35/1.37	15/0.59	7.5°	5.0
PF42	42/1.65	21.8/0.86	7.5°	14.0
PF42T	42/1.65	14.9/0.59	7.5° or 3.75°	8.0
PF55	55/2.16	25/0.98	7.5°	23.0

SM & PJ Series Hybrid Step Motors

Size 17 (1.65" square), Size 23 (2.3" OD), Size 34 (3.4" OD) and Size 42 (4.2" OD). 0.9°, 1.8° or 3.6° step angles. 100, 200 or 400 steps per revolution. Standard ball bearings.

Model	Dia (mm/in)	Length (mm/in)	Step angle	Max (oz-in)
SM39	39/1.53	24/1	0.9°, 1.8°, 3.6°	7.8
SM42	42/1.65	34/1.34	1.8°, 3.6°	9.5
PJ39	56.4/2.2	39/1.54	1.8°	27.8
PJ42	56.4/2.2	42/1.65	1.8°	34.7
PJ50	56.4/2.2	50/1.97	1.8°	69.4
PJ55	56.4/2.2	55/2.17	1.8°	83.3
PJ80	56.4/2.2	80/3.15	1.8°	111.1
SM3424-170	86.4/3.4	61/2.4	1.8°	156
SM3424-400	86.4/3.4	93.3/3.67	1.8°	312
SM3424-350	86.4/3.4	127/5.0	1.8°	469
SM4270-340	106.7/4.2	176/6.93	1.8°	1349
SM4288-890	106.7/4.2	153.5/2130	1.8°	2130

PCL series high speed programmable pulse generators offer simpler control of motion with an external CPU, reduced board space and reduced overall cost in high performance step or servo motion control systems.

The PCL series can be used to generate preprogrammed pulse rates with controllable ramps and cyclic functions. Parameters can be changed "on-the-fly" upon cue from the CPU. PCL-3AM features max programmable frequency up to 3 M Hz and built-in facility to close the position loop with an encoder. PCL-240AK has similar features with a max programmable frequency of 240 K Hz. Lower cost, lower speed chips (PCL-AK) and surface mount versions (PCL-240MK and PCL-MK) are also available.

Detailed data sheets & application notes by fax at a moment's notice by our "fast fax" service. Fax 703.731.0847.

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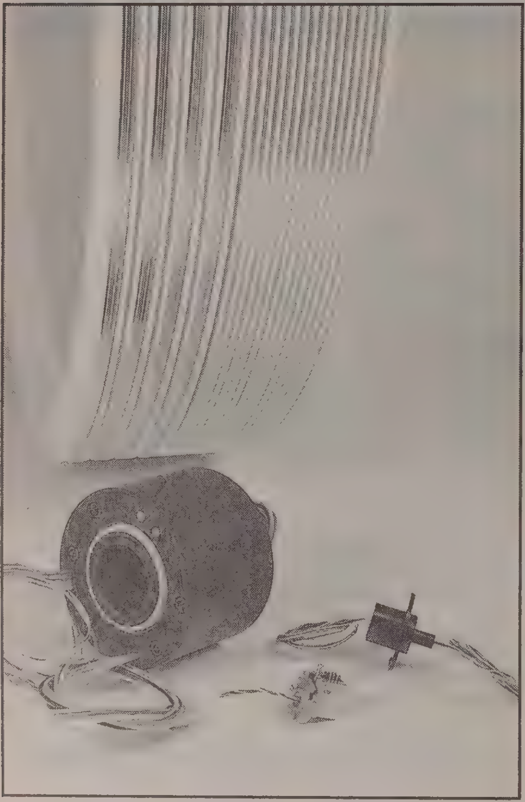
Slip Rings



If you design rotating machinery, here's something to think about.

Slip rings are devices used to pass power or data from a stationary to a rotating structure. Slip ring assemblies can be used in any mechanical system that requires unrestrained, continuous rotation while transmitting power and data.

Poly-Scientific is the largest slip ring manufacturer in the world. We have developed over 4,000 slip ring designs, many of which are available for use in their existing configuration, or they can be modified to meet specific requirements. New designs can be created to meet the most demanding specifications.

There was a time when slip rings were too complicated, too big and too expensive for many commercial/industrial designs. But due to advances in manufacturing methods, we are now able to offer compact, low maintenance slip rings for commercial use that feature the same high reliability contact technology found in our military and aerospace slip rings. These are mass-produced, off-the-shelf assemblies which are immediately available for a wide variety of applications. They are successfully operating in such diverse environments as packaging, food processing, CCTV and revolving doors, to name a few.

The next four pages describe our commercial slip ring assemblies. The following three pages describe our slip rings for space/vacuum, vehicular, helicopter, pedestal and other demanding environments, as well as slip ring separates and twist capsules. Our slip rings are used in some of the most sophisticated and demanding military and industrial applications imaginable.

There are two pages describing our "special" assemblies including cable reel and mooring slip rings, and our line of fiber optic rotary joints (the optical equivalent of a slip ring).

The last page of our slip ring section is "How to Specify A Slip Ring", a paper that guides the design engineer through the process of specifying a slip ring to make certain that it meets all system requirements.

New to our section this year are products from Litton Clifton Precision. We have consolidated the operations of Clifton Precision and Poly-Scientific, allowing us to offer a full line of rotary components. The three pages describing Clifton products give a brief overview of their product line including brush and brushless DC motors, digital and brushless resolvers, torque motors and DC servo motors.

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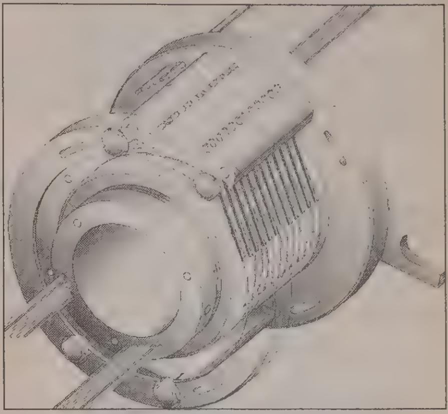
Commercial Slip Ring Assemblies

AC4598/AC4831

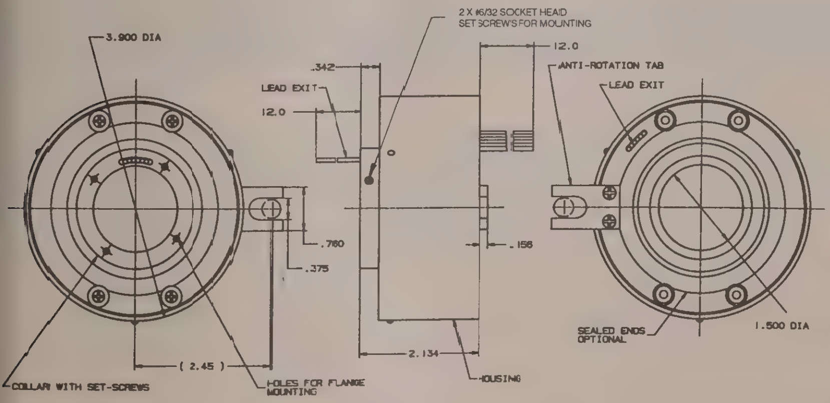


This device is compact and maintenance-free (no lubrication required) and is a standard design available with short delivery. Each slip ring assembly features Litton Poly-Scientific's patented fiber brush technology.* The fiber brush contact allows greater rotational speeds (up to 250 rpm**), while minimizing contact wear to extend operational life. Radial contact ball bearings are used for smooth, quiet operation. Precious metal-plated rings are used for enhanced conductivity and low electrical noise. Up to 24 circuits, in six circuit increments, provide system engineers with additional design flexibility. Available in either 5 Amp per circuit (AC4831) or 10 Amp per circuit (AC4598) versions.

The 1½" unobstructed bore through the center provides routing space for hydraulics, pneumatics, or for a concentric shaft mount. The frame, standard bearing, and cover are molded of high-impact, engineering thermoplastics.

General Specifications

- Radial contact ball bearings.
- Operating speed of 0-250 rpm continuous.**
- Contact Materials: rings - precious metal plated.
  brushes - fiber (multifilament silver alloy wire).
- Maximum voltage rating per circuit of 220 VRMS.
- Noise rating per circuit less than 100 milliohms peak.
- Standard lead wires are 12", premium 16 gauge, color-coded.
- Operating temperature 80°C max.



Part #	# of Circuits	Current Rating Per Circuit	Size - Diam. x Length
AC4598-6	6	max. 10A	3.9" x 2.2"
AC4598-12	12	max. 10A	3.9" x 3.1"
AC4598-18	18	max. 10A	3.9" x 4.1"
AC4598-24	24	max. 10A	3.9" x 5.0"
AC4831-6	6	max. 5A	3.9" x 2.2"
AC4831-12	12	max. 5A	3.9" x 3.1"
AC4831-18	18	max. 5A	3.9" x 4.1"
AC4831-24	24	max. 5A	3.9" x 5.0"

- *Continuous 360° rotation for transmission of power or data signals*
- *5A or 10A circuit models*
- *6, 12, 18 or 24 circuit assemblies available as standard parts*
- *Up to 250 rpm continuous***
- *Rugged design*

Examples of applications include machining centers, rotary index tables, heavy equipment turrets or cable reels, test equipment, packaging machines, palletizing machines, magnetic clutches, robotics, process equipment, rotary sensors and emergency lighting.

Standard Options

- 5.0" O.D. flange with 4 mounting holes *(slips over the collar for flange mounting).*
- Splash seals for dust and moisture resistance.

Custom Options - contact a sales engineer

- Various axial and radial lead exits.
- Higher rotational speeds with alternate bearings.
- Higher current capacity per circuit.
- Signal and power circuit combinations.

---

* U.S. patent #4398113 and other foreign patents.

** Sustained high speed operation will reduce overall, effective operational life.

Call ***800-336-2112*** for more information and a data sheet on our **Commercial slip ring assemblies**.

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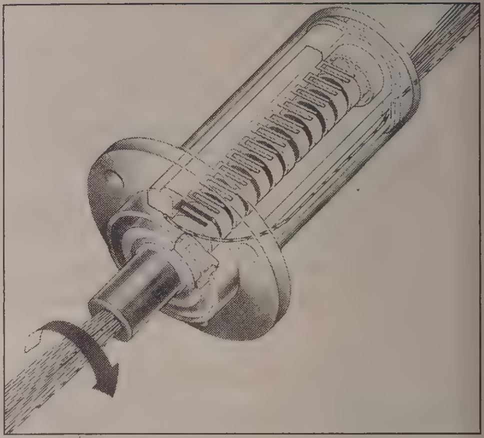
Commercial Slip Ring Assemblies

AC4023



The AC4023 was specifically designed to be a standard, off-the-shelf product for use in industrial and commercial applications. The size of the envelope is optimized for maximum economy.

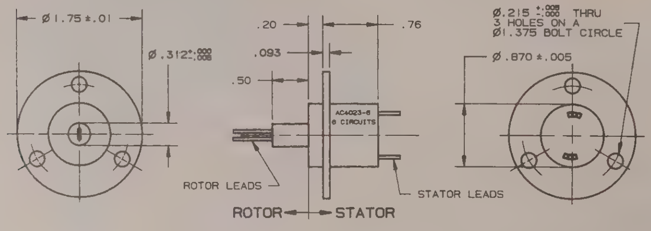
Available in four basic configurations, the capsules range from 1.46 to 2.90 inches in length and come with your choice of 6, 12, 18 or 24 two Amp/210 VDC circuits. The housing is made from tough, durable engineering thermoplastic. The use of precious metal contacts and precision ball bearings provides life that meets or exceeds the requirements for most industrial/commercial applications. Please note that the operational life of the unit is dependent upon rotational speed.

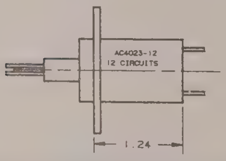
- *Continuous 360° rotation for transmission of power or data signals*
- *2 amp/210VDC circuits*
- *6, 12, 18 or 24 circuit models*
- *Up to 500 rpm**

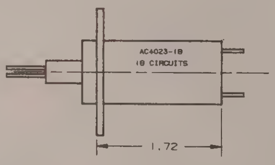
Examples of applications include CCTV pan/tilt camera mounts, manufacturing equipment such as indexing tables, robotics (end-effectors, arms, vision systems, sensors), and electrical test equipment.

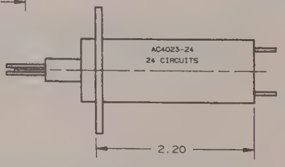
General Specifications

- Operating Speed of 500 rpm.*
- Contact Material - precious metal plated.
- Voltage rating range per circuit is low millivolts to 210 VDC.
- Electrical noise is < 20mΩ @ 5RPM, 6VDC, 50mA.
- Lead wires are 10", 26 gauge color-coded. 24" or 36" leads are optional.
- Operating temperature 80°C max.









Part Number	Number of Circuits	Current Rating per Circuit**	Dimensions		
			Barrel Diam.	Flange Diam.	Length
AC4023-6	6	max. 2A	.875"	1.75"	1.46"
AC4023-12	12	max. 2A	.875"	1.75"	1.94"
AC4023-18	18	max. 2A	.875"	1.75"	2.42"
AC4023-24	24	max. 2A	.875"	1.75"	2.90"

* Sustained high speed operation will reduce overall, effective operational life.
** Full current load of 2 amps per circuit for continuous use is not recommended.

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Slip Ring Products
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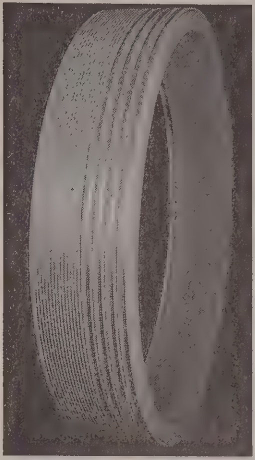
Large Industrial Slip Ring Assemblies

Utilizing a new fabrication process - a breakthrough in slip ring technology - we are able to offer an economical large slip ring that is mass producible. Using this new process, we can quickly install individual rings on a CNC-machined epoxy base. This operation can be done in an assembly-line fashion that eliminates dependence on time-intensive electro-forming processes, making these large slip rings quite economical.

Our patented fiber brush technology* minimizes contact wear and resultant debris while it extends operational life. The patented high frequency design provides excellent digital data transfer, even at a 50 megabit/second NRZ data rate.

We offer slip rings with an inside diameter up to 50", length up to 18" and rotation speeds up to 120 rpm. The length is dependent on the number of circuits and the power requirements.



- *Up to 20 signal circuits rated at 1 amp / 1000 VDC or VAC*
- *Up to 120 rpm*

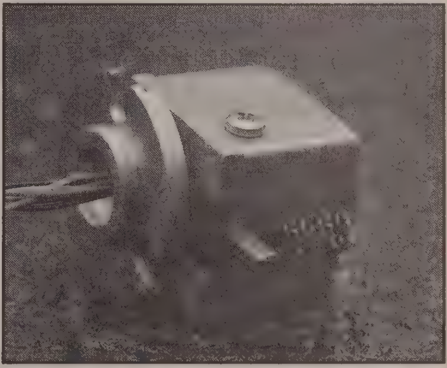
Examples of applications include slip rings for CT scanners, cranes, off-shore mooring, amusement rides, or any industrial application requiring a large diameter slip ring.

Miniature High Speed Slip Ring Capsules

EC3848

The EC3848 features precious metal contacts at the rotary interface. Flying lead wires on the rotating side and solder terminals on the stator side complete the electrical connections. Precision ball bearings and the patented fiber brush design* allow operation up to 10,000 rpm without the need for cooling equipment.

The capsule is available with up to 10 circuits rated at 1 amp, 100 VDC.



- *1 amp / 100VDC circuits*
- *10 circuits*
- *Up to 10,000 rpm*

Examples of applications include centrifuges and various high speed instrumentation applications such as tire testing.

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* U.S. patent #4398113 and other foreign patents.

Call ***800-336-2112*** for more information and a data sheet on our **Large and High Speed slip rings**.

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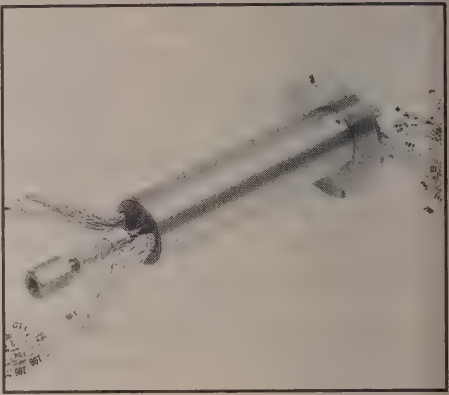
High Speed Slip Ring Capsules

For successful slip ring operations at or above several thousand RPM, important design and material changes must be incorporated. These changes address increased structural demands and frictional heating at the sliding contact surface.

Applications for high speed slip rings include centrifuges, aircraft turbine testing, gasoline or diesel engine testing and other high speed instrumentation applications.

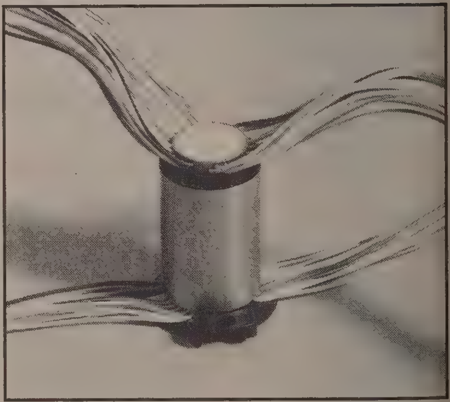


The following table presents a cross-section of selected Poly-Scientific high speed designs.

Number of Circuits	Part Number	Length	Diameter	Bore	Brush	Notes
28	3042	2.43	1.25	N/A	Gold	Liquid Cooled
28	3762	1.67	1.0	N/A	Gold Fiber Brush	Gas Cooled
36	3757	2.53	1.625	N/A	Gold Fiber Brush	Gas Cooled
40	1823	4.08	1.63	N/A	Composite	
64	4160	5.0	3.5	1.5	Gold Fiber Brush	
100	3057	6.40	1.5	N/A	Gold	Liquid Cooled
200	4064	10.0	2.25	N/A	Gold	Liquid Cooled
300	4075	11.75	2.28	N/A	Gold	Liquid Cooled

Miniature Low Speed Slip Rings

Miniature slip ring capsule assemblies address both critical space and weight limitations. These smallest of all slip ring assemblies are widely used in the pitch, roll and yaw axes of inertial navigation systems where there can be no sacrifice in reliability to achieve packaging density. Very tight pitch controls are maintained in individual ring locations with center-to-center spacings as small as 0.015 inch between adjacent rings. Miniature slip rings are available with 7-95 circuits. Some designs feature a through-bore. Poly-Scientific miniature slip ring assemblies are currently performing in Boeing's 747, Jaguar, F14, F15, F18, KC135, and the Cruise and Trident missile weapons systems. Existing designs for miniature slip rings are available, or they may be modified for your needs. We can also design a custom miniature slip ring.



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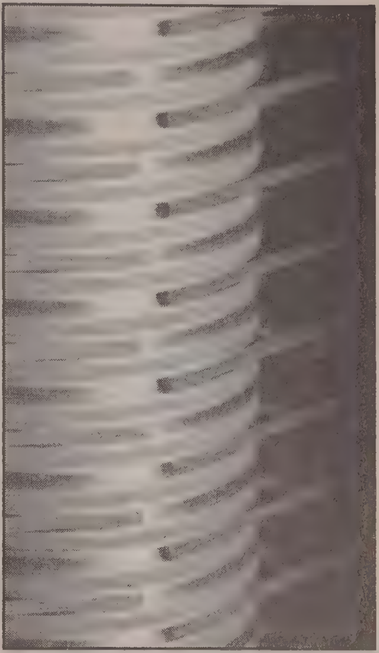
Space / Vacuum Slip Rings



Generally aerospace slip rings and brushes (sliding electrical contacts) are designed using traditional contact technologies such as lubricated monofilament wire brushes or self lubricating composite brushes. These traditional approaches have been proven successful many times through testing and actual flight experience.

An alternative to traditional aerospace slip ring contact designs is the use of Poly-Scientific's patented fiber brush contact design.* Fiber brush is the term for a patented design of sliding electrical contacts. Fiber brushes are simply a group of individual metals fibers (wires) that are collimated by and terminated into a metal tube. The free, unterminated end of the fiber brush bundle rides in a groove on the ring surface in the fashion of a paint brush. Ring groove geometry will differ depending on the required system parameters for the respective circuit (power transfer, signal transfer, etc.). The axial space consumed by each fiber brush circuit will depend on factors such as voltage and current ratings for the circuit, crosstalk isolation and capacitance limits.

Fiber brushes have several distinct advantages over conventional slip ring contacts:
- Multiple points of contact per brush bundle to provide low electrical noise.
- Low contact wear rates to provide long life.
- Low contact force per fiber to eliminate the need for lubrication.
- Ability to perform in ambient conditions as well as in vacuum conditions.

The following table compares three types of brush technology, all of which are used by Poly-Scientific depending upon system requirements.

Composite Brushes Ag/MoS$_2$/Graphite	**Monofilament Brushes** Lubricated	**Fiber Brushes** Unlubricated
Most flight history	Considerable flight history	Limited flight history
Meets outgassing requirements	Does not meet outgassing requirements	Meets outgassing requirements
Self lubricating contacts (solid lubricant in brushes)	Requires liquid lubricant on contact surface	No oil or dry film lubricant application required
Requires largest ring to ring axial pitch	Requires smallest axial pitch (50% of composite brush pitch)	Requires less axial pitch than composites (70% of composite brush pitch)
Manufacture subject to greatest number of process variables	Manufacture subject to few process variables	Manufacture subject to few process variables
Greatest amount of wear debris generation (approx. 100 times the wear rate of fiber or monofilament brushes)	Small amount of wear debris generation	Smaller amount of wear debris generation than monofilament brushes
High electrical noise if operated in humid environment	Low electrical noise in air and vacuum	Low electrical noise in air and vacuum
Must operate in vacuum or dry inert atmosphere	Operational in air or vacuum with lubricant present	Operational in air or vacuum
Wide operating temperature range	Viscosity limited operating temperature range	Wide operating temperature range
Wide range of surface speeds	Limited range of surface speeds	Wide range of surface speeds

Satellite systems using Poly-Scientific fiber brush slip rings include:

- *Olympus*
- *Intelsat Test Program*
- *Eurostar*
- *Inmarsat*
- *Orion*
- *Hispasat*
- *Telecom II*

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* U.S. patent #4398113 and other foreign patents.

Call ***800-336-2112*** for your copy of our ***"Getting Rid of Wear Debris... The Fiber Brush Solution"*** brochure, an engineering discussion of the merits of the fiber brush.

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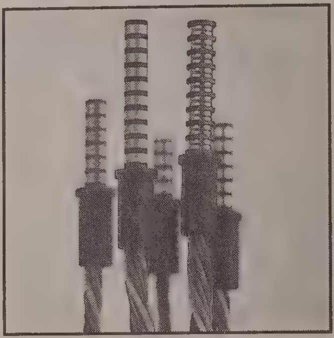
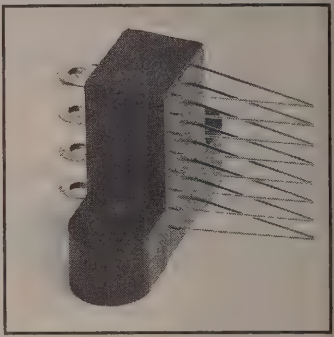
Slip Ring Separates

Sometimes a self-contained "capsule" slip ring is not practical due to system size constraints or cost limitations. We can provide the slip ring (rotor) and brush block (stator) as separate components to be mated by the customer in his system. The rotor can be supplied in either a drum or pancake configuration. The drum approach features consecutive individual rings along the axis of rotation. With the pancake approach, individual rings are positioned concentrically on a flat surface. Miniature separates may have slip ring rotor diameters less than 0.100 inch.





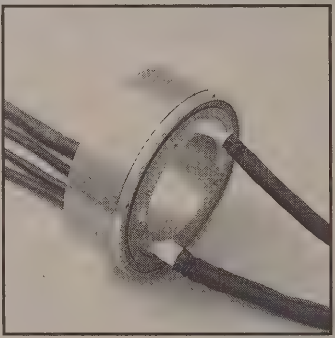
The following table presents a cross-section of selected Poly-Scientific separates designs.

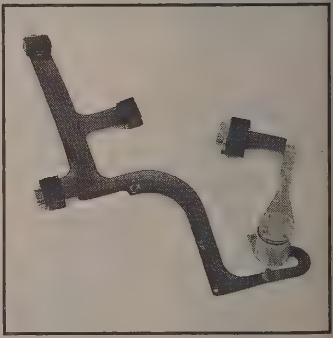
Number of Circuits	Mating Part Number	Brush Block	Ring O.D.	Back Ring Pitch	Back Shaft Diameter	Shaft Length	Flange Diameter	Special Features
1-10	2690	259	.081	.050	.125	.250	.150	FB, RB, P, VG, UG, S
1-12	4183	4184	1.320	.100	1.360	.375	N/A	.985 Bore
1-20	1202	262	.125	.050	.250	.375	.312	FB
1-37	2731	262	.220	.050	.250	.375	.312	RB, FB, VG, UG
3	2384	2981 2385	.067	.025	.071	.070	.115	Double V-Groove
5	3046-1	3046-2	.550	.060	.580	.640	.580	.376 Bore, RB, VG
6	3795	3416	.067	.025	.061	.125	.109	Double V-Grooves
8	1454	1455	.550	.060	.584	.640	.580	.376 Bore, RB, VG
19	2037	2038	1.860	.030	1.880	.685	1.880	1.500 Bore, VG

Abbreviations Used: FB - Flat Barrier VG - V-Groove RB - Raised Barrier UG - U-Groove P - Plastic Backshaft S - Stainless Steel Backshaft
Circuits 1-10 -- Option of having 1 through 10 circuits. Shaft lengths shown are for maximum number of rings (circuits).

Poly-Twist or Twist Capsules

The Poly-Twist is a reliable slip ring substitute for limited rotation applications, up to 1½ turns of rotational freedom. Sometimes called a twist-cap, this device resembles miniature slip ring assemblies in size and appearance and provides a self-contained, no-sliding contact rotary interface using flexible circuit tapes for those applications where continuous rotation is not required. We have designed and produced Poly-Twists with 14 to 1,920 circuits. Poly-Twists feature low torque, no noise and a very long performance life. Although the majority of applications for the thousands of units supplied to date have required miniature twist-cap assemblies, some very large designs have also been provided.





Applications include:

- *LANTIRN*
- *F18 FLIR*
- *Toronado*

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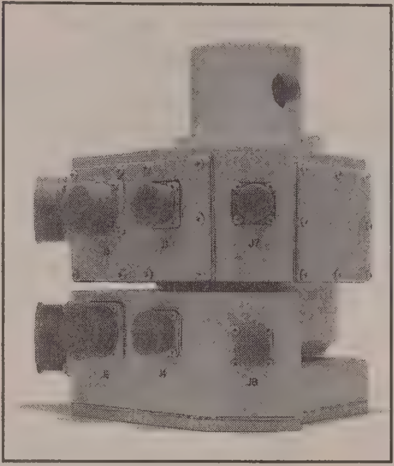
Vehicular Slip Rings

Electrical slip rings are used in vehicles such as tanks, retrievers, mobile missile launchers, and armored personnel carriers. A typical vehicle might contain slip rings in the turret, the commander station and the infrared sight. In each of these applications, slip rings have provided reliable signal and power coupling for the most rugged battlefield conditions.

In addition to producing compact slip rings for minimal space applications, we have provided units which combine conventional electrical slip rings with hydraulic joints to form electro-hydraulic slip rings, meeting pressure requirements of 3000 psi and flow rates of 30 gpm. Pneumatic couplings through slip rings for high or low pressure air transfer is another area where we can offer field-proven experience.



Current applications include:

- *M48 & M60 Tanks*
- *M2/M3 Bradley Fighting Vehicle*
- *LVT P7 Vehicle*
- *V150 Commando Vehicle*

The following table presents a cross-section of selected Poly-Scientific vehicular designs.

POWER				SIGNAL			
Part Number	**Number of Circuits**	**Cont. Current Rating**	**Voltage Rating**	**Number of Circuits**	**Gauge or Type**	**Intended Signal**	**Special Features**
2985	1 1	150A 150A	150V Peak Ground	12	Control	5A, 150V	
2993	1 1	150A 150A	150V Ground	24	Control	5A, 150V	
3489	1 1	150A 150A	Ground	80		5A	
3733	2	200A	24VDC	42	20 AWG	3A, 28VDC	CBR Air Channel
4231	13	2 @ 15A 2 @ 10A 2 @ 5A 6 @ 3A 1 @ 10A	150V Peak Ground	34 1	Control RG 179	2A, 150V 10MHz	6.5 Inch Bore

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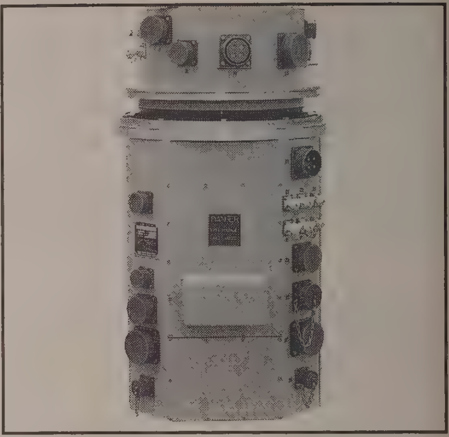
Pedestal Slip Rings

Typically found in radar, missile and gun fire control systems, pedestal slip rings contain varying combinations of logic, control, and high frequency analog signal and power circuits.

Our standard pedestal slip rings typically include shrouded compartments to minimize EMI, special provisions to reduce VSWR and crosstalk; removable cover plates for field servicing; rotary seals for protection from hostile environments; and clearance holes through the center of the slip ring for routing wave guides. Ruggedness, long life and the ability to operate in harsh environments are standard requirements for pedestal slip rings. These slip rings are usually custom designed to meet specific application requirements.

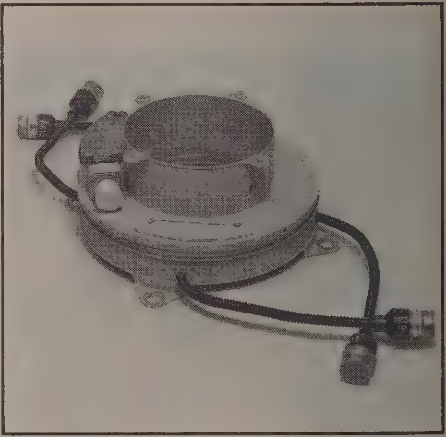


Applications include:
- *AWACS*
- *Aegis gun director*
- *MK 75 3" gun*
- *ASR 9 Radar*

Helicopter Slip Rings

Slip rings that power de-icing and blade folding systems must transfer high current levels to blade systems rotating at high speeds. Main rotor slip rings must also transfer signal level circuitry for control gauges mounted on the rotor blades. Most main rotor capsules incorporate angle sensing devices for proper blade folding or blade pitch control. They must also withstand vibration levels and environmental hazards typical of helicopter operation. The latest de-icing applications include both main and tail rotor slip rings, with main rotor current levels to 60 amperes and tail rotor speeds to 1,500 rpms.

Our slip rings meet stringent EMI requirements, and, in the case of the tail rotor slip ring assemblies, accommodate rotor misalignment while simultaneously operating in heavy rain conditions. These units are usually custom designed to meet specific application requirements.



Applications include:
- *Apache*
- *Blackhawk*
- *Seahawk*
- *V22 Osprey*

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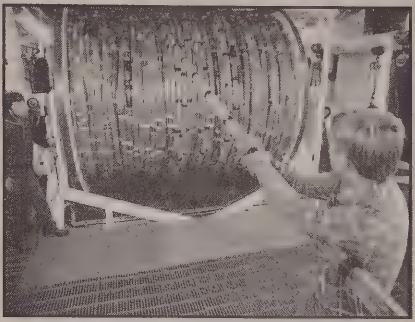
Special Slip Rings

Cable Reel Slip Rings



Cable reel slip rings can be found in a wide range of military and industrial applications including marine/seismic exploration, underwater towed vehicles, remote tele-operated vehicles, construction cranes and buoyant submarine antennas. These slip rings are designed for particularly rugged environments while also providing field accessibility of the brush block assemblies if repairs are necessary. With access plates in place, sealed bearings and integral gasketed connectors, the internal portion of the unit is well protected from environmental conditions. For many reel applications, our compact packaging allows the slip ring to be installed in the reel axle (inside diameter) to eliminate an obtrusive and damage-prone cantilever mount.

Mooring Slip Rings

Deep water oil production requires a slip ring that allows complete freedom to weathervane for floating power generation stations (SALM type installations). Experience to date in mooring applications include current to 600 amps, voltages to 35,000 volts (transmission of 36 megawatts of power) in sizes to 8 feet in diameter by 10 feet in length. One such unit has been operating continuously for 10 years in a petrochemical application off the coast of Santa Barbara, California.

Fiber Optic Rotary Joints *(FORJ)*

A Fiber Optic Rotary Joint is a device used to pass fiber optic signals from a stationary structure to a rotating mechanism in a fiber optic system. They provide the same unlimited rotational freedom for fiber optic systems that the slip ring provides for electrical systems. We offer several FORJs:

On-Axis Fiber Optic Rotary Joint

(On-Axis FORJ) FO3585

The On-Axis FORJ is a single channel device which has only one fiber. It is a totally passive device that is designed to provide a single optical path across a rotating interface. It occupies the centerline of axis of a rotating system, hence the term "on-axis". The device is fully bidirectional and will allow light transmission simultaneously in both directions.

Features

- Provides rotary coupling for multimode fiber links.
- Wide operating wavelength range for wavelength multiplexing.
- Completely bidirectional.
- Available in wide range of fiber sizes and pigtail lengths.
- Can be integrated into existing slip ring designs.

Applications include:

- *Cable reels*
- *Medical systems*
- *Two axis milling machines*

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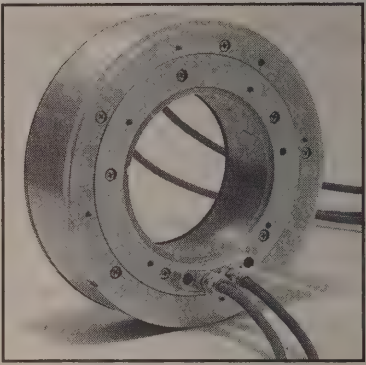
Fiber Optic Rotary Joints *(FORJ)* continued

Off-Axis Fiber Optic Rotary Joint

(Off-Axis FORJ) FO3595



The Off-Axis FORJ is a multi-channel device which contains a 4 inch bore along the axis. The design is rugged and environmentally sealed. The unit is available with 1 to 6 bidirectional optical channels. Designs are also available with integrated slip rings for electrical signals. Due to the optical design, the unit must be ordered with specially designed transmitters, receivers, and repeaters.

Features

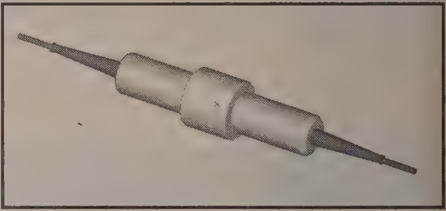
- Provides rotary coupling for multimode fiber links.
- Completely bidirectional.
- The unit may be hard mounted to either the inner or outer housing and soft mounted or derotated on the opposite housing using the built in features.

Applications include:

- *Computerized pipe bending*
- *Marine propulsion system*
- *Four axis milling machines*
- *Industrial and military*

Singlemode Fiber Optic Rotary Joint

(SMORJ) FO3588-1



Provides rotary coupling for singlemode fiber links and offers a wide operating wavelength range for wavelength multiplexing.

Features

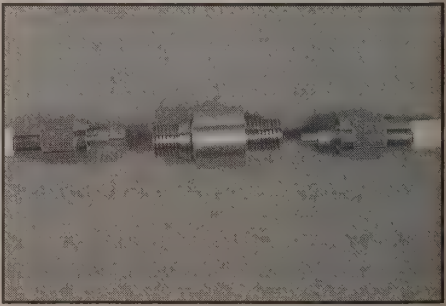
- High bandwidth for multi-gigahertz operation.
- Completely bidirectional.
- May be combined with existing slip ring designs.

Applications include:

- *Tethered robotic vehicles*
- *Towed array*
- *Aircraft antenna*

Low Cost Fiber Optic Rotary Joint

(Low Cost FORJ) FO4698



A low cost alternative to the FO3585 On Axis FORJ, this device features a smaller package design.

The units are designed for easy hook up to 906 SMA or ST style fiber optic cable assemblies. The units are not intended for the harsh environments of the FO3585 On-Axis FORJ.

Features

- Provides rotary coupling for multimode fiber link.
- No collimating lens required.
- Quick and easy hook-up to ST or SMA connectors.
- Completely bidirectional.

Applications include:

- *Security Systems*
- *Medical Systems*
- *Other clean environments*

Call ***800-336-2112*** for a copy of our ***Fiber Optic Rotary Joints Application Notes***, a paper that describes our FORJs and multiplexing systems.

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How to Specify a Slip Ring

Many of the more than 4,000 Poly-Scientific slip ring designs are available for use in their existing configuration, or they may be modified to meet your specific requirements. New designs can also be created to meet the most demanding specifications.

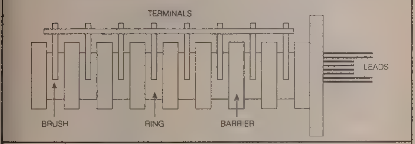
Our engineers are experienced in a wide range of slip ring applications. We utilize resources such as the Anvil computer-aided design (CAD) system. And, a very active in-house quality circle program solicits the best inputs from all of our many skilled craftspeople, from start to finish.

This section is designed to guide you through the process of specifying a slip ring. We've outlined below the major considerations that a slip ring engineer will need to know about your application.

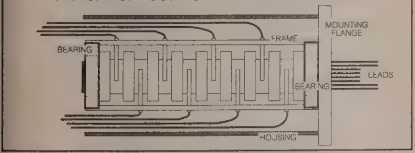
Basic Slip Ring Design

Throughout these pages, you will see the terms "slip ring capsule" and "slip ring separates". The term "separate" indicates an individual rotor/brush block combination. The term "capsule" is used to denote a self-contained unit consisting of a rotor, stator and its own integral ball bearings.

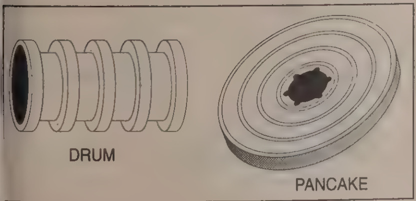
SEPARATE BRUSH BLOCK AND ROTOR



TYPICAL CAPSULE SLIP RING ASSEMBLY



There are two basic slip ring configurations to consider based on space allocation in your system: the more common drum approach where each ring is adjacent to the next along the centerline, somewhat like the threads on a bolt, and the pancake approach where the rings are concentric with one another like the grooves on a phonograph record. The pancake approach is used when length is at a premium but diameter is less restrictive.



Defining the Mechanical Envelope

The envelope is, of course, largely dictated by the space available in the system. The slip ring engineer should be given the maximum space available in the system so all existing candidate designs can be considered. It is imperative that the space required for the slip ring be specified in the early stages of the system design and that it be consistent with the structural and electrical demands.

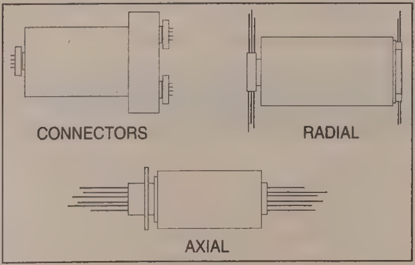
Defining System Interface Requirements

The slip ring engineer will need to know these system interface considerations:

1. Is a bore required through the slip ring for routing coolant plumbing, hydraulic lines, pneumatic lines, waveguides, etc? In such applications, the slip ring actually mounts concentric with these lines in the system.

2. How will the slip ring attach to the system? It is never advisable to hard mount both the rotor and the stator to the system since the slip ring bearings may overload if there is any misalignment between them and the system bearings.

3. How should the electrical connections to the slip ring be made? Is it desirable to have connectors integral with the slip ring on both the rotor and stator, or would flying leads on one or the other ends be desirable? And if flying leads are preferred, should they exit the rotor in a radial or axial direction, and what length should the leads be?



Defining Electrical Requirements

The current specified enables the slip ring engineer to propose a unit with the appropriate cross-sectional area of the rings, brushes and lead wires. The specified voltage dictates the spacing between adjacent rings and brushes. It is helpful in achieving the most cost effective and smallest practical envelope not to rate all circuits at the maximum level. For example, if you need 20 circuits total, three of which must carry ten amps, designate three for high current. Don't go for 100% functional interchangeability by specifying that all 20 be able to carry ten amps. And, if the ten amps is a surge current with a continuous current of only two amps, tell us that, too. There is no reason for you to pay for ten amps continuous capacity when you only need two.

Be aware that voltage surges and spikes are the major cause of system slip ring failures. Poly-Scientific uses a very conservative approach to circuit design, however, it is not uncommon in some power supply systems to see voltage spikes ten or more times the normal operating voltage. We strongly recommend surge protection on all power supplies.

Most smaller slip rings will satisfactorily conduct signals to 1 MHz or 500 Kilobits. Special slip rings can be used to pass broadband signals from dc to 1 gigahertz and data rates of 500 megabits or even higher. Cross-talk, insertion loss and bit error rate information can be provided if data rates, formats and impedances are defined.

Defining Mechanical Requirements

1. Operating speed (rpm's). Almost any slip ring can operate successfully at speeds to 100 RPM although many applications only require operation at a few rpm. But slip rings are also routinely used to instrument jet turbine engines operating at speeds in excess of 20,000 RPM. The operating speed in conjunction with the diameter dictates the surface speed of the brush relative to the ring and hence the internal design approach and material selection.

2. What rotational life is necessary for your application? Will the unit oscillate or rotate at a continuous speed?

Defining the Environment

The environment in which the slip ring must survive is a key factor. Operating temperature is important in specifying the proper lubricant. And if the slip ring will operate exposed to the elements or to a hostile environment, integral seals must be included in the design. Any unusual shock or vibration should also be specified.

Many of the designs and manufacturing processes described in these pages are proprietary and are covered under one or more U.S., European or Japanese patents. Poly-Twist is a registered trademark of Litton Poly-Scientific. The information provided in these pages is intended to assist the system engineer in initial discussions and is not intended as a specification.

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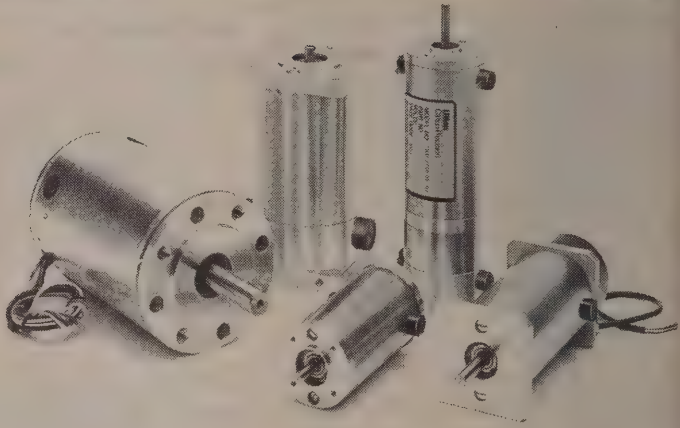
DC Motors

Permanent Magnet DC Motors

2" to 4" Diameter - With Integral Feedback



Magnets: Ceramic, for high coercivity
Insulation: Class F, 155°C
Bearings: Double shielded, permanently lubricated
Shafts: Carbon steel, in custom configurations
Brushes: Replaceable, long life
Endcaps: Custom mounting configurations

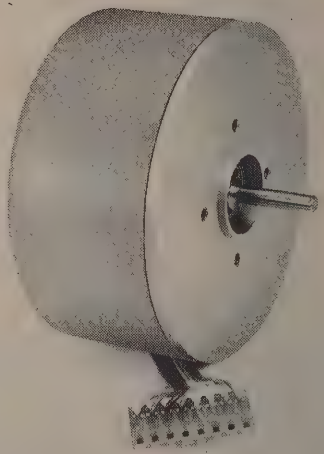
Litton Clifton Precision offers a complete line of 2" to 4" diameter permanent magnet motors, available with integral feedback devices for closed-loop control.

Optional pre-aligned encoders and rugged brushless resolvers provide accurate positioning and displacement feedback. Integrally mounted tachometers are available on the 2¼" diameter motors.

The permanent magnet motors offer continuous torques from 10 to 560 oz-in, peak torques from 90 to 3500 oz-in, and lengths from 3 to 9 inches. They have extended-life brushes; double-shielded, permanently lubricated bearings; and stainless steel shafts.

Brushless DC Motors

for high-torque applications
BOH-3500 series

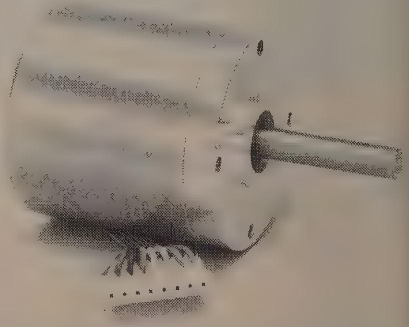


The powerful BOH-3500 series motors are well-suited to continuous use, with a brushless design that generates very low noise and heat, while ensuring long life and a wide degree of speed control. Designed to achieve high operating efficiencies, these maintenance-free DC motors are an ideal choice for virtually any prime mover requirements.

These motors feature outside rotor construction which provides the benefits of low cost, ease of manufacturing, and high output power for continuous speed applications. Typical motors in this series are 3.74 inches in diameter and less than 2 inches in length. Magnet options range from bonded ferrites to bonded rare-earth material which provide continuous torque ranges from 30 oz-in to 80 oz-in. Other standard features include low-loss M19 silicon steel laminations, stainless steel shafts, and die-cast aluminum housings.

Brushless DC Motors

for extremely reliable, controlled high-speed, continuous operation
BOH–1600 Series



These motors are designed for use in high-speed, continuous operation applications where they operate with low noise levels, low heat, and high reliability. Electronic commutation ensures exceptionally long life and speed control over a broad range.

A typical motor in this series features a diameter of 1.75 inches and a length of 1.8 inches. It incorporates sintered ferrite magnets and delivers up to 8.5 oz-in of continuous torque. Typical no-load speeds range from 1000 to 20,000 rpm. Precision ball bearings and stainless steel shafts are standard. Options include integral drive electronics which allow these motors to directly replace brush type dc motors.

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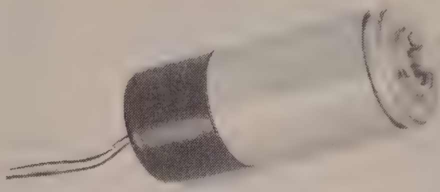
Digital Resolver

Model DRBB-11-AA-01AA
DC Input/Digital Output

FEATURES

- ○ Size 11 heavy-duty brushless resolver
- ○ Totally digital input/output
- ○ Absolute position data output
- ○ Incremental encoder with A Quad B and North Marker outputs
- ○ 12-bit resolution standard
- ○ Maximum system error of ±15 arc minutes
- ○ High readout rate
- ○ Mechanical modifications to order



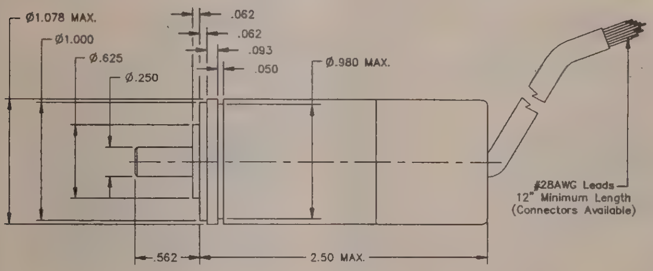
Litton's new digital resolver was designed for rugged OEM applications where reliability, size, system cost, data transmission and simple interface with computers are prime considerations. The resolver is an absolute position sensor based upon proven resolver technology, but transformed through combination with new semiconductor technology. The result is a universal device for the measurement of mechanical rotation with outstanding accuracy even in hostile environments. Brushless resolvers are superior to encoders in terms of ruggedness, accuracy, and resolution. Resolvers have low sensitivity to variations in voltage and perform efficiently under temperature extremes, humidity, shock and vibration.

Model DRBB-11-AA-01AA requires five inputs* and provides four outputs, all of which are TTL compatible. This unit can be used with a differential line driver/receiver for high ambient noise and long distance data transmission applications.

Applications include:

- *Position & velocity sensing*
- *Brushless dc servo communication*
- *Robotics & factory automation*
- *CNC machine tools*
- *Material handling*
- *Medical devices*

TYPICAL OUTLINE DRAWING



Lead Connections

Input		Output		Optional	
+5VDC	Red	Red/Wht	DATA	Red/Grn	VEL
−5VDC	Yel	Yel/Wht	A	Blk/Grn	DIR
GND	Blk	Blu/Wht	B	Yel/Grn	NMC
$\overline{CS}$	Grn	Blk/Wht	NM	Blu/Grn	CLKOUT
SCLK	Blu				

---

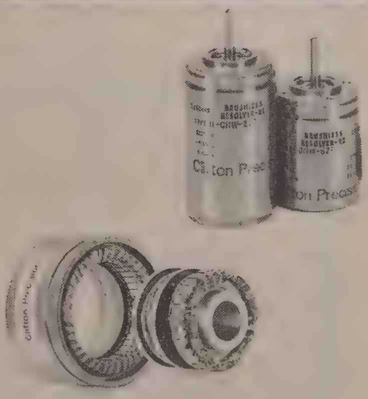
* Not required for incremental encoder outputs.

Brushless Resolvers

Brushless resolvers are economical, highly accurate motion feedback sensors that can be used to provide position and velocity information for closed-loop control, as well as brushless DC motor commutation. They contain no internal electronics or optics, and are unaffected by heat, electrical noise, shock, and vibration.

Clifton's Size 11 housed and Size 15 and 21 pancake brushless resolvers feature a compact size, high accuracy and exceptional reliability which makes them an ideal choice for absolute position measurement in a wide range of industrial and medical equipment. Coupled to A/D converters, they provide a digital interface to computerized motion control systems.

Accuracies of ±7 minutes for the Size 11, and ±15 minutes for the Size 15 and 21 pancake designs are standard. Multispeed windings, higher accuracies, and custom modifications are available.



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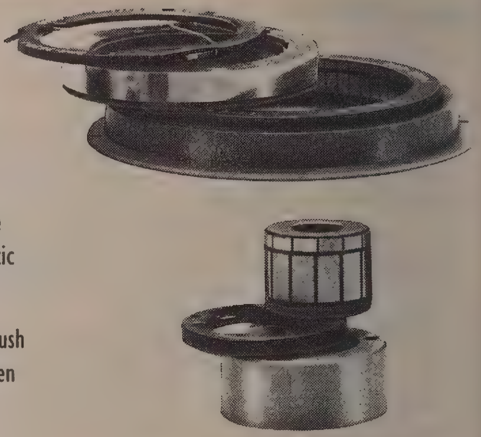
Torque Motors

FEATURES

○ Torques from 6 oz-in to 1000 lb ft.
○ 1.1 inches 40 inch O.D.
○ Precision tolerances
○ Gold commutators
○ High reliability



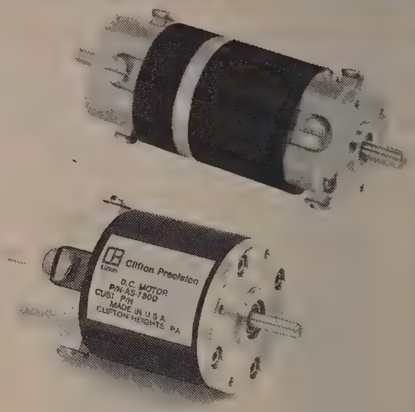
Clifton Torque motors feature double insulated high temperature magnet wire to minimize le current and promote superior insulation. Our molded brush block assembly has interchangeable brush blocks, optimizing brush position on the commutator. Brush contour is done on automatic tooling rather than "run-in" individually.

Brushes are mechanically fastened to the brush spring in addition to soldering to assure top brush alignment during soldering operation plus establish a fine mechanical and electrical bond between spring and brush.

Miniature High-torque, DC Servo Motors

FEATURES

○ High torque-to-inertia ratio
○ Up to 50 oz-in peak starting torque
○ AS-780D highly resistant to demagnetization
○ Low cost
○ Weighs only 6.8 oz
○ Samarium cobalt or Alnico magnets
○ Encoder and tachometer packages
○ Custom modifications



The series AS-780D samarium cobalt servomotors provide fast response and high starting torque, but are priced significantly less than comparable samarium cobalt motors. They offer high coercivity and high flux density for greater mechanical output.

Samarium cobalt motors are lightweight, yet highly reliable. They will not demagnetize under severe conditions.

The series AS-718D Alnico motors are an economical alternative for less demanding applications.

Custom-modified shaft designs, mounting configurations, speed variations, and input drive voltages are available. Consult our engineering department to help you develop a motor that is tailored to your application.

Applications include:

- *Robotics & factory automation*
- *Medical equipment*
- *Process control equipment*
- *Computer peripherals & office equipment*
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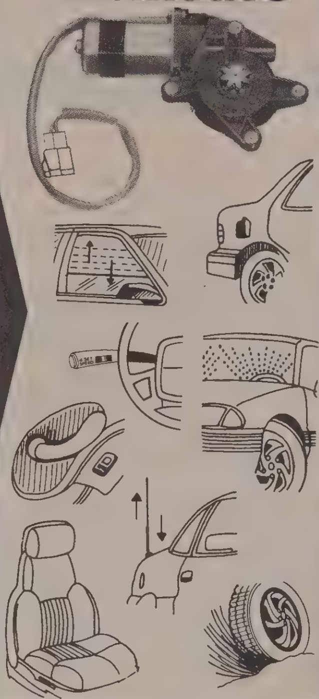
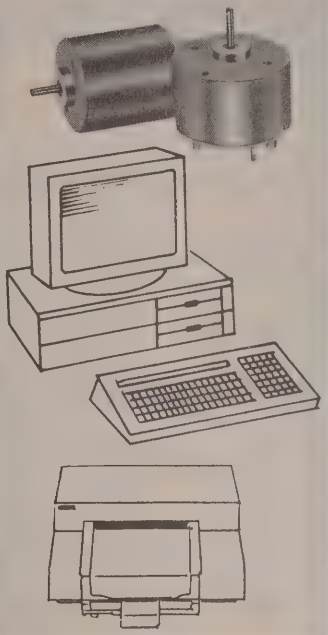
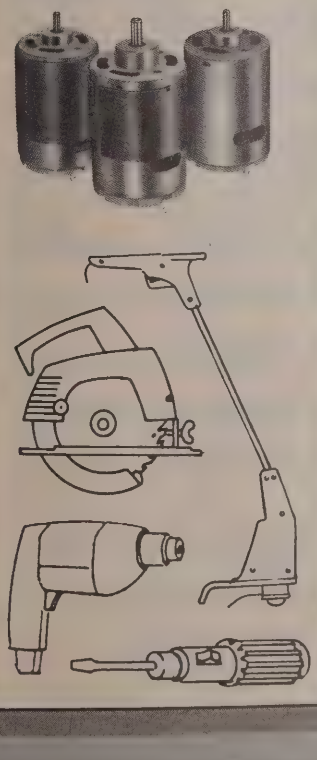
in automotive



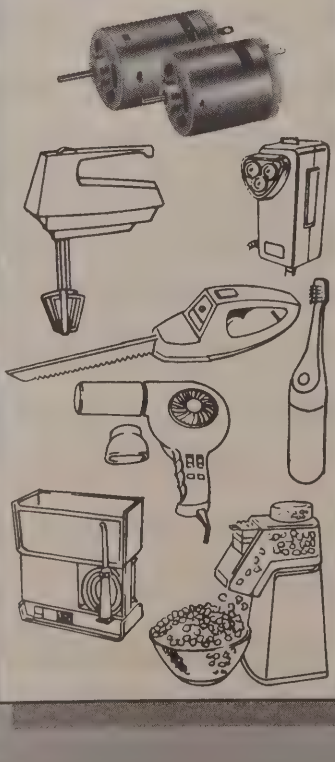
in computer related



in power tools



in appliances



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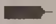
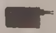
- ■ Originators of Skew-Wound Coreless Micromotors.
- ■ Patented and Licensed the World Over.

MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	(in)	OVERALL LENGTH (mm)	(in)	CONT. MA.X. POWER OUTPUT (W)	MAX.CONT. TORQUE (oz.-in)	RECOMMENDED MAX SPEED (RPM)
	1016 FITS GEARHEAD SERIES 10/1, & 12/3	10	(.39)	16	(.63)	0.45	.07	13,000
	1212 FITS GEARHEAD SERIES 12/3, & 10/1	12	(.47)	12.2	(.48)	0.1	.01	15,000
	1219 FITS GEARHEAD SERIES 12/3, & 10/1	12	(.47)	18.7	(.74)	0.45	.11	12,000
	1319 FITS GEARHEAD SERIES 14/1, 15/1, 15/2,15/3, & 15/5	13	(.51)	19	(.75)	0.9	.17	12,000
	1331 FITS GEARHEAD SERIES 14/1,15/5 & 15/8	13	(.51)	31.2	(1.23)	2.0	.36	12,000
	1516 FITS GEARHEAD SERIES 15/1, 15/2,15/3,15/5,15/8, & 16A	15	(.59)	15.8	(.62)	0.3	.07	12,000
	1524 FITS GEARHEAD SERIES15/1, 15/2, 15/3,15/5, 15/8, & 16A	15	(.59)	23.8	(.94)	0.6	.14	12,000
	1616 FITS GEARHEAD SERIES 16/2,16/3,16/5,16/7,16/8, & 16A	16	(.63)	15.8	(.62)	0.45	.11	12,000
	1624 FITS GEARHEAD SERIES 16/2,16/3,16/5,16/7,16/8, & 16A	16	(.63)	23.8	(.94)	0.9	.21	12,000
	1717 FITS GEARHEAD SERIES 16A & 16/7	17	(.67)	17	(.67)	1.8	.20	13,000
	1724 FITS GEARHEAD SERIES 16A & 16/7	17	(.67)	24	(.95)	2.2	.28	8,000
	2017	20	(.79)	17.2	(.68)	0.45	.11	12,000
	2025	20	(.79)	24.8	(.98)	0.9	.21	8,000
	2225 FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG	22	(.87)	24.8	(.98)	1.0	.28	8,000
	2230 FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG	22	(.87)	30.0	(1.18)	2.0	.36	8,000
	2233 FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1, & 34PG	22	(.87)	32.8	(1.29)	2.0	.43	8,000
	2338 FITS GEARHEAD SERIES 23/1, 30/1, 32PG, & 34PG	23	(.91)	37.6	(1.48)	3.5	.85	8,000
	2842 FITS GEARHEAD SERIES 23/1, 30/1, 32PG, 34PG, 38/1, & 38/2	28	(1.10)	42.0	(1.65)	6.0	2.80	5,000
	3540 FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2	35	(1.38)	40.0	(1.57)	10.0	3.55	5,000
	3557 FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2	35	(1.38)	57.0	(2.24)	15.0	6.38	5,000
	3557...CS FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2	35	(1.38)	57.0	(2.24)	25.0	7.09	5,000
	3557...CR FITS GEARHEAD SERIES 30/1, 32PG, 34PG, 38/1, & 38/2	35	(1.38)	57.0	(2.24)	50.0	8.50	5,000
GEARMOTORS								
	2020	20	(.79)	20.0	(.79)	0.4	.21 to 1.42	200 to 3,000
	2034	20	(.79)	33.3	(1.31)	0.8	.43 to 1.42	500 to 2,000

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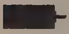
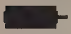
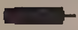
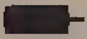
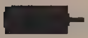
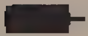
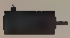
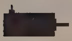
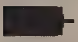
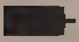
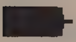
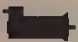
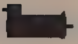
- Control Systems
- Shaft Couplings
- Precision Gearheads
- Motor-Tachometers

MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER		OVERALL LENGTH		CONT. MA.X. POWER OUTPUT	MAX.CONT. TORQUE	RECOMMEND MAX SPEED
		(mm)	(in)	(mm)	(in)	(W)	(oz.-in)	(RPM)
	GNM 2130	34	(1.34)	94	(3.70)	8.0	1.81	6,000
	FITS GEARHEAD SERIES G4, G4A, & G5							
	GNM 2145	34	(1.34)	110	(4.33)	12.0	2.70	6,000
	FITS GEARHEAD SERIES G1.1, G4, G4A, & G5							
	GNM 2636	45	(1.77)	98	(3.86)	22.0	13.14	4,000
	FITS GEARHEAD SERIES G1.2, & G12.1							
	GNM 2670	45	(1.77)	142	(5.59)	40.0	21.72	4,000
	FITS GEARHEAD SERIES G13.1							
	GNM 3125	55	(2.17)	126.5	(4.98)	30.0	15.07	4,000
	FITS GEARHEAD SERIES G24							
	GNM 3150	55	(2.17)	126.5	(4.98)	55.0	27.65	4,000
	FITS GEARHEAD SERIES G2.6							
	GNM 3175	55	(2.17)	126.5	(4.98)	75.0	37.74	4,000
	FITS GEARHEAD SERIES G11.1							
	GNM 4125	70	(2.76)	118	(4.65)	45.0	32.71	3,000
	FITS GEARHEAD SERIES G8N							
	GNM 4150	70	(2.76)	143	(5.63)	75.0	52.67	3,000
	FITS GEARHEAD SERIES G11.2							
	GNM 4175	70	(2.76)	168	(6.61)	100	79.01	3,000
	GNM 5440	83	(3.27)	166.5	(6.56)	125	79.37	3,000
	FITS GEARHEAD SERIES G3.1, & G6.1							
	GNM 5480	83	(3.27)	206.5	(8.13)	210	149.53	3,000
	FITS GEARHEAD SERIES G6.1, G40.1							
	GNM 6250	100	(3.94)	193	(7.60)	250	133.00	3,000
	GNM 62100	100	(3.94)	243	(9.57)	450	225.00	3,000
	FITS GEARHEAD SERIES G40.1							
	GNM 7045	120	(4.72)	202	(7.95)	175	177.87	3,000
	GNM 7085	120	(4.72)	256	(10.08)	300	295.16	3,000
	GNM 70130	120	(4.72)	313	(12.32)	430	414.88	3,000
	FITS GEARHEAD SERIES G50.1							

- Available with Integral Brakes, AC/DC Tachs, and Optical & Magnetic Encoders.
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POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	(in)	SHAFT DIAMETER (mm)	(in)	RATIOS FROM TO	MAX.CONT. TORQUE (oz.-in)	INTER-MITTENT TORQUE (oz-in)
GEARHEADS								
	10/1	10	(.394)	2	(.079)	4:1 - 1024:1	≤ 14.00	≤ 28.3
		FITS MOTOR SERIES 1016, 1212, & 1219						
	12/3	12	(.472)	2	(.079)	9.17:1 - 164,368:1	≤ 5.6	≤ 14.1
		FITS MOTOR SERIES 1212,1219, & 1016						
	14/1	14	(.551)	3	(.118)	3.71:1-5647:1	≤ 42	≤ 63.0
		FITS MOTOR SERIES 1319,1331						
	15/1	17	(.669)	2	(.079)	11.8:1- 5752:1	≤ 2.8	≤ 7.1
		FITS MOTOR SERIES 1516, & 1524						
	15/2	16	(.630)	2	(.079)	3.45:1- 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524						
	15/3	16	(.630)	2	(.079)	6.3:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524						
	15/5	16	(.630)	3	(.118)	6.3:1- 235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1331, 1516, & 1524						
	15/6	16	(.630)	3	(.118)	6.3:1- 235,067:1	≤ 7	≤ 21
		FITS MOTOR SERIES 1319, 1331, 1516, & 1524						
	15/8	16	(.630)	3	(.118)	22:1- 1670:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1516, 1524, & 1331						
	16A	16	(.630)	2	(.079)	11.8:1 - 5752:1	≤ 7.1	≤ 14.2
		FITS MOTOR SERIES 1516, 1524, 1616, 1624, 1717, & 1724						
	16/2	17	(.669)	2	(.079)	3.45:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, & 1624						
	16/3	17	(.669)	2	(.079)	6.3:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, 1624						
	16/5	17	(.669)	3	(.118)	6.3:1 - 235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1616,1624						
	16/6	17	(.669)	3	(.118)	6.3:1-235,067:1	≤ 7	≤ 21
		FITS MOTOR SERIES 1616,1624						
	16/7	16	(.630)	3	(.118)	3.71:1-5647:1	≤ 42	≤ 64.0
		FITS MOTOR SERIES 1616,1624,1717,1724						
	16/8	17	(.669)	3	(.118)	22:1 - 1670:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1616, 1624						
	22B	24	(.945)	4	(.157)	9:1 - 2187:1	≤ 14.2	≤ 56.6
		FITS MOTOR SERIES 2225, 2230, & 2233						
	22/2	23.8	(.937)	4	(.157)	3.1:1 - 983,447:1	≤ 14.2	≤ 56.7
		FITS MOTOR SERIES 2225, 2230, & 2233						
	22/5	23.8	(.937)	4	(.157)	29.6:1-2050:1	≤ 14.2	≤ 56.7
		FITS MOTOR SERIES 2225, 2230, & 2233						
	23/1	23	(.906)	6	(.236)	3.71:1-1526:1	≤ 100	≤ 141.6
		FITS MOTOR SERIES 2225, 2230, 2233, 2338, 2444, & 2842						
	30/1	30	(1.18)	8	(.31)	3.71:1-1526:1	≤ 640	≤ 850
		FITS MOTOR SERIES 2338, 2444, 2842, 3540, & 3557						
	32PG	32	(1.26)	6	(.236)	4:1 - 2076:1	≤ 640	≤ 850
		FITS MOTOR SERIES 2338, 2444, 2842, 3540, & 3557						
	34PG	34	(1.339)	8	(.315)	12:1 - 54880:1	≤ 710	≤ 710
		FITS MOTOR SERIES 2233, 2338, 3540, & 3557						

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- Zero Back-Lash Gearing on Selected Models.

GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	OUTSIDE DIAMETER (in)	SHAFT DIAMETER (mm)	SHAFT DIAMETER (in)	RATIOS FROM TO	MAX.CONT. TORQUE (oz.-in)	INTER-MITTENT TORQUE (oz-in)
	38/1 & 38/2 FITS MOTOR SERIES 2842, 3540 & 3557	38	(1.60)	8	(.315)	14:1 - 1526:1	≤ 1,416	≤ 2,124
	G1.1 FITS MOTOR SERIES GNM 2145	—		6	(.236)	7.3:1 - 38:1	≤ 92	≤ 283.2
	G1.2 FITS MOTOR SERIES GNM 2636	—		8	(.315)	7.3:1- 38:1	≤ 155.7	≤ 283.2
	G2.6 FITS MOTOR SERIES GNM 3150	—		10	(.394)	4.8:1 - 36:1	≤ 424.8	≤ 1132.8
	G3.1 FITS MOTOR SERIES GNM 5440	—		12	(.472)	5.6:1-35:1	≤ 877.9	≤ 1,840.8
	G4 FITS MOTOR SERIES GNM 2130 & 2145	—		8	(.315)	15:1 - 43740:1	≤ 339.8	≤ 424.8
	G4A FITS MOTOR SERIES GNM 2130, & 2145	—		8	(.315)	60:1 - 9720:1	≤ 453.1	≤ 566.4
	G5 FITS MOTOR SERIES GNM 2130, & 2145	34	(1.34)	8	(.315)	30:1 - 54880:1	≤ 710	≤ 710
	G6.1 FITS MOTOR SERIES GNM 5440, & 5480	83	(3.27)	20	(.787)	8:1-185.7:1	≤ 7,080	≤ 18,408
	G8N FITS MOTOR SERIES GNM 4125	—		12	(.472)	15:1-405:1	≤ 2,832	≤ 2,832
	G11.1 FITS MOTOR SERIES GNM 3175	56	(2.21)	14	(.551)	8.3:1- 242.9:1	≤ 3,115	≤ 4,248
	G11.2 FITS MOTOR SERIES GNM 4150	56	(2.21)	14	(.551)	8.3:1-242.9:1	≤ 3,115	≤ 4,248
	G12.1 FITS MOTOR SERIES GNM 2636	—		10	(.394)	10:1 - 810:1	≤ 708	≤ 1,133
	G13.1 FITS MOTOR SERIES GNM 2670	45	(1.77)	12	(.472)	5.5:1 - 220:1	≤ 2,195	≤ 2,832
	G24 FITS MOTOR SERIES GNM 3125	—		10	(.394)	15:1- 540:1	≤ 1,416	≤ 1,699
	G40.1 FITS MOTOR SERIES GNM 5480 & 62100	—		15	(.591)	10:1- 56:1	≤ 3,540	≤ 9,912
	G50.1 FITS MOTOR SERIES GNM 70130	—		20	(.787)	10:1-40:1	≤ 5,310	≤ 14,160

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Brushless NEMA 23 and 34 frame size servo motors replace stepper and DC brush motors. Advantages of these MFM brushless servo motors:

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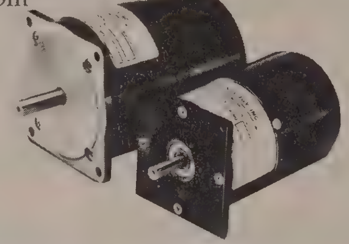
* instantaneous linear acceleration
* full torque to 6,000 rpm
* no resonance effects
* cool operation

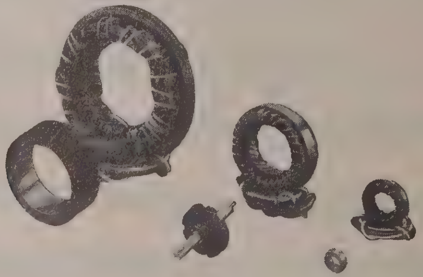


Using samarium-cobalt magnets, MFM brushless DC motors are available in 10 frame sizes from 1.25 inch through 10.0 inch diameter with peak torque ratings from 13.5 oz-in. to 4500 lb-in.

Modular motor components are matched to provide optimum performance using many standard rotor configurations.

No cogging!

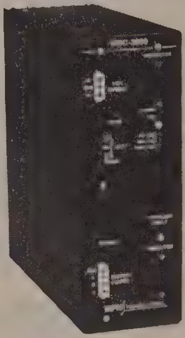
Unhoused motors are supplied as kits for better performance and cost savings for direct mounting onto the driven shaft. Eliminate performance-reducing effects of conventional couplings, belts, or pulleys. Choice of Hall sensor, optical encoder, or resolver commutation. No cogging!



Servo *Master* is a complete brushless servo system consisting of a programmable motion controller, power supply, brushless servo amplifiers, and brushless DC motors with shaft encoder feedback.

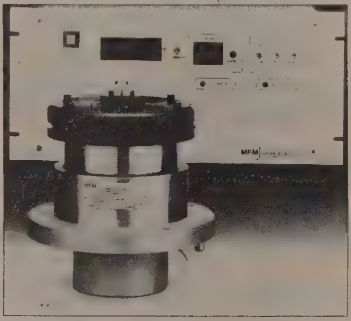
This system provides closed loop control of up to three axes, and makes possible micropositioning of mechanical stages, combined with high speeds.

Model BDC 2000 is a four quadrant sine-wave PWM brushless motor drive. Output bus rating is 160 Volt at 8.0 Amp. Velocity or current loop control accepts a ±10 volt analog command signal. Resolver-to-digital conversion provides electronic commutation, absolute shaft position, and velocity control.



Emulated channel A, B and index encoder output is provided for use with a motion controller. Other models offer power ratings to match a broad range of motor speed and torque requirements.

Precision air or ball-bearing spindles with embedded brushless DC motors are available with micro-inch shaft run-out tolerances.
Model BDC 0550 linear sine-wave drive offers programmable acceleration/deceleration, virtually no EMI/RFI, closed loop servo control and IEEE-488 or RS-232C digital interface.
Speed accuracy > .001% with smooth speed from less than 1 rpm to more than 15,000 rpm.



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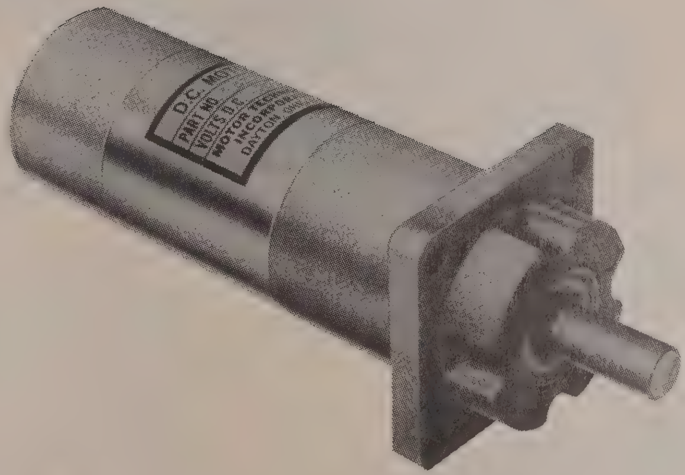
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At Motor Technology we solve most applications over the phone lines.

Your call to us goes straight to a competent motor application engineer, never to a clerk, correspondent or some other non-technical person. You discuss your project with a highly qualified engineer who is experienced with motors—motor application problem solving, motor design, and motor related hardware.

For a lot of projects, you won't always know the exact torque or speed you need. Or, maybe there's a voltage variation you're not sure how to cope with. The odds are 100:1 we've had experience with a similar application. So, basically, all you need to do is explain the conditions and what you want the motor to do. We help fill in the blanks, then come up with a design that's cost efficient for you.

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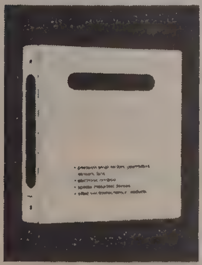

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Wide range of standards, with complete performance and specification data. Includes short course on how to predict performance when torque, speed or voltage conditions vary. Shipped UPS, same day.

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MINIGLOSSARY

SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{sH}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

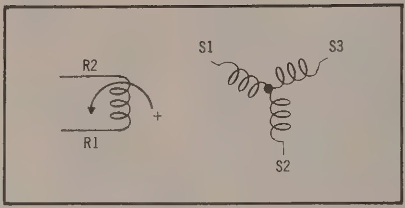
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

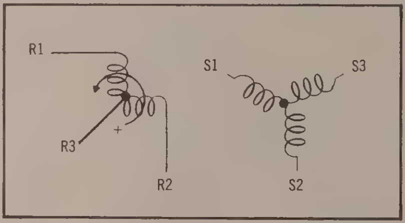
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

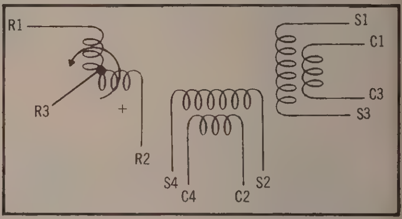
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

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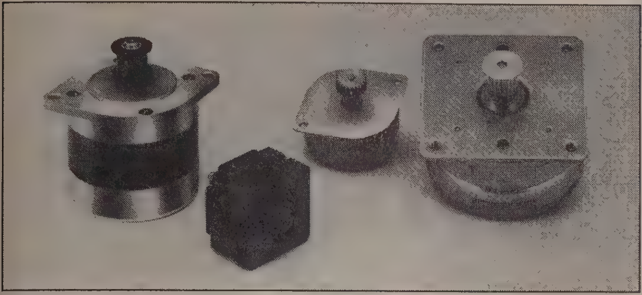
ASTROSYN STEPPING MOTORS HYBRID CONSTRUCTION



Laminated and Press Construction

FEATURES and BENEFITS

- Quiet, reliable performance, long life
- Wide range of laminated and press construction models – standard or custom designs
- Step Angles – 0.9°, 1.8°, 2.0°, 3.6°, 3.75°, 5.0°, 7.5°, 15° and 18°

COMPETITIVE PRICING

- Vertically integrated processing for total quality control
- Precision automated production
- In-line quality control and testing

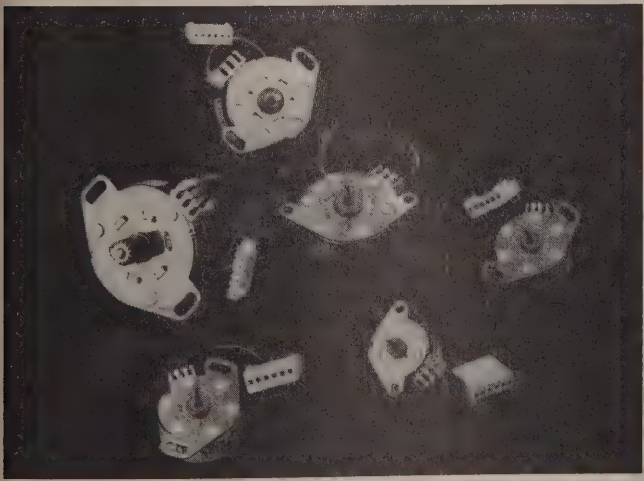
TYPICAL HYBRID MODEL SPECIFICATIONS

Model Number	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g·cm
1.8° STEP ANGLE					
17PM-M002	4	12.0	0.15	38.00	500
17PM-H301	4	4.9	0.77	6.40	1,800
23LM-C004	4	6.0	1.20	5.00	5,000
23LM-C108	4	5.4	1.50	3.60	6,000
23LM-C202	4	4.0	1.10	3.50	2,500
23LM-C302	4	1.3	3.90	0.33	4,000
23LM-C401	4	1.7	4.70	0.37	8,000
23LM-C501	4	2.2	4.60	0.48	10,800
23LM-C602	4	12.0	0.16	75.00	980
34PM-C006	4	2.0	3.60	0.55	10,000
34PM-C108	4	12.0	1.00	12.00	20,000
34PM-C201	4	5.0	4.40	1.13	30,000
42PM-C015	4	4.0	3.10	1.20	45,000
42PM-C109	4	12.0	1.50	7.70	81,000
42PM-C201	4	4.3	6.10	0.70	150,000

NOTES:

1. First two digits on P/N denote frame diameter size in inches x 10. Example: 23 LM C006 has a frame size of 2.3 inches.
2. Most motors are available with single or double-ended shafts.
3. Options available include lead screws, gears and pulleys.
4. Standard drivers are available for all standard motors. For special designs contact NMB application engineers.

PERMANENT MAGNET CONSTRUCTION



FEATURES and BENEFITS

- Superior torque and heat dissipation
- High quality - fully automated coil asembly
- Low failure rate
- Low cost

Type	Number of Steps per Rotation	Holding Torque (g·cm)	Torque Characteristics		Driving Conditions	
			Pull-Out Torque (g·cm)	Driving Frequency (P.P.S.)	Winding Resist. (Ω)	Drive Volts (V)
PM20-S	20	55	34	500	100	12
PM20-L	20	85	59	500	80	12
PM25-S	24	74	44	500	80	12
PM25-L	24	90	75	500	50	12
PM35-L	48	580	470	300	20	12
PM42-S	48	680	485	300	15	12
PM42-S	100	440	400	600	15	12
PM42-L	48	1,100	820	300	10	12
PM55-L	48	1,800	1,100	200	10	12
PM55-L	100	1,500	980	300	10	12

NOTE: S refers to low profile body, L is a standard body side.

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TECHNOLOGIES INC.

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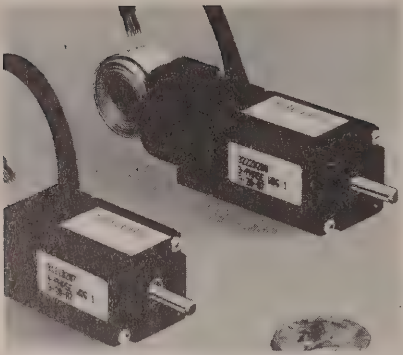
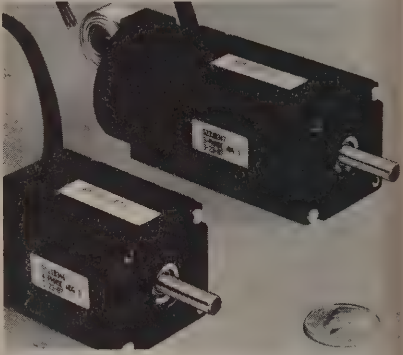
Demonstrably superior brushless servo motors



Series 3000 30mm sq. frame size; lengths of 55.2 and 65.4mm. At 7,200 rpm, longest motor develops 1/15 hp, continuous duty, with normal heat sink.

Series 4000 40mm sq. frame size; lengths of 67.8, 75.3, and 83.0mm. At 7,200 rpm, longest motor develops 1/6 hp, continuous duty, with normal heat sink.



Series 5000 50mm sq. frame size; lengths of 77.4, 90.1, and 102.8mm. At 7,200 rpm, longest motor develops 1/3 hp, continuous duty, with normal heat sink.

- Samarium cobalt rotor construction
- Exceptional thermal efficiency
- Negligible magnetic cogging
- Very low winding inductances
- High torque to inertia ratios
- Low mechanical time constants
- Capable of high speed operation
- Optional patented 12-step drive for minimum commutation torque ripple
- Conventional 6-step drives, digital control systems, and power supplies available from Pittman

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Series 6000 65mm sq. frame size; 202mm long. Internally mounted 1,000 line, 3-channel optical encoder. At 3,600 rpm, develops 1 hp, continuous duty, with normal heat sink.

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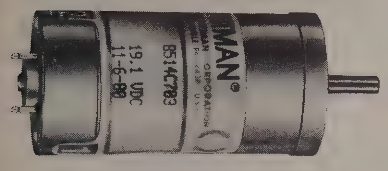
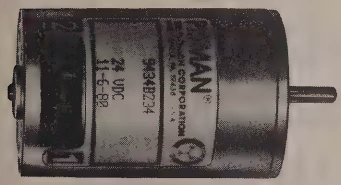
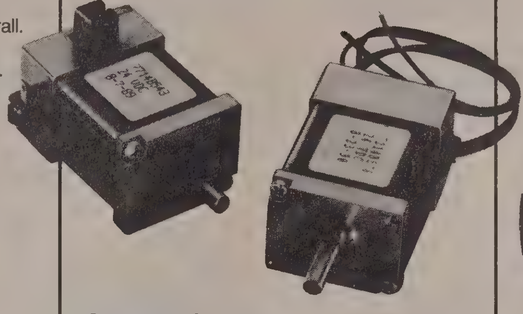


Series 8000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.2 in.; 3 lengths to 2.4 in. overall. Stall torques to 17 oz.-in. Mechanical time constants as low as 14.1 ms. (some models).



Series 9000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in.; 3 lengths to 2.5 in. overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 14.7 ms. (some models).



Series 7000 Servo Motors. 13-slot armatures. 4 pole samarium cobalt fields. Voltage inputs to about 40 VDC. 1 in. x 1.25 in. cross section; lengths to 1.85 in. overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 4.8 ms. (some models).

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24 VDC
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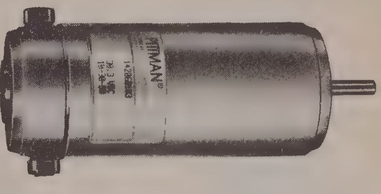
Series 9030 Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in.; 3 lengths to 2.5 in. overall. Stall torques to 41 oz.-in. Mechanical time constants as low as 9.2 ms. (some models).



Series 14000 Servo Motors. 11-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 2.13 in.; 4 lengths to 5.2 in. overall. Stall torques to 286 oz.-in. Mechanical time constants as low as 6.2 ms. (some models).

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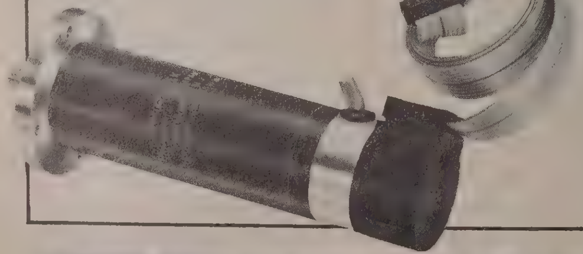
For inexpensive single-pulse-train feedback, Servo-Tek Pulsers are your best bet. 4 to 12 pulses/revolution; 4.5 to 15 Vdc supply; stand-alone and add-on models.



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- Elevated-temperature operation?
- No electronics in the motor?
- Low-inertia rotor?

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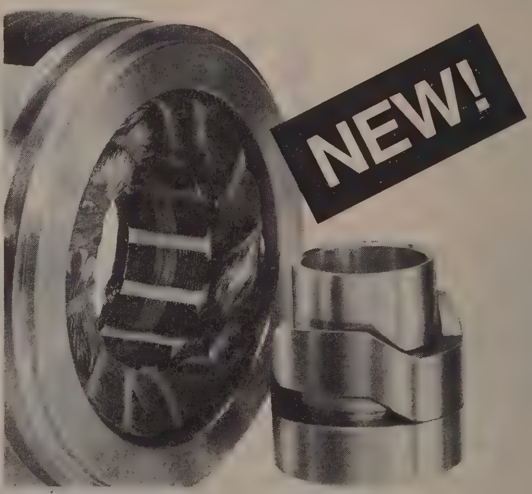
The Tachsyn brushless three-phase transducer is available in 4-, 6-, and 8-pole configurations to match your motor. With remote signal conditioning electronics, it provides accurate 6-step Hall-equivalent or sine-wave signals plus a low-ripple analog dc tachometer output.

The rotor is a low-inertia, passive component suitable for high speeds. Overhung mounting eases addition to your motor–no extra bearings or couplings are required.



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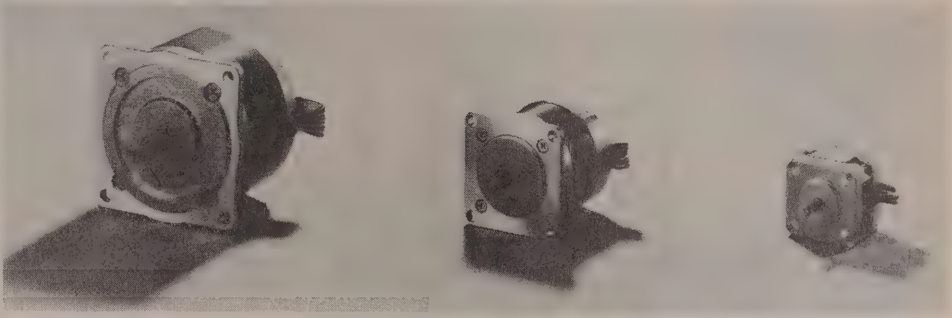


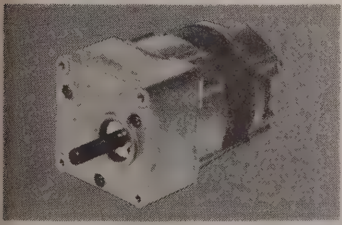
LINEAR ACTUATORS

Efficiently translate rotary to linear motion. Based on a size 23 hybrid stepper motor with a modified threaded rotor and fitted with a leadscrew shaft. **Applications:** XY tables, medical pumps, valve actuators and test equipment.

BRUSHLESS DC MOTORS

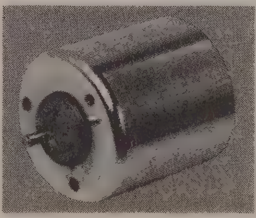
Rare earth magnets, 3 phase bipolar winding, efficient radial gap, precision ball bearings, outer or inner rotor available, with or without Hall sensors. **Applications:** Tape streamers, laser scanners, computer peripheral equipment, medical equipment and air movers.

AC & DC GEARED MOTORS



Induction motors, frame sizes of 60 to 100 mm dia. 120 or 220 vac, 50 or 60 HZ, torque ratings up to 70 KG-CM at 70 RPM. DC motors, frame sizes of 50 & 70 mm, various voltage ratings, torque ratings up to 40 KG-CM at 82 RPM.

CORELESS DC MOTORS



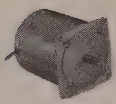
Ironless rotor, 23mm to 50mm dia., 8.5 to 1400 GM-CM starting torque. **Options:** Ball bearings, tachometer, terminals. **Applications:** Medical equip., office equip., recorders, small printers, plotters.

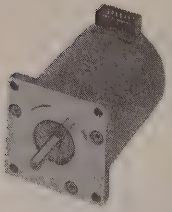
DC SERVO MOTOR AND ENCODER

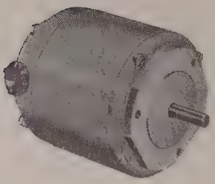
State of the art performance, output range: 12 watts to 330 watts. Torque constant up to 1.8 KGCM/AMP, DIA: 38, 50, 52 and 72 mm. Precision ball bearings, high energy magnet, incremental encoder, all steel construction **Applications:** Robotics, NC machines, office automation, computer peripherals.

SLO-SYN® DC Stepping Motors

Permanent magnet type stepping motors that provide high torque-per-pound and torque-to-inertia ratios. Can be driven to speeds above 20,000 steps/second with low power input. Motors have Class B insulation and can be operated at an ambient temperature range of –40°C to +65°C. Continuous duty temperature is 65°C. Standard 1.8 degree step angle motors can be half-stepped or microstepped with accuracies of ± 5% or ± 3% noncumulative. Holding torque ratings from 53 to 5000 oz-in. To simplify installation and connections, new quick-connect, plug-in types are available. Motors have no brushes, ratches or gear and use shielded ball bearings to ensure reliability and long life.



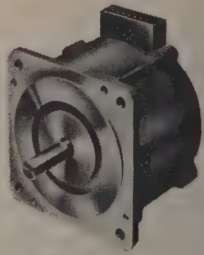


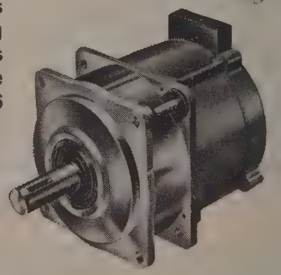


BASIC MOTOR SERIES	MINIMUM HOLDING TORQUE,(2)(5) OZ-IN(6) (kg-cm)	MINIMUM RESIDUAL TORQUE,(5) OZ-IN (kg-cm)	NOMINAL ROTOR INERTIA, LB-IN^2 (kg-cm^2)	TYPICAL TORQUE TO INERTIA RATIO (RAD/SEC^{-2})	SHAFT DIAMETER, INCHES (mm)	MAXIMUM OVERHANG LOAD, LBS (kg)	MAXIMUM THRUST LOAD, LBS (kg)
M061	60 (4,3)	1 (0,07)	0.04 (0,12)	32x10^3 (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M062	100 (7,2)	1.4 (0,1)	0.08 (0,23)	30x10^3 (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M063	150 (10,8)	2.5 (0,18)	0.11 (0,32)	33x10^3 (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M091	150 (10,8)	2 (0,14)	0.23 (0,67)	15.6x10^3 (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M092	300 (21,6)	3.9 (0,28)	0.42 (1,23)	17.2x10^3 (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M093	450 (32,4)	6.9 (0,5)	0.64 (1,87)	16.8x10^3 (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M111	625 (45)	6 (0,43)	1.34 (3,93)	11.2x10^3 (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M112-FD	1125 (81)	12 (0,86)	2.75 (8,06)	9.8x10^3 (3)	0.500 (12,7)	25 (11,3)	50 (22,7)
M112-FJ	1125 (81)	12 (0,86)	2.75 (8,06)	9.8x10^3 (3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M113	1550 (112)	20 (1,44)	4.1 (12,0)	9.1x10^3 (3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M172	2700 (194,4)	50 (3,6)	21 (61,5)	3.1x10^3 (3)	0.625 (15,88)	50 (22,7)	100 (45,4)

(2) Both windings energized at rated current.
(3) Calculated from holding torque in oz-in and rotor inertia in oz-in-sec^2 (lb. in^2/24).
(5) Values are subject to change without notice. Parameters used as part of a specification should be verified with the factory.
(6) Operation below rated current will reduce torque and may degrade step accuracy.

SLO-SYN® AC Synchronous & Gearmotors





Provide slow basic shaft speed synchronous with line frequency. Allow direct load coupling without gearing. Instantaneous starting, stopping and reversing eliminate clutching and braking. Simple single-pole, 3-position switch provides complete forward, reverse and off control. Will not overheat or be damaged if stalled. Starting and running currents nearly identical. Conventional motors have speeds of 72 and 200 rpm at 60 Hz and torque ratings from 25 to 1800 oz-in.

New **high torque models** provide more power per frame size than any other synchronous motors. Types offered in NEMA frame size 23 and 34 with minimum running torque ranging from 60 to 420 oz-in. Shaft speed is 72 rpm at 60 Hz, 60 rpm at 50 Hz. **AC gearmotor models** offer torque ratings to 5000 oz-in and shaft speeds as low as 0.72 rpm at 60 Hz. All are designed for quick-connect, plug-in connection with optional mating connectors having 36 in. minimum length leads.

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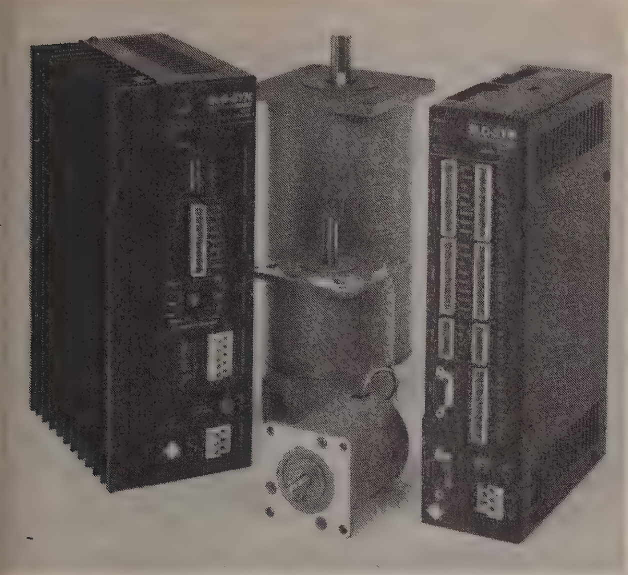
SLO-SYN®
Series 2000 Motion Controls



UL Recognized Components (File No. E146240)

Bipolar Chopper Drive SS2000D6

- Provides position control from any pulse and direction input
- Fully protected against short circuits and over/undervoltage conditions
- 10 switchable motor resolutions from 200 to 50,000 pulses/revolution; from full step to 1/250 microstep
- Switch-selectable currents from 1 to 6 amperes
- Matched step motors produce optimum torque throughout the speed range

Programmable Motion Control SS2000I

- Dual drive capability. Non-sequential operation of 2 drives for 2 axes of control for the price of one
- New, English language IBM PC compatible software simplifies programming
- Program flexibility for complete machine control
- 16 versatile, optically isolated, single point inputs (13 programmable, 3 dedicated high speed) and 8 fully protected programmable outputs
- Optional plug-in module for closed loop operation

Modular Drive SS2000MD7

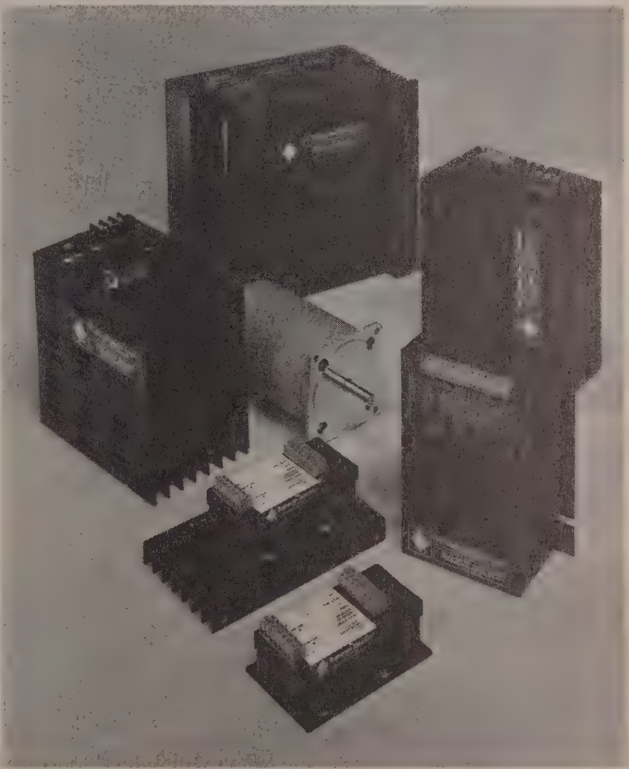
- Powerful bipolar PWM design provides maximum torque over a wide range of speeds
- Full short circuit, under/overvoltage and thermal protection
- Operates SLO-SYN® DC Step Motors in switch-selectable 1/2, 1/10, 1/25 or 1/100 microsteps
- Switch-selectable current levels from 1 through 7 amperes — no external resistors or jumpers
- Control signal optically isolated from the drive signal
- Separate power supply can operate several drives
- Small, compact, rugged design

Micro Series Step Motor Drives & Motion Controls

230 & 430 Series Translator Drives

All types in these series are available as modules for use with user supplied power supplies or packaged with all necessary power supplies.

- Bipolar chopper, 2-phase step motor drives
- 230 Series units are 2 A, 30 VDC
- 430 Series units are 3.5 A, 30 VDC
- Capable of operating at reduced currents
- Full/half step operation
- Optically isolated inputs
- Modular units can be used alone or as integral PC board components with user supplied power supply
- Can be packaged with an integral power supply
- Also available with the following motion control features:
  - Oscillator for internal pulse source
  - Preset indexer for simple motion control
  - Fully programmable indexer for more sophisticated motion control

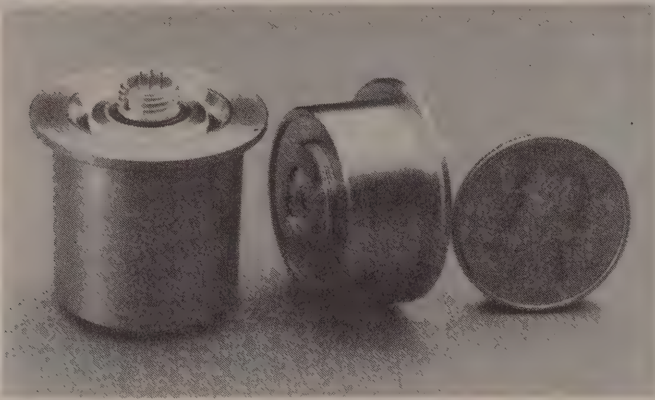


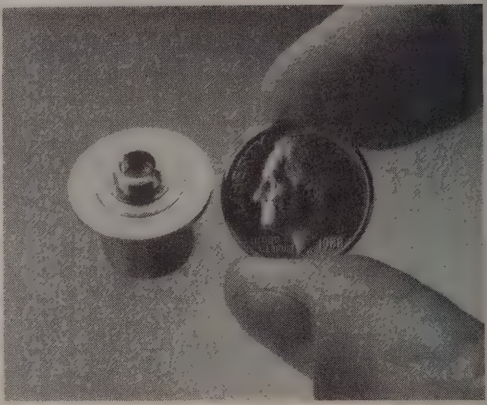
440 Series Translator Drives

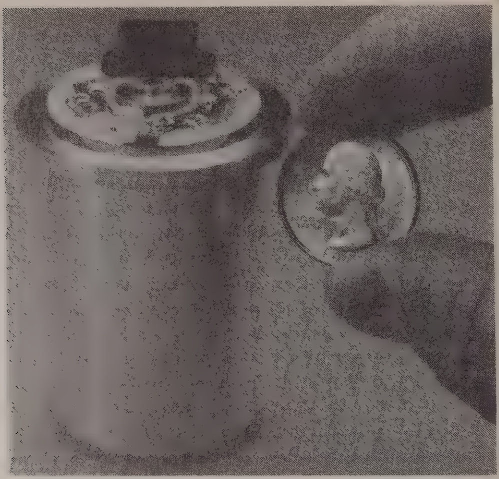
- Bipolar chopper, 2-phase step motor drives
- 1, 2, 3 or 4 A switch selectable motor current, 36 VDC
- 1/5 - 1/10 or 1/125 microstep operation gives smoother performance and resonance-free operation
- Optically isolated inputs
- Full short circuit, undervoltage and transient overvoltage protection
- Available in easily mounted packages, power supply not included

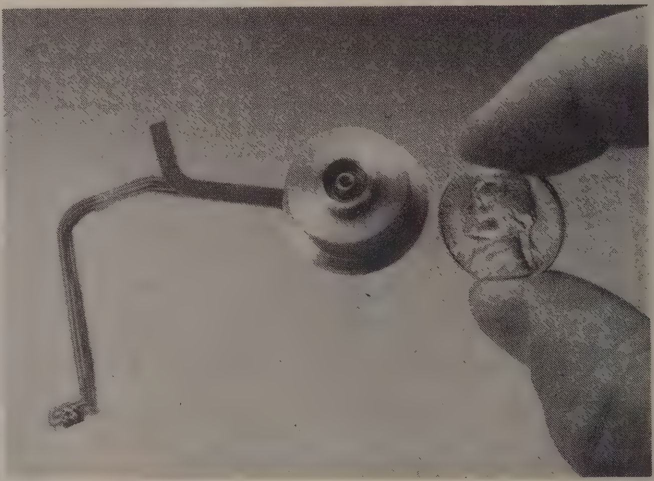
SYNEKTRON
A TDK GROUP COMPANY

SPINDLE MOTORS









Synektron D.C. Brushless Motors offer low acoustical noise, exacting runouts and ceramic or rare earth magnet materials. In addition, you get U.S. engineering support and Far East manufacturing.

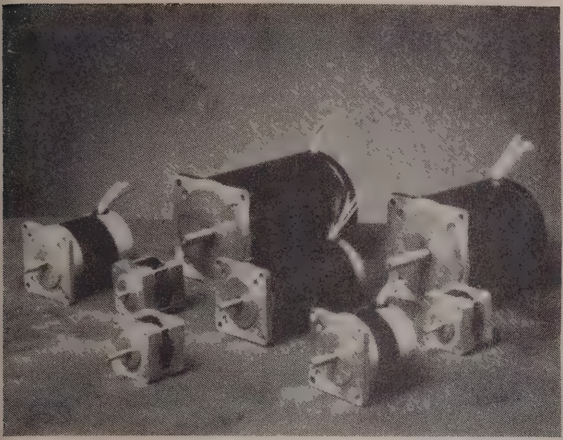
Custom designs are our expertise.
Applications include computer peripherals (magnetic and optical), laser scanners and printers.

Form Factor	Supply Voltage (V)	EMF Constant (V/krpm)	Motor Constant $\left(\frac{\text{oz-in}}{\#R}\right)$	D.C. Resistance (ohm)	Operating Speed (rpm)	Nominal Outer Diameter	Height (in)	NRRO (µin)
5.25"	12	1.41	2.49	.32	5400	1.85	2.50	10
3.5"	12	1.62	.98	2.75	5400-7200	1.20	1.07	10
2.5"	5	.695	.46	2.25	4800	.97	.45	10
1.8"	5	.675	.27	6.40	4500	.96	.16	10

For more information about
Synektron Spindle Motors write or call:

SYNEKTRON
A TDK GROUP COMPANY
12000 Southwest Garden Place
Portland, Oregon 97223
Phone: 503-684-3090

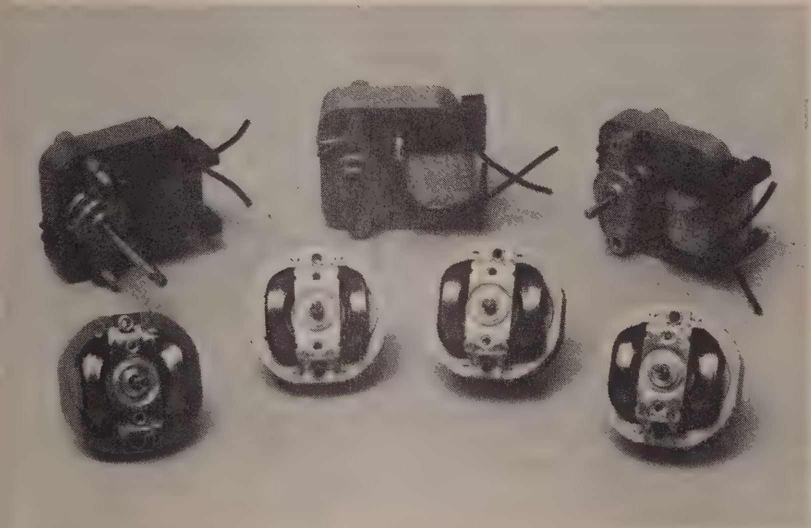
TECO STEPPING MOTORS



TECO is the third largest manufacturer of electric motors worldwide. For the past five decades they have led the field in technology, R&D, and specialized custom motors. Teco offers the Hybrid Stepping motor in NEMA sizes (17 - 23 & 34).

Model #	Nema Size	Step Angle	Rated Voltage	Rated Current	Resistance Ohms/ph.	Inductance mH/phase	Holding Torque (oz-in)
4H4018S-01—	17	1.8	12	.16	75	35	6.25
4H4018M-01—	17	1.8	24	.24	100	70	22.3
4H4018L-01—	17	1.8	6	.8	7.5	5.7	29.2
4H5618X-01—	23	1.8	6.4	.53	12	15	37
4H5618S-01—	23	1.8	5.1	1.0	5.1	9.0	70
4H5618M-01—	23	1.8	12	.6	20	25	84
4H5618L-01—	23	1.8	3	2.7	1.1	2.0	125
4H5618C-01—	23	1.8	2.9	3.5	.83	1.7	170
4H8618S-01—	34	1.8	1.6	6.1	.2	1.1	180
4H8618M-01—	34	1.8	3.0	4.0	.75	4.5	348
4H8618L-01—	34	1.8	5.0	4.0	1.25	6.6	500
4H8609S-01—	34	.9	2.4	2.2	1.09	11	167
4H8609M-01—	34	.9	2.41	3.6	.67	9.7	278
4H8609L-01—	34	.9	2.77	3.9	.71	11.2	417

TELCO SHADED POLE MOTORS



- Shaded Pole/UL Recognized
- Subfractional hp (1/40 hp or Less)
- CW/CCW Rotations
- AC, 2 pole, C-Frame Induction
- Custom Designs Available
- Applications: Range Hoods, Microwave Ovens, Refrigerators, Air Cleaners, Cooling Fans, Blowers and Toys

TELCO

TELCO INTERCONTINENTAL CORPORATION

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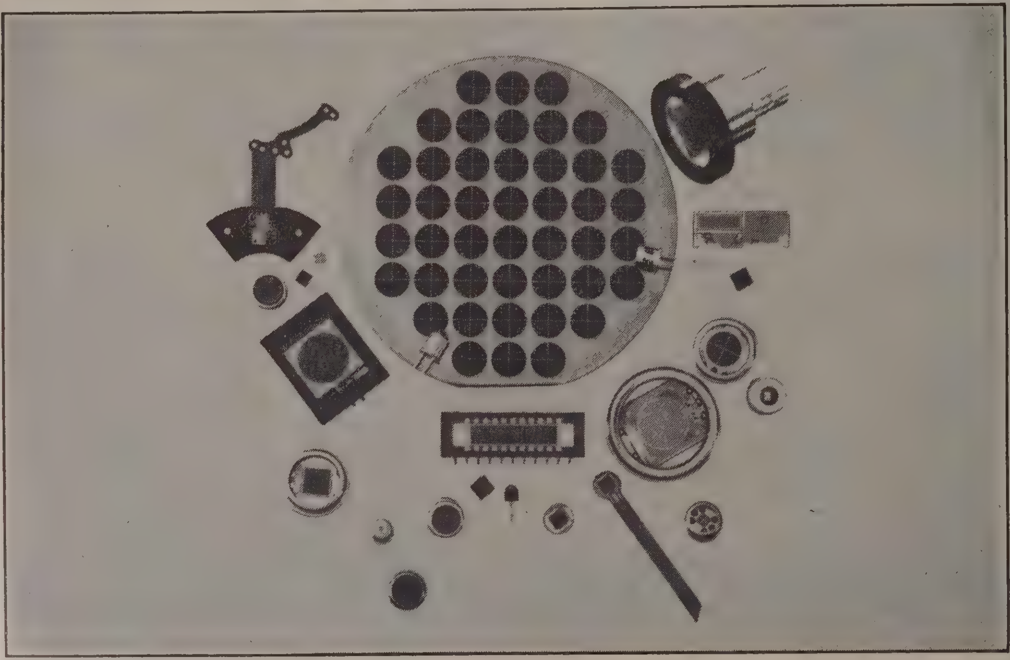

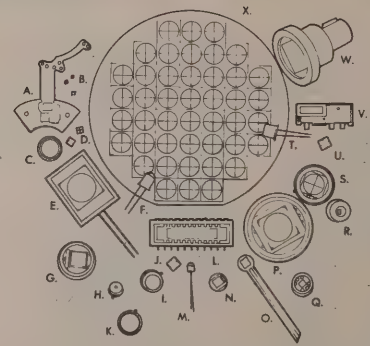

COMPONENT IDENTIFICATION

A. Special Flex Circuit Mounting
B. BPX65 Chips
C. Special Filter
D. Silicon Chips
E. OSD100-5T Special Mounting
F. BPX65B
G. OSI35
H. AX65-R2F
I. OSD5-E
J. Silicon Chip
K. OSD5-5T With Filter
L. LD20
M. CD1705
N. Special PC Board Mounting
O. Special Flex Circuit Mounting
P. OSI100-1R-40K
Q. CD3H-4D
R. Special Detector OP/AMP - 1444F
S. OD50-5T
T. BPX65
U. OSD15-5T Chip
V. Special PC Board Mounting
W. OSD100-5T-BNC
X. QD50-5T Silicon Wafer

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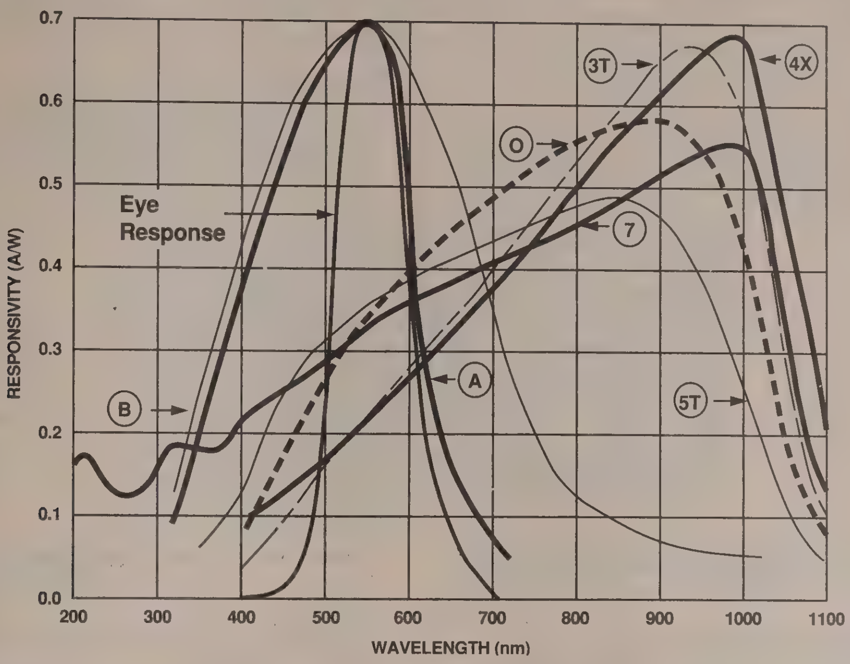

Photodiode Selection Guide

Series	Features	Spectral Range	Response Characteristics	
		nm	Test Wavelength nm	Curve Code
Series - 0 General Purpose	These devices exhibit low capacitance, high speed and a broad spectral response range. Available in single, dual, quad and array configurations, they may be packaged in a variety of standard and custom package options.	430 - 1064	900	0
Series - 3T High Speed IR Pulse Operation	Specially designed and processed to achieve high speed detection of pulsed near IR radiation. Available in seven (7) standard package outlines and several "application specific" engineered configurations.	400 - 1100	900	3T
Series - 4X Low Capacitance Pulsed Laser Detection	Optimized response to the 1064nm wavelength for laser applications.	400 - 1100	1064	4X
Series - 5T Blue Enhanced	Exhibiting excellent sensitivity in the blue spectral range, these strong signal-to-noise ratio devices are particularly useful in low light level applications	350 - 1100	436	5T
Series - 7 Super UV	The Super UV series provides UV sensitivity with high shunt resistance. The response of this series is particularly useful in the 190 - 400 nm range.	190 - 1100	254	7
Series - 29 Specialty Products	A variety of standardized single, dual, quadrant and high speed devices for cost effective volume applications.	400 - 1100	Various	Various
Series - OSI Photodiode / OP/AMP	Centronic high performance single element devices with selected operational amplifiers. Series prefaced by the OP/AMP Development System.	400 - 1100	Various	Various
Series - E Eye Response	High quality color correcting filters are combined with high performance Series 5T devices to produce spectral responses approximating that of the human eye.	380 - 750	Photopic	A B Relative Response Curve

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Centronic offers a wide variety of standard and custom silicon photodiodes either packaged in die form, or incorporated into higher level assemblies. The selection below is a sampling of our popular devices.

Series O, 3T, 4X, 5T and E - Single Element

Type No.	Active Area		Package
	mm²	mm	
OSD1-____	1	1.13 dia	TO-18
OSD3-____	3	2.16 x 1.4	TO-18
OSD5-____	5	2.52 dia	TO-5
OSD7.5-____	7.5	2.75 x 2.75	TO-5
OSD15-____	15	3.8 x 3.8	TO-5
OSD35-____	35	5.9 x 5.9	TO-8
OSD50-____	50	7.98 dia	TO-8
OSD60-____	62	7.9 x 7.9	TO-8
OSD100-____	100	11.3 dia	1"
OSD300-____	300	19.54 dia	1"

Order by indicating OSD, Active Area (1 thru 300), Followed by the -Series No. (0-5T or E).

Series 7 – UV Enhanced - Single Element

Type No.	Active Area		Package
	mm²	mm	
OSD1.2-7	1.2	1.1 x 1.1	TO-18
OSD5.8-7	5.8	2.4 x 2.4	TO-5
OSD35-7	33.6	5.8 x 5.8	TO-8
OSD100-7	100	10 x 10	1"

Series 29 – Specialty Products - Single Element

Type No.	Active Area		Package
	mm²	mm	
CD1705	.88	.93 x .93	TO-18
CD11H	1.22	1.1 x 1.1	TO-18
CD11HL	1.22	1.1 x 1.1	TO-5
CD33H	7.29	3.6 x 3.6	TO-5
CD33HL	7.29	3.6 x 3.6	Plastic
BPW34	7.3	2.71 x 2.71	Ceramic
CD1712	19.5	4.4 x 4.4	Ceramic
CD1700R/F*	19.5	4.4 x 4.4	Ceramic
CD1701R/F*	19.5	4.4 x 4.4	Ceramic

*With visible light-blocking filter

Ultra High Speed - Single Element

BPX65	1	1 x 1	TO-18
AX65-R2F	1	1 x 1	TO-18

Dual Element

CD25T	2.3	4.6 x .05	TO-5
CD33H-2D	9.0	3 x 3	TO-5

Quadrants

CD1515H-4D	.547	.74 x .74	TO-18
CD33H-4D	1.49	1.23 x 1.23	TO-5

Order Series 29 by Type Number Listed.

Optical Silicon Integrated Detector

The OSI Series integrates Centronic high performance single element photodiodes with selected operational amplifiers in a single hybrid package. The photo response and transimpedance gain of the devices can be tailored to fit any application. Custom designs are welcome including multi-channel, thermo electrically cooled, fiber-coupled, and others to fit your application.

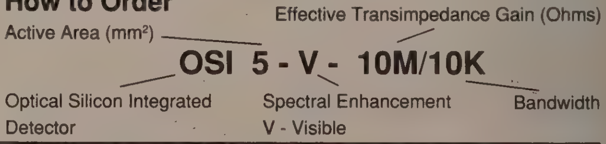
Hybrid Selection Guide

Series	Active Area	Gain	Band-width	Spectral Enhancement Note 1				Peak Responsivity V/µW Note 2	Typical NEP µW/Hz$^{1/2}$ Notes 2 & 3	Typical Min. Power Level µW at 900nm Note 2	Typical Sat. Level µW at 900nm Note 2	Package
	mm²	Ohm	Hz	UV	V	IR	E					
BPX65-100	1	-	150M	-	-	-	-	-	-	-	-	TO-18
OSI 1-300K/10M	1	300k	10M	◊	◊	◊	-	0.15	2×10^{-12}	7×10^{-3}	26	TO-18
OSI 5-10M/10K	5	10M	10k	◊	◊	◊	◊	5.8	1.5×10^{-12}	2×10^{-4}	2	TO-5
OSI 5-50M/2K	5	50M	2k	-	◊	◊	-	29	6×10^{-13}	4×10^{-5}	0.4	TO-5
OSI 5-100M/1K	5	100M	1k	-	◊	◊	-	58	1×10^{-13}	4×10^{-5}	0.23	TO-5
OSI 15-100K/25K*	15	100k	25k	-	◊	◊	-	5.8×10^{-2}	6×10^{-12}	5×10^{-4}	200	TO-5
OSI 35-1M/2K5	35	1M	2.5k	-	◊	◊	-	5.8×10^{-1}	6×10^{-12}	4×10^{-4}	22	TO-8
OSI 50-40K/20M*	50	40k	20M	-	◊	◊	-	3×10^{-2}	3×10^{-11}	0.15	130	TO-8
OSI 100-40K/15M	100	40k	15M	-	◊	◊	-	3×10^{-2}	3×10^{-11}	0.15	130	1"

NOTES:

1. - Spectral Enhancement: UV = Ultra Violet, V = Visible
IR = Infra-Red, E = Eye Response
2. - Values given are for the IR spectral enhanced version
3. - NEP figures are stated at 900 nm

How to Order



Active Area (mm²)

Effective Transimpedance Gain (Ohms)

OSI 5 - V - 10M/10K

Optical Silicon Integrated Detector

Spectral Enhancement
V - Visible

Bandwidth

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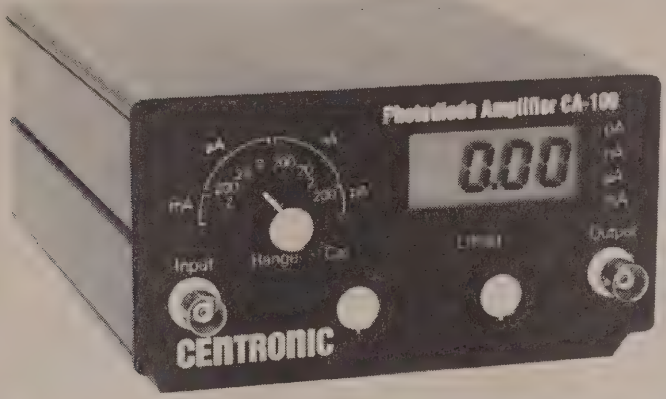
Photodiode Amplifier CA-100



High Performance

The CA-100 Photodiode Amplifier is a general purpose, high-performance unit that converts the signal from Centronic detectors into a voltage that can be used to drive oscilloscopes or other voltage sensing equipment. This compact, low cost amplifier generates up to ±2 Volts from 8 gain settings ranging from 10^3 to 10^{10} V/A with high gain accuracy and low noise.

Optical Power Mode

In normal Current Meter Mode, the CA-100 displays the photocurrent directly on a 3½ digit LCD. The unit can also be operated in an Optical Power Mode in which the Calibration Adjust knob sets the amplifier to a known optical power and the LCD display presents the optical power directly. An Offset Adjust knob allows the user to null out room light or photodetector leakage current.

CENTRONIC OFFERS CALIBRATED DETECTORS SUCH AS THE OSD 100-0BNC FOR USE WITH THE CA-100

Specifications

Specifications subject to change without notice.

Performance	**Full Scale**	**Gain (V/A)**	**Bandwidth**
	2mA	10^3	35KHz
	200µA	10^4	25KHz
	20µA	10^5	23KHz
	2µA	10^6	18KHz
	200nA	10^7	26KHz
	20nA	10^8	8KHz
	2nA	10^9	500Hz
	200pA	10^{10}	100Hz
Output	± 2V, Full Scale		
Accuracy	± 1% Full Scale, All Ranges		
Noise	0.1% rms Full Scale		
Zero Adjust	0 to -2V, Display Only		
Calibration Adjust	1X to 10X, Display Only		
Display	3 ½ Digit LCD		
Power	Rechargeable NiCd with Recharger		

CENTRONIC

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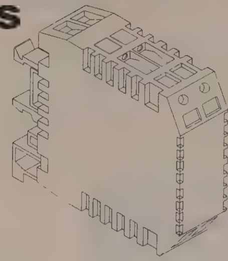
CLAROSTAT

ELECTRO-OPTICAL EQUIPMENT

T-60 SERIES

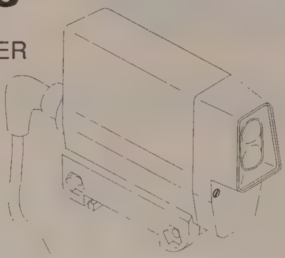
LED MODULATING
AMPLIFIER



These controls provide ambient light immunity in a DIN Rail mountable DC powered package. Each control modulates the LED or IRED source of a reflective scanner or thrubeam pair, and responds only to photodetector signals with the same modulation frequency.

C-80 SERIES

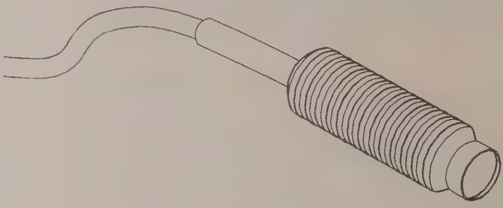
MODULATED
REFLECTIVE SKANNER



These controls provide ambient light immunity in a DIN Rail mountable AC or DC powered package. Each control has a modulated red LED source and responds only to photodetector signals with the same modulation frequency.

L33/P33 SERIES

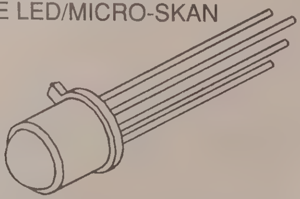
THRUBEAMS/MINIATURE
LED PAIR



The L33/P33 Series is a rugged LED thrubeam combination in a miniature size, designed for use under conditions of severe shock and vibration.

S-27 SERIES

REFLECTIVE SKANNERS/
SUBMINIATURE LED/MICRO-SKAN

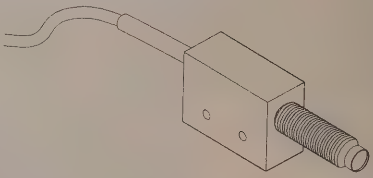


The MICRO-SKAN is a specially constructed LED sensor, specifically intended for the OEM and high volume industrial market.

The LED directs infrared energy through a formed epoxy lens to the target. The reflected energy is received by a fiber optic rod at the lens center, then passes through an ambient light filter to the photodetector.

S-35 SERIES

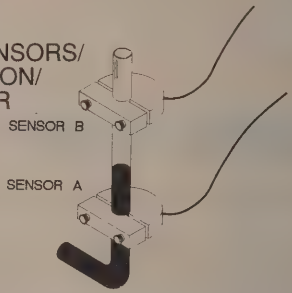
SPECIAL PURPOSE SENSORS/
COLOR DETECTION SKANNER



The S35 Series Color Detection Skanner is designed to detect a wide range of colored marks, including blue, green, yellow, orange and red. The units contain an incandescent lamp, a photodetector, a combination of optical filters, and feature the fiber optic construction of the S30 Series SKAN-COAX.

S-19 SERIES

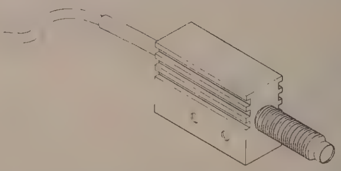
SPECIAL PURPOSE SENSORS/
LIQUID LEVEL DETECTION/
SIGHT GLASS SKANNER



The S19 Series Sight Glass Skanners contain a light source and photodetector mounted in a rugged aluminum housing. The housing clamps onto the sight glass tube with two thumb screws with tension springs for easy positioning.

S30 SERIES

SELF-CONTAINED PHOTOELECTRIC
CONTROLS/AMPLIFIED COAXIAL/SKAMP

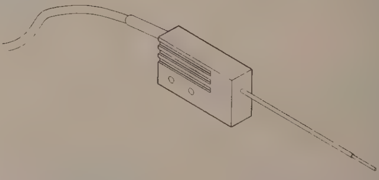


The S30 Series is a photoelectric skanner designed to provide sensing and control capability from a single convenient point.

The S30 Series is available with either an incandescent or LED light source in models wired for light energized or dark energized operation.

C56 SERIES

SELF-CONTAINED PHOTOELECTRIC
CONTROLS/FIBER OPTIC FLEXIBLE SNOUT/
NANO-SKAMP



The C56 NANO-SKAMP is a self-contained photoelectric skanner/amplifier designed to provide sensing and control capability from a single convenient point. It combines the fiber optic construction of the NANO-SKAMP with a hybrid amplifier in a compact integral package.

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HAMAMATSU

▼ MAIN PRODUCTS ▼ MAIN PRODUCTS ▼ MAIN PRODUCTS ▼

- ▼ Silicon Photodiodes
- ▼ PIN Silicon Photodiodes
- ▼ Silicon Avalanche Photodiodes
- ▼ GaAsP Photodiodes
- ▼ Photo IC
- ▼ MOS Linear Image Sensors
- ▼ Position Senesitive Detectors
- ▼ Infrared Detectors
- ▼ CdS Photoconductive Cells
- ▼ Photocouplers
- ▼ Solid State Emitters
- ▼ Pyroelectric Detectors
- ▼ Photomultiplier Tubes
- ▼ Phototubes
- ▼ Electron Multipliers
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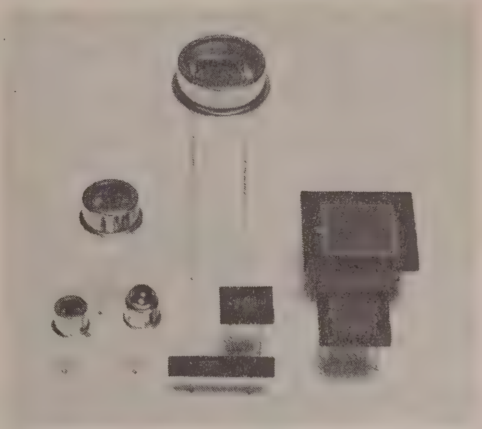
Light Sources

- ▼ Hollow Cathode Lamps
- ▼ Deuterium Lamps
- ▼ Mercury Lamps
- ▼ Xenon Lamps
- ▼ Mercury-Xenon Lamps

▼ See our LAMP PAGES in Section 2460 — Vol. B ▼

SILICON PHOTODIODES FOR PRECISION PHOTOMETRY

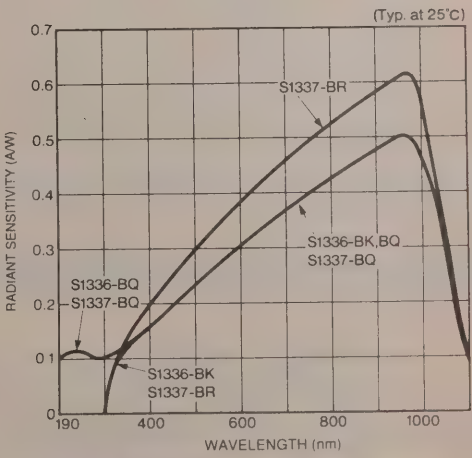
Type No.	Package (mm)	Active Area (mm)	Photo Sensitivity S at λp (A/W)	NEP at λp (W/Hz $^{1/2}$)	Short Circuit Current Isc at 100lux 2856K Typ. (μA)	Shunt Resistance Rsh V_R = 10mV Typ. (GΩ)	Dark Current I_D V_R = 10mV Max. (pA)	Rise Time t_r R_L = 1kΩ V_R = 0V 10 to 90% (μs)	Terminal Capacitance C_t V_R = 0V (pF)
S2386 Series (Visible to IR)									
-18K	Metal Case TO-18	1.1x1.1	0.6 λp 960	6.8×10^{-16}	1.2	100	2	0.4	170
-18L					4.0				
-5K	TO-5	2.4x2.4		9.6×10^{-16}	5.8	50	5	1.8	800
-44K		3.6x3.6		1.8×10^{-15}	12	15	20	3.6	1700
-45K		3.9x4.6		1.4×10^{-15}	15	25	30	5.5	2500
-8K	TO-8	5.8x5.8		2.1×10^{-15}	33	10	50	10	4400



Silicon Photodiodes for General Photometry

Type No.	Active Area (mm)	Spectral Response λ (mm)	Photo Sensitivity S at λp Typ. (A/W)	NEP at λp Typ. (W/Hz $^{1/2}$)	Short Circuit Current Isc at 100lux 2856K Typ. (μA)	Shunt Resistance Rsh V_R = 10mV Typ. (GΩ)	Dark Current I_D V_R = 10mV Max. (pA)	Rise Time t_r R_L = 1kΩ V_R = 0V 10 to 90% Typ. (μs)	Terminal Capacitance C_t V_R = 0V Typ. (pF)
S1226 Series (UV to Visible)							(Similar Devices Available In Ceramic Packages)		
-18BQ	1.1x1.1	190 to 1000	0.35 λp 729	3.7×10^{-15}	0.65	10	15	0.15	50
-18BK		320 to 1000							
-5BQ	2.4x2.4	190 to 1000		3.7×10^{-15}	2.8	10	20	0.5	200
-5BK		320 to 1000							
-44BQ	3.6x3.6	190 to 1000		5.2×10^{-15}	5.5	5	50	1	400
-44BK		320 to 1000							
-8BQ	5.8x5.8	190 to 1000		1.2×10^{-14}	15	1	100	2	1000
-8BK		320 to 1000							

Type No.	Active Area (mm)	Spectral Response λ (mm)	Photo Sensitivity S at λp Typ. (A/W)	NEP at λp Typ. (W/Hz $^{1/2}$)	Short Circuit Current Isc at 100lux 2856K Typ. (μA)	Shunt Resistance Rsh V_R = 10mV Typ. (GΩ)	Dark Current I_D V_R = 10mV Max. (pA)	Rise Time t_r R_L = 1kΩ V_R = 0V 10 to 90% Typ. (μs)	Terminal Capacitance C_t V_R = 0V Typ. (pF)
S1336 Series (UV to IR)							(Similar Devices Available In Ceramic Packages)		
-18BQ	1.1x1.1	190 to 1100	0.5 λp 960	5.7×10^{-15}	1.2	2	20	0.1	20
-18BK		320 to 1100							
-5BQ	2.4x2.4	190 to 1100		8.1×10^{-15}	5	1	25	0.2	65
-5BK		320 to 1100							
-44BQ	3.6x3.6	190 to 1100		1.1×10^{-14}	10	0.6	60	0.5	160
-44BK		320 to 1100							
-8BQ	5.8x5.8	190 to 1100		1.3×10^{-14}	28	0.4	150	1	370
-8BK		320 to 1100							



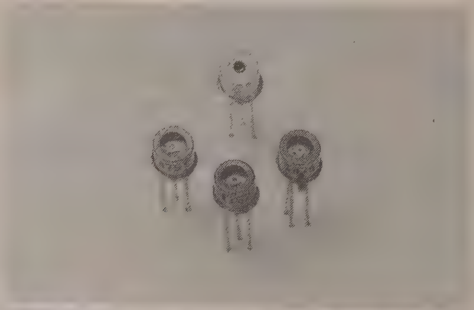
SPECTRAL RESPONSE

PIN SILICON PHOTODIODES

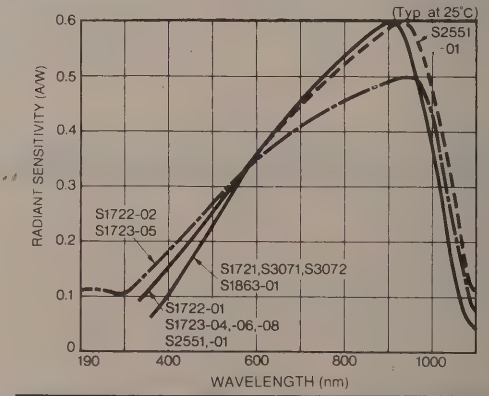
(Ta = 25°C)

Type No.	Package (mm)	Active Area (mm)	Spectral Response λ (nm)	Peak Sensitivity Wavelength λp (nm)	Photo Sensitivity S at λp Typ. (A/W)	NEP at λp Typ. (W/Hz$^{1/2}$)	Dark Current ID Max. (nA)	Cutoff Frequency f_c Typ. (MHz)	Terminal Capacitance C_t Typ. (pF)	Maximum Reverse Voltage VR Max. (V)
S2216-01	3-pin TO-18	ø 0.8	320 to 1060	900	0.57	5×10^{-15} (VR = 5V)	1 (VR = 5V)	40 (VR = 5V)	3 (VR = 5V)	30
S2839	3-pin TO-18	ø 0.4	320 to 1000	800	0.5	3.6×10^{-15} (VR = 5V)	0.15 (VR = 5V)	150 (VR = 5V)	2 (VR = 5V)	30
S2840		ø 0.8				7.2×10^{-15} (VR = 5V)	0.3 (VR = 5V)	150 (VR = 5V)	4 (VR = 5V)	
S1190	TO-18	1.1 x 1.1	320 to 1100	960	0.57	2×10^{-15} (VR = 10V)	2 (VR = 10V)	25 (VR = 10V)	10 (VR = 10V)	20
S1190-01	TO-18 (Lens Window)									
S1190-13	3-pin TO-18 (Lens Window)									
S4751	3-pin TO-18	ø 0.8	320 to 1000	800	0.57	3.1×10^{-15} (VR = 12V)	0.5 (VR = 12V)	0.5GHz (VR = 12V)	3 (VR = 12V)	20
S4752		ø 0.6		780	0.55	2.3×10^{-15} (VR = 12V)	0.3 (VR = 12V)	1GHz (VR = 12V)	2 (VR = 12V)	
S4753		ø 0.4		760	0.52	1.5×10^{-16} (VR = 12V)	0.1 (VR = 12V)	1.5GHz (VR = 12V)	1.5 (VR = 12V)	
S5531	3-pin TO-18 (Mini Lens Window)	ø 0.8	320 to 1000	800	0.57	3.1×10^{-15} (VR = 12V)	0.5 (VR = 12V)	0.5GHz (VR = 12V)	3 (VR = 12V)	20
S5532		ø 0.6		780	0.55	2.3×10^{-15} (VR = 12V)	0.3 (VR = 12V)	1GHz (VR = 12V)	2 (VR = 12V)	
S5533		ø 0.4		760	0.52	1.5×10^{-15} (VR = 12V)	0.1 (VR = 12V)	1.5GHz (VR = 12V)	1.5 (VR = 12V)	
S3883	3-pin TO-5	ø 1.5	320 to 1000	840	0.6	9.4×10^{-16} (VR = 20V)	1 (VR = 20V)	300 (VR = 20V)	6 (VR = 20V)	30
S3399		ø 3.0			0.58	1.2×10^{-14} (VR = 10V)	1 (VR = 10V)	100 (VR = 10V)	20 (VR = 10V)	
S1223	TO-5	2.4 x 2.8	320 to 1100	960	0.6	8.9×10^{-15} (VR = 20V)	10 (VR = 20V)	30 (VR = 20V)	10 (VR = 20V)	30
S1223-01		3.6 x 3.6				1.2×10^{-14} (VR = 20V)	20 (VR = 20V)	20 (VR = 20V)	20 (VR = 20V)	
S2506-02	Epoxy SIP (7.8 x 7)	2.77 x 2.77	320 to 1100	960	0.58	9.8×10^{-15} (VR = 12V)	10 (VR = 12V)	25 (VR = 12V)	15 (VR = 12V)	35
S2506-04	Epoxy SIP (7.8 x 7)	2.77 x 2.77	800 to 1100	960	0.58	9.8×10^{-15} (VR = 12V)	10 (VR = 12V)	25 (VR = 12V)	15 (VR = 12V)	35
S4707-01	4-pin epoxy DIP (4.5x5.5)	2.4 x 2.8	320 to 1100		0.56	5×10^{-15} (VR = 10V)	5 (VR = 10V)	20 (VR = 10V)	14 (VR = 10V)	20
S5077	4-pin epoxy DIP (4.0x4.8)	1.1 x 1.1				2×10^{-15} (VR = 10V)	2 (VR = 10V)	40 (VR = 10V)	10 (VR = 10V)	
S2973	4-pin epoxy DIP (4.5x5.5)	1 x 3				3.2×10^{-15} (VR = 10V)	1 (VR = 10V)	20 (VR = 10V)	25 (VR = 10V)	
S3321	4-pin epoxy DIP (4.0x4.8)	ø 0.8	320 to 1060	900	0.53	5×10^{-16} (VR = 5V)	1 (VR = 5V)	40 (VR = 5V)	2.5 (VR = 5V)	
S5573	Epoxy SIP (3.8x4.8) Lens									
S3072	3-pin TO-5	ø 3.0	320 to 1060	920	0.6	1.6×10^{-14} (VR = 24V)	10 (VR = 24V)	45 (VR = 24V)	7 (VR = 24V)	60
S3071	3-pin TO-8	ø 5.0	320 to 1060	920	0.6	2.0×10^{-14} (VR = 24V)	10 (VR = 24V)	40 (VR = 24V)	18 (VR = 24V)	100
S1863-01	3-pin ø 14 mm TO-8						10 (VR = 24V)	40 (VR = 24V)		
S3590-01	Ceramic (14.5x12.7)	10 x 10	320 to 1060	920	0.56	3.9×10^{-14} (VR = 30V)	5 (VR = 30V)	30 (VR = 30V)	70 (VR = 30V)	50
S3590-03		10 x 10	320 to 1100	960	0.59	5.3×10^{-14} (VR = 70V)	10 (VR = 70V)	45 (VR = 70V)	50 (VR = 70V)	100
S3590-05		9 x 9	320 to 1060	980	0.6	8.4×10^{-14} (VR = 100V)	30 (VR = 100V)	60 (VR = 100V)	30 (VR = 100V)	150
S2662-03	Ceramic (24x10)	7.5 x 20	320 to 1100	960	0.59	5.3×10^{-14} (VR = 70V)	10 (VR = 70V)	30 (VR = 70V)	75 (VR = 70V)	100
S2744-03	Ceramic (27x14)	10 x 20	320 to 1100	960	0.59	6.1×10^{-14} (VR = 70V)	15 (VR = 70V)	25 (VR = 70V)	100 (VR = 70V)	100
S3204-03	Ceramic (25.5x25.5)	18 x 18	320 to 1100	960	0.59	7.4×10^{-14} (VR = 70V)	20 (VR = 70V)	15 (VR = 70V)	140 (VR = 70V)	100
S3584-03	Ceramic (35.6x35.6)	28 x 28	320 to 1100	960	0.59	9.6×10^{-14} (VR = 70V)	30 (VR = 70V)	5 (VR = 70V)	330 (VR = 70V)	100
S3588-03	Ceramic (34.0x5.8)	3.4 x 30	320 to 1100	960	0.59	6.1×10^{-14} (VR = 70V)	15 (VR = 70V)	40 (VR = 70V)	55 (VR = 70V)	100
S5106	Ceramic (10.6x8.8)	5 x 5	320 to 1100	960	0.72	1.4×10^{-14} (VR = 10V)	5.0 (VR = 10V)	20 (VR = 10V)	60 (VR = 10V)	30
S5107	Ceramic (16.5x4.5)	10 x 10	320 to 1100	960	0.72	2.5×10^{-14} (VR = 10V)	10.0 (VR = 10V)	10 (VR = 10V)	240 (VR = 10V)	30

A wide-range amplifier (C4890) designed for PIN photodiode use is also available, which facilitates detection of high-speed optical signals by connecting the various types of PIN photodiodes.



PIN Silicon Photodiodes



Spectral Response

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HAMAMATSU

▼ PHOTODIODES ▼ APD'S ▼ PHOTOMETRY ▼

FOR GENERAL PHOTOMETRY (Visible Light to IR/Visible Light Only)

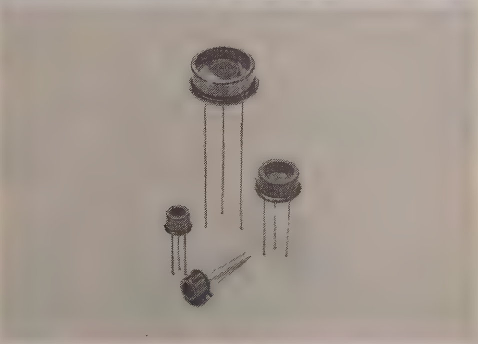
(Ta = 25°C)

Type No.	Package (mm)	Active Area (mm)	Spectral Response λ (nm)	Peak Sensitivity Wavelength λp (nm)	Photo Sensitivity S at λp (A/W)	IR Sensitivity Ratio R/W (%)	Short Circuit Current Isc AT 100LUX 2856k Typ. (μA)	Shunt Resistance Rsh VR = 10mV Max. (GΩ)	Dark Current ID VR = 1V Max. (pA)	Rise Time t_r RL = 1kΩ VR = 0V 10 to 90% (μs)	Terminal Capacitance Ct VR = 0V (pF)	Maximum Reverse Voltage VR MAX. (V)
S1087-01	Ceramic case (5x6)	1.3 x 1.3	320 to 1100	960	0.58	—	1.3	4	10	0.5	200	10
S1087			320 to 730	560	0.3	10	0.16					
S1087-03								2	20	0.2	60	
S2164	Chip carrier type ceramic case (4x5)	1.3 x 1.3	320 to 1100	960	0.58	—	1.6	4	10	0.5	200	10
S2164-01			700 to 1100		0.55		1.2					
S1133-01	Ceramic case (6 x 8)	2.4 x 2.8	320 to 1100	960	0.58	—	5.6	4	10	2.5	700	10
S1133-11								2	20	0.5	200	
S1133			320 to 730	560	0.3	10	0.65	4	10	2.5	700	
S1133-03							0.60	2	20	0.5	200	
S1133-02			320 to 840			20	0.90	4	10	2.5	700	
S1133-12							0.80	2	20	0.5	200	
S1133-14			320 to 1000	720	0.4	—	3.4					
S1133-05			320 to 730	560	0.3	8	0.65					
S1787-08	Epoxy SIP (6 x 8)	2.4 x 2.8	320 to 1100	960	0.58	—	5.6	4	10	2.5	700	
S1787-04			320 to 730	560	0.3	10	0.65					
S1787-06							0.60	2	20	0.5	200	10
S1787-05			320 to 840			20	0.90	4	10	2.5	700	
S1787-07							0.80	2	20	0.5	200	
S4011	4-pin epoxy DIP 4 x 4.8	1.3 x 1.3	320 to 730	560	0.3	10	0.26	4	10	0.5	200	10
S2833	4.5 x 5.5	2.4 x 2.8					0.95			2.5	700	

SILICON AVALANCHE PHOTODIODES (Si APD)

Type No.	Break Down Voltage VB ID = 100μA Typ. (V)	❶ Dark Current ID Max. (nA)	Active Area (mW)	Spectral Response λ (nm)	Cutoff ❶ Frequency f_c RL = 50Ω (MHz)	Gain M λ = 800 (MΩ)
S2381	150	1	ø 0.2	400 to 1000	1200	100
S2382		3	ø 0.5		900	
S2383		6	ø 1.0		700	
S2384		10	ø 3.0		120	60
S2385		30	ø 5/0		40	40

❶ Measured at gain indicated in characteristics table.



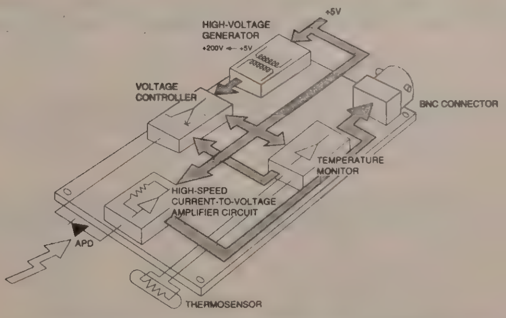
Silicon Avalanche Photodiodes & APD Modules

APD MODULES • C5331 SERIES

- ▼ Evaluation of APD
- ▼ Spatial light transmission
- ▼ Bar code reader
- ▼ Laser rader
- ▼ Optical rangefinder
- ▼ Optical communication

Selection Guide

Parameters	C5331	C5331-01	C5331-02	Units
Active Area	ø 1.5	ø 0.2	ø 0.5	mm
Frequency Bandwidth (-3dB)	0.004 to 100	0.004 to 100	0.004 to 100	MHz
Parameters	**C5331-03**	**C5331-04**	**C5331-05**	**Units**
Active Area	ø 1.0	ø 3	ø 5	mm
Frequency Bandwidth (-3dB)	0.004 to 100	0.004 to 80	0.004 to 50	MHz



Block Diagram

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Brightwater, NJ 08807-0910 • 908-231-0960 • FAX: 908-231-1539
1-800-430-0404

HAMAMATSU

▼ PHOTODIODES ▼ PYROELECTRIC DETECTORS ▼

GaAsP PHOTODIODES

(Ta = 25°C)

Type No.	Package (mm)	Active Area (mm)	Spectral Response λ (nm)	Peak Sensitivity Wavelength λp (nm)	Photo Senesitivity S at λp (A/W)	NEP at λp (W/Hz$^{1/2}$)	Short Circuit Current Isc at 100lx 2856K Typ. ① (µA)	Shunt Resistance Rsh V_R = 10mV Typ. (GΩ)	Dark Current I_D V_R = 1V Max. (pA)	Rise Time t_r R_L = 1KΩ V_R = 0V 10 to 90% (µs)	Terminal Capacitance C_t V_R = 0V (pF)	Maximum Reverse Voltage V_R Max. (V)
Diffusion Type (for Visible Light)												
G1115	TO-18	1.3 x 1.3	300 to 680	640	0.3	1.5×10^{-15}	0.15	80	10	1	300	5
G1116	TO-5	2.7 x 2.7				2.5×10^{-15}	0.6	30	25	4	1400	
G1117	TO-8	5.6 x 5.6				3.5×10^{-15}	2.5	15	50	15	6000	
G1118	Ceramic (5x6)	1.3 x 1.3				1.5×10^{-15}	0.15	80	10	1	300	
G1120	Ceramic (8.9x10.1)	5.6 x 5.6				3.5×10^{-15}	2.5	15	50	15	6000	
G3067	TO-18	1.3 x 1.3				1.5×10^{-15}	0.95	80	10	1	300	
G2711-01	4-pin epoxy DIP	1.3 x 1.3				1.5×10^{-15}	0.18	80	10	1	300	
G1735	TO-18	1.3 x 1.3	400 to 760	710	0.4	2.0×10^{-15}	0.25	25	20	0.5	250	5
G1736	TO-5	2.7 x 2.7				3.2×10^{-15}	1.1	10	50	1.8	1200	
G1737	TO-8	5.6 x 5.6				4.5×10^{-15}	4.5	5	100	10	4500	
G1738	Ceramic (5x6)	1.3 x 1.3				2.0×10^{-15}	0.25	25	20	0.5	250	
G3297	TO-18	1.3 x 1.3				2.0×10^{-15}	1.8	25	20	0.5	250	
Schottky Type (for Ultraviolet to Visible Light)												
G1126-02	TO-5	2.3 x 2.3	190 to 680	610	0.18	5.8×10^{-16}	0.3	15	50	3.5	1800	5
G1127-02	TO-8	4.6 x 4.6				8.0×10^{-16}	1.2	8	100	12	7000	
G2119	Ceramic (15x16.5)	10.1 x 10.1				2.4×10^{-14}	6	0.7	1000	55	25000	
G1746	TO-5	2.3 x 2.3	190 to 760	710	0.22	6.5×10^{-15}	0.65	8	100	3	1600	5
G1747	TO-8	4.6 x 4.6				1.2×10^{-14}	2.4	2.5	200	12	6000	
GaP Photodiodes												
G1961	TO-18	1.1 x 1.1	190 to 550	440	0.12	5.4×10^{-15}	0.05	40	25	5	600	5
G1962	TO-5	2.3 x 2.3				7.6×10^{-15}	0.3	20	50	10	3000	
G1963	TO-8	4.6 x 4.6				1.1×10^{-14}	0.9	10	100	30	12000	

① GaP Photodiodes measured at 1000lx.

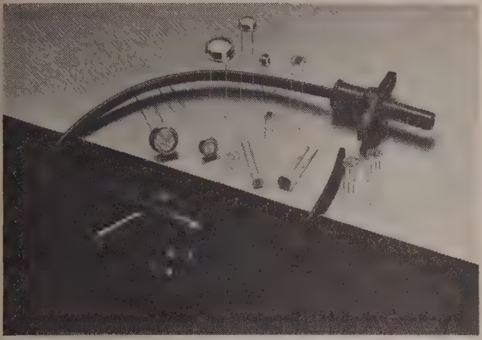
PYROELECTRIC DETECTORS

(Ta = 25°C)

Type No.	Window Material	Active Area (mm)	Spectral Response λ (µm)	Sensitivity Typ. (500, 1) (V/W)	Noise Max. Typ. (µV/Hz$^{1/2}$)	NEP (500, 1, 1) Typ. (W/Hz$^{1/2}$)	D * (500, 1, 1) Typ. (cmHz$^{1/2}$/W)	Rise Time t_r 0 ~63% Typ. (ms)	Temperature Coefficient of Sensitivity Max. (%/°C)	Supply Voltage (V)	Offset Voltage R_L = 22kΩ (V)	Temperature Operating (°C)	Temperature Storage (°C)
Dual Element P2288 Series													
P2288	7µm long-pass filter	2x1 (x2)	7 to 20	1300	15	1.0×1.0^{-9}	1.5×10^{8}	100	0.2	3 to 15	0.2 to 1.5	-20 to +60	-30 to +85
P2288-02	5µm long-pass filter		5 to 20	1500	15	8.5×10^{-10}	1.7×10^{8}						
P2288-09	7µm long-pass filter		7 to 20	1300	15	1.0×1.0^{-10}	1.5×10^{8}						
P2288-10	5µm long-pass filter		5 to 20	1500	15	8.5×10^{-10}	1.7×10^{8}						
Temperature-compensated Single-element P3782 Series Models													
P3782	Silicon	ø2	2 to 20	1500	15	8.5×10^{-10}	1.7×10^{8}	100	0.2	3 to 15	0.2 to 1.0	-20 to +60	-30 to +85
P3782-01	7µm long-pass filter		7 to 20	1300		1.0×10^{-9}	1.5×10^{8}						
* P3782-02	4.3µm band-pass filter		4.3 (HW=80nm)	*3900		5.0×10^{-10}	3.0×10^{8}						
* P3782-03	8-14µm band-pass filter		8 to 14	900		1.0×10^{-9}	2.0×10^{8}						
P3782-05	5µm long-pass filter		5 to 20	1500		8.5×10^{-10}	1.7×10^{8}						
* P3782-12	4.3µm band-pass filter		4.4 (HW=650nm)	*4100		5.0×10^{-10}	3.0×10^{8}						
Thermally-compensated Single-element P4736 Series Models													
* P4736	Silicon	ø2	2 to 20	1500	15	8.5 x 10-10	1.7 x 108	100	0.2	3 to 15	0.2 to 1.0	-20 to +60	-30 to +85
* P4736-01	7µm long-pass filter		7 to 20	1300		1.0 x 10-9	1.5 x 108						
* P4736-05	5µm long-pass filter		5 to 20	1500		8.5 x 10-10	1.7 x 108						
* P4736-12	4.4µm band-pass filter		4.4 (HW=650nm)	* 4100		5.0 x 10-10	3.0 x 108						

* Sensitivity at wavelengths of 4.3µm and 4.4µm. The Pyroelectric Sensor Module H4741 (P2280-01 built in, 36.5(W) x 32.0(H) x 23.5 (D) mm) is also available.

CdS Cells



Cds Cells

(Ta = 25°C)

Type No.	Package (mm)		Maximum Ratings			Characteristics		
			Supply Voltage (Vdc)	Power Dissipation (mW)	Ambient Temp. (°C)	Peak Senesitivity Wavelength Typ. (nm)	Resistance Value 0 lx Ⓑ Min. (MΩ)	Resistance Value 10 lx Ⓒ Min. Max. (KΩ) (KΩ)
P201D-5R	Resin Coating	4.3x5.1	100	50	-30 to +60	520	20	48 to 140
P722-5R			100	70	-30 to +60	560	0.5	5.3 to 15
P380-5R			100	30	-30 to -50	620	20	12 to 36
P1444			100	30	-30 to +50	620	5	10 to 50
P1445			100	30	-30 to +50	620	20	48 to 140
P1201			100	70	-30 to +80	540	5	20 to 60
Ⓐ P1395-01			50	25	-30 to +60	550	0.1	5 to 15
P201D-7R		5.9x7.0	200	100	-30 to +60	520	20	23 to 67
P722-7R			100	150	-30 to +60	560	0.5	2.5 to 7.5
P380-7R			200	50	-30 to +50	620	20	4.4 to 13
P1195			200	100	-30 to +70	550	20	50 to 150
P1202-12			100	150	-30 to +60	560	0.5	3.5 to 14
Ⓐ P2478-01			100	50	-30 to +60	530	1	25 to 75
Ⓐ P1109			100	30	-30 to +50	620	10	15 to 45
P722-10R		8.5x10.1	200	300	-30 to +60	560	0.5	12 to 36
P1096-06			100	100	-30 to +60	550	0.5	2.8 to 8.4
P930-05	Assembly with Vinyl Cord		150	50	-30 to +70	560	0.5	7 to 23
P930-06			150	50	-30 to +70	560	0.5	7 to 23

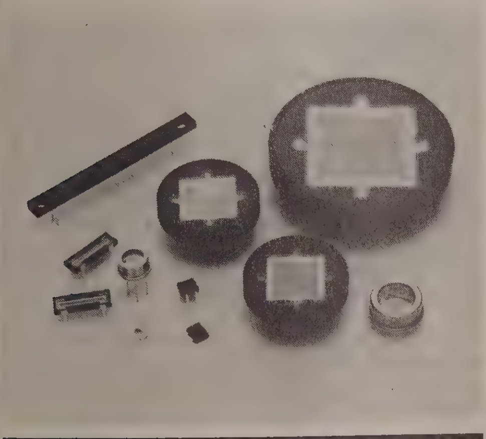
Ⓐ Dual-element cell. Listed data is for one element.

Ⓑ Measured 10 seconds after removal of incident illumination of 10 lux.

Ⓒ Measured with a tungsten lamp of 2856K.

Position Sensitive Detectors (PSD)

The position sensitive detector (PSD) is a sensor used to detect the location of light spots by using the surface resistance of the semiconductor. Because various types of non-separable elements are used, in contrast to MOS and CCD components, electrical signals which correspond to consecutive 1- or 2-dimentional positions can be obtained, providing this unit with superb characteristics such as position analysis and response characteristics.



A Variety of 1-dimensional & 2-dimensional PSDs

Type No.	Active Area	Package
One-dimentional Type		
S3271	1x2 mm	4-pin epoxy mold
S3272	1x2.5 mm	
S3273	1x3 mm	
S3274	1x3.5 mm	
S3979	1x3 mm	Metal case (TO-5)
S3931	1x6 mm	4-pin Ceramic case (4.8x9.2 mm)
S3932	1x12 mm	4-pin Ceramic case (4.8x15.2 mm)
S1662	13x13 mm	Ceramic case (ø 28 mm)
S1352	2.5x34 mm	Ceramic case (9x57 mm)
S3270	1x37 mm	Ceramic case (5x55 mm)
Two-dimentional Type		
S1300 (Duo-lateral type)	13x13 mm	Ceramic case (ø 28 mm)
S1743 (Tetra-lateral type)	4.1x4.1 mm	Metal case (TO-8 ø 14 mm)
S1200 Tetra-lateral type)	13x13 mm	Ceramic case (ø 28 mm)
S1869 Tetra-lateral type)	27x27 mm	Ceramic case (ø 52 mm)
S2044 (Pin-cushion type)	4.7x4.7 mm	Metal case (TO-8 ø 14 mm)
S1880 (Pin-cushion type)	12x12 mm	Ceramic case (ø 28 mm)
S1881 (Pin-cushion type)	22x22 mm	Ceramic case (ø 52 mm)

Spectral response range is either 320 to 1100 nm or 700 to 1100 nm.

MINIGLOSSARY
OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

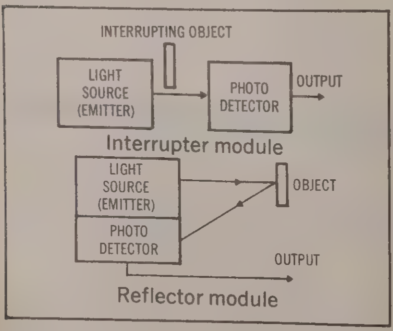
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

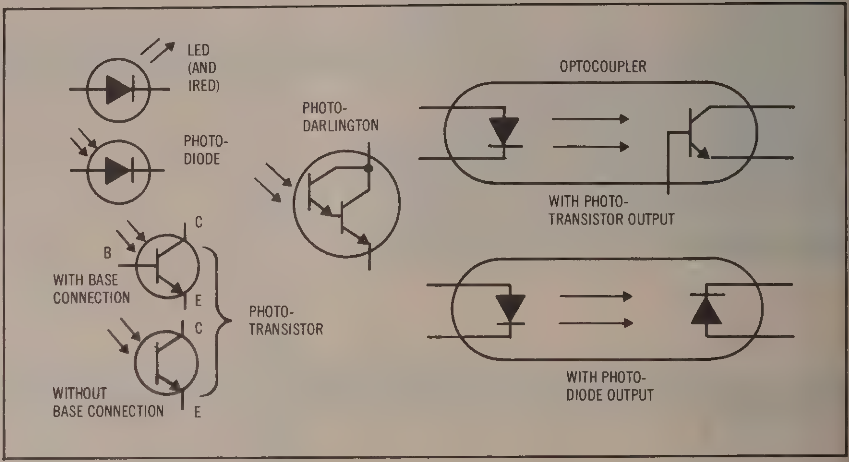
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

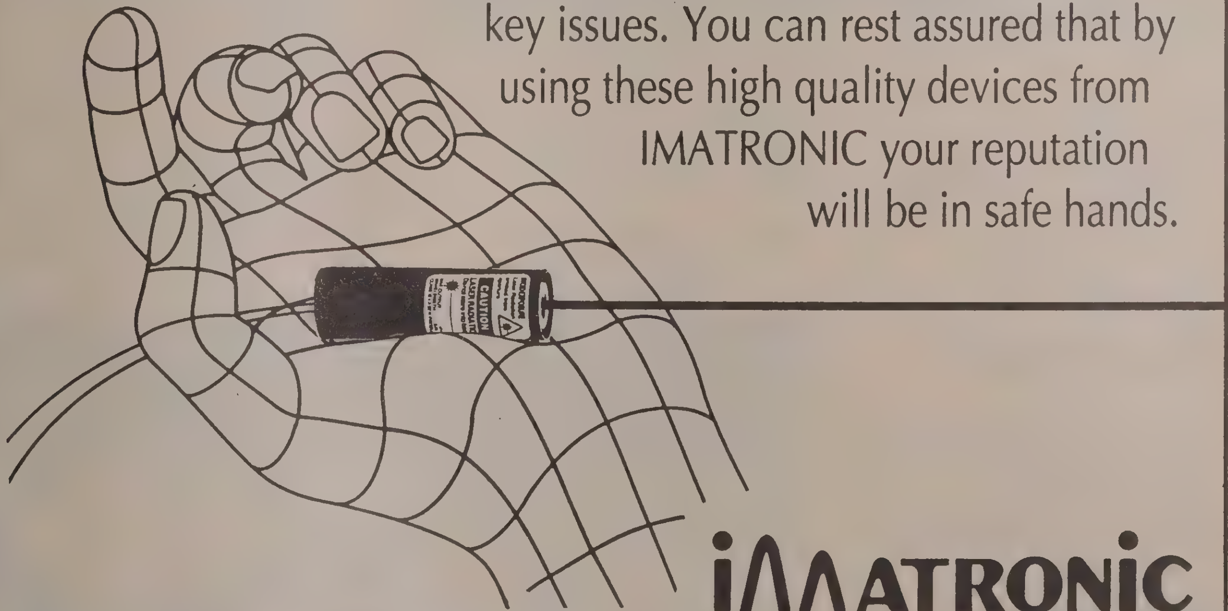
Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

LDM 145

LASER DIODE MODULE

- Visible or infra red
- CW or modulated
- Spot or line optics
- Adjustable focus
- Emission Indicator
- Compact (49 x 16mm)
- Power stabilisation
- Polarity protected
- Rugged and reliable
- OEM versions

The LDM 145 is a precision laser diode module ideally suited to applications where size, reliability and a lifetime's use are the key issues. You can rest assured that by using these high quality devices from IMATRONIC your reputation will be in safe hands.



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MICRO SWITCH
a Honeywell Division

Solid State Sensor Capabilities

Honeywell, MICRO SWITCH division, means one-stop shopping for all commercially available sensors - from electromechanical through solid state.

Solid state sensing capabilities include: optoelectronic, Hall effect, pressure, temperature, air flow, optoelectronic airborne-ordnance-marine sensors, and fiber optic interconnect local area network (LAN) components. We are the complete single source for solid state components to meet your requirements. Our worldwide field specialists can recommend the best sensing solution for all your application needs.

Hall effect, pressure, temperature and airflow sensors are in the Switches section 5100.

Our Richardson, Texas facilities consolidate a full sensor/integrated circuit design capability with a "Class 10" wafer fabrication operation. Our sensor design specialists utilize the most up-to-date technologies and processes to provide you with the best quality solutions, at the best prices worldwide. Real time, Honeywell operated data links allow us to meet your JIT and SPC requirements.

You can get the world's largest lines of standardized catalog listings and customized sensing solutions in:

- Optoelectronic sensors
- Fiber optic sensors
- AOM (airborne-ordnance-marine) optoelectronic sensors.

We offer optoelectronic fiber optic components, modules, and integrated interfaces such as ethernet. Also available are custom-designed or off-the-shelf components and value-added assemblies for government, military and other applications requiring high reliability, radiation hardened, or special packaging. Applications range from satellites to missiles to drilling equipment.

Optoelectronic Sensors

Optoelectronics, the integration of optical principles and semiconductor electronics, has become the technology of choice for many sensing applications. Products include:

- **IREDs** (Infrared Emitting Diodes)
  Hermetic IREDs
  Plastic Encapsulated IREDs
- **Sensors**
  Hermetic Sensors
  Plastic Encapsulated Sensors
  Hermetic Optoschmitts
  Plastic Encapsulated Optoschmitts
- **Transmissive Assemblies**
- **Reflective Assemblies**

General application areas include:

- Object presence sensing
- Motion sensing
- Position encoding
- Non-invasive medical applications
- Limit sensing

Some specific application for Honeywell sensors are:

- Printers
- Tape drives
- Copiers
- Flow meters
- Drop sensors
- Liquid-level sensing
- Thread-break sensing

One of Honeywell's many advantages is the unique transfer molded T-1 package which has no parting line in the optical lens area to interfere with beam emission.

The sensors in Catalog 25 are the standard listings. They offer a broad selection of low cost, off-the-shelf solutions for many applications.

Telephone: 1-800-367-6786
In Texas: 214-470-4271

In addition to the standard products offered in Catalog 25, Honeywell can also provide custom solutions, ranging from special parameter selections, special marking or packaging, to completely customized sensors. Honeywell has a staff of experienced design engineers who are available to provide assistance at any stage of the product development, from R & D through production. Contact one of Honeywell's field sales engineers for further information or design assistance.

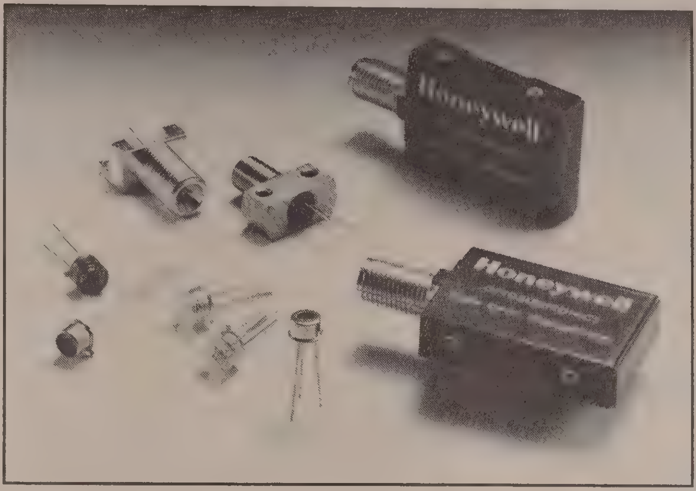
MICRO SWITCH
a Honeywell Division

Other Optoelectronic Products

FIBER OPTICS

Honeywell is a leader in the field of fiber optics. The Fiber Optics group specializes in the design, development and manufacture of active optoelectronic components and subassemblies for the short-haul fiber optic datacom market. Honeywell active fiber optic products are compatible with the majority of standard multimode fiber optic connectors and cables now available in the industry.

Honeywell also offers custom fiber optic products (Dash 900). These products are Honeywell standard products with special testing, selection, documentation and/or minor physical changes to meet special requirements. In addition, Honeywell has the capability for major development programs for new innovative fiber optic products. Technical assistance and additional product data as well as custom capability are available from the Honeywell Sales Offices.



The **Fiber Optic Components Selection Guide** lists the Honeywell standard products now available and includes:

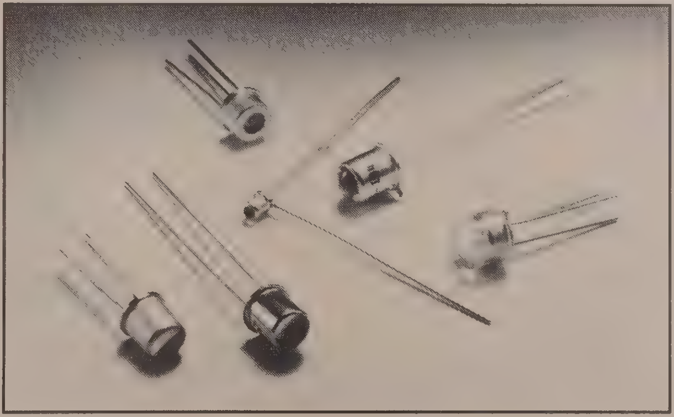
- Connectorized Components
- Fiber Optic Modules
- Fiber Optic LEDs and Integrated Transmitters
- Photo Diodes and Integrated Receivers
- Conversion Information

HIGH RELIABILITY PRODUCTS

Honeywell Optoelectronics has been a leader in advancing both fiber optic and optoelectronics technology. Its products have been used in many different commercial and military applications all over the world.

Both individual optoelectronic components and custom designed and manufactured sub-assemblies have been used in aerospace, missile, land vehicles, aircraft and shipboard systems. Honeywell Optoelectronics' products and sub-assemblies, for example, have been used in the TOW and Hellfire anti-armor missile systems, the Trident submarine navigation system, the heat-seeking Sidewinder air-to-air missile, PAVEWAY glided bombs, and in the M1 Main Battle Tank's fire control system.

Because Honeywell is a leading supplier of both commercial and high-reliability military specification optoelectronic components, it has the largest selection of emitters and detectors of any manufacturer in the industry.



Many of these proven commercial components undergo additional testing in accordance with MIL-S-19500 for vibration, thermal shock, burn-in, constant acceleration and hermeticity. They can be designed for radiation hardened applications, qualifying them for use by defence contractors in their products.

High reliability optoelectronic components from Honeywell are the choice of many major defense contractors because of their proven reliability, their electrical performance and because Honeywell delivers on-time.

SALES AND SERVICE

MICRO SWITCH serves its customers through a worldwide network of sales offices and distributors. For ordering, application assistance, pricing or name of nearest Authorized Distributor, contact a nearby MICRO SWITCH sales office. See the EEM Yellow Pages or contact:

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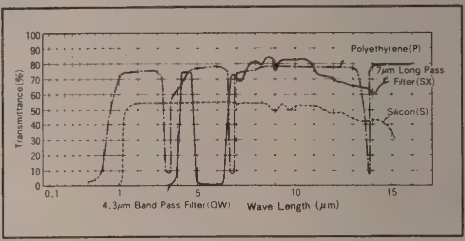
sensors

Pyroelectric Infrared Sensor IRA Series

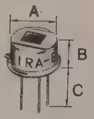
FEATURES
- Low cost
- Broad band response
- High sensitivity
- No cryogenics
- HIC® H8D1779 type preamplifier is available for dual elements.

APPLICATIONS
- Passive IR Intruder Alarm System
- Automatic Door
- Light Switch
- Physical Detectors
- Toy, etc.

SPECTRAL RESPONSE OF WINDOW MATERIALS



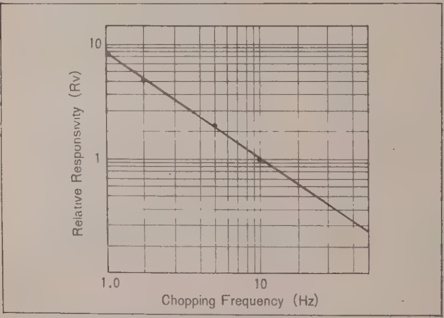
IRA Series



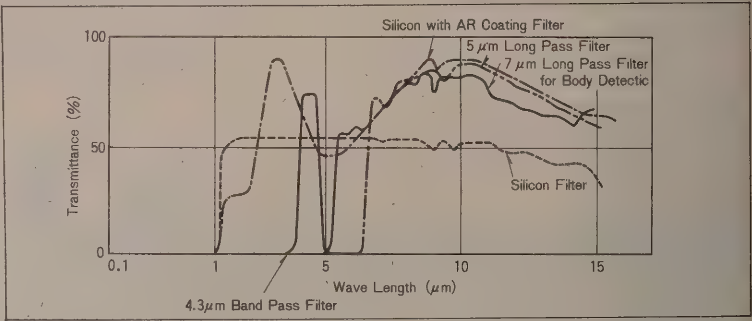
SPECIFICATIONS (At 25°C)

Part Number	Dimensions (mm)			Element	Optical Filter	FoV	Temp. Range
	A	B	C				
IRA-E600S1	ø9.1	5.0	11.0	Dual	1μm	38° x 38°	-25°C to +55°C
IRA-E600ST1	ø9.1	5.0	11.0	Dual	5μm	40° x 40°	-25°C to +85°C
IRA-E100SZ1	ø9.2	5.5	11.0	Dual	7μm	51° x 51°	-25°C to +55°C
IRA-E401S1	ø9.2	4.9	11.0	Dual (single eye)	1μm	17° x 17°	-25°C to +55°C
IRA-E401SX1	ø9.2	4.9	11.0	Dual (single eye)	7μm	17° x 17°	-25°C to +55°C

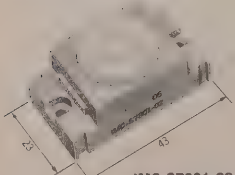
FREQUENCY CHARACTERISTICS



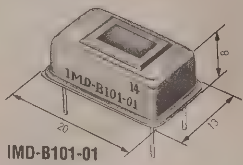
SPECTRAL RESPONSE OF WINDOW MATERIALS



Infrared Sensor Module



IMC-S7801-02



IMD-B101-01
IMD-B102-01

Part Number	Sensing Distance	FOV	Supply Voltage	Current Consumption	Output
IMC-S7801-02	5m	90°X52.5°	3~5 v	2.5mA	Open collector with timer
IMD-B101-01	3.5m (With Fresnel lens IMD-FL01 W/G) 1.0m (With lens)	104°X30° (With Fresnel lens)	5p2.6~5.5 v	0.05mA	Digital & Analog output
IMD-B102-01					Digital output

•IMD-B102-01 has CdS input terminal which control its mode on or off in accordance with the ambient darkness.
•Two fresnel lens models are available for IMD module. IMD-FL01W (White) IMD-FL01G (Grey)

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OPTOELECTRONIC DEVICES

Light Emitting Diodes

Remote Control

Part Number	Material	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristics (T_a = 25°C)			
			P_d (mW)	I_F (mA)	T_{stg} (°C)	V_F TYP. (V) (I_F = 30 mA)	I_R TYP. (μA) (V_R = 3 V)	λp TYP. (nm) (I_F = 30 mA)	P_o TYP. (mW) (I_F = 30 mA)
SE301A	GaAs	High output High reliability	150	100	−65 to +125	1.2 (I_F = 50 mA)	0.01	940 (I_F = 50 mA)	6 (I_F = 50 mA)
SE302A	GaAs	Mini size	75	50	−30 to +80	1.2	0.01	940	1.5
SE303A-C	GaAs	High output Wide radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	8 (I_F = 50 mA)
SE307-C	GaAs	ULTRA High output Narrow radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	30 mW/sr (I_F = 50 mA)
SE308	GaAs	Small package Lateral direction output	100	50	−40 to +100	1.14 (I_F = 20 mA)	0.01	940 (I_F = 20 mA)	0.85 mW/sr (I_F = 20 mA)
SE310	GaAs	High output Small package	150	60	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	11 mW/sr (I_F + 50 mA)
SE313	GaAs	ULTRA High output Middle radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	25 mW/sr (I_F = 50 mA)
SE1003-C	GaAlAs on GaAs	ULTRA High output Wide radiation angle	150	100	−40 to +100	1.27 (I_F = 50 mA)	0.01 (V_R = 5 V)	950 (I_F = 50 mA)	20 mW/sr (I_F = 50 mA)

PIN Photo Diodes

Remote Control

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristics (T_a = 25°C)		
		V_R (V)	P_D (mW)	T_{stg} (°C)	S_{IR} TYP* (μA) (V_R = 5 V)	I_R (nA) (V_R = 10 V)	t_r (ns) (R_L = 1 kΩ) (V_R = 5 V)
PH302	Low cost PIN photo diode	32	150	−40 to +80	6 (S = 50 nA/lx)	to 30	50
PH302B	Low cost PIN photo diode PH302 with visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 30	50
PH302C	Low cost PIN photo diode Built-in visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 30	50
PH309	Low cost PIN photo diode Small Package with Lens Built-in visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 10	30
PH310	Low cost PIN photo diode Ultra Small Package with Lens Built-in visible cut filter	32	150	−40 to +100	5 (S = 32 nA/lx)	to 10	30

*Measured with an infrared LED (λp = 940 nm).
**Measured with a tungsten filament lamp operated at a color temperature of 2 854 K.

See NECEL's other products in Sections 1500, 2450 and 4500.

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OPTOELECTRONIC DEVICES

Photo Transistors

Part Number	Features	Absolute Maximum Ratings ($T_a = 25°C$)				Typical Characteristics ($T_a = 25°C$)		
		P_c (mW)	I_c (mA)	V_{CEO} (V)	T_{stg} (°C)	I_{CEO} (nA) V_{CE} = 10 V L = 0	$V_{CE(sat)}$(V) (L = 1000 lx)	L_L (μA) V_{CE} = 2 V (L = 100 lx)
PH108A	PH108w with Built-in visible cut off filter	100	40	30	−40 to +100	to 100	to 0.3 (I_C = .5 mA) (H = 5 mW/cm²)	0.2 mA to (V_{CE} = 5 V) (H = .5 mW/cm²)
PH108A-T	PH108A with Tape and reel	100	40	30	−40 to +100	to 100	to 0.3 (I_C = .5 mA) (H = 5 mW/cm²)	0.2 mA to (V_{CE} = 5 V) (H = .5 mW/cm²)

Photo ICs

Photo Interrupter

Part Number	Features	Absolute Maximum Ratings ($T_a = 25°C$)			Typical Characteristic ($T_a = 25°C$)	
		V_{CC} (V)	I_{OL} (mA)	T_{opt} (°C)	I_{CCL} (mA) ($V_{CC} = 5$ V)	V_{OL}(V) ($I_{OL} = 16$ mA) ($V_{CC} = 5$ V)
PH502HR	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor	17	50	−30 to +85	to 5	to 0.4
PH502HC	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output	17	50	−30 to +85	to 5	to 0.4 ($R_L = 280Ω$)

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OPTOELECTRONIC DEVICES

Photo ICs (cont.)

Photo Interrupter

Part Number	Features	Absolute Maximum Ratings ($T_a = 25°C$)			Typical Characteristic ($T_a = 25°C$)	
		V_{CC} (V)	I_{OL} (mA)	T_{opt} (°C)	I_{CCL} (mA) ($V_{CC} = 5$ V)	V_{OL}(V) ($I_{OL} = 16$ mA) ($V_{CC} = 5$ V)
PH502LR	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor	17	50	− 30 to + 85	to 5	to 0.4
PH502LC	Built-in Schmitt Trigger circuit Active "LOW" Open collector output	17	50	− 30 to + 85	to 5	to 0.4 ($R_L = 280\Omega$)

Optoisolators

Multichannel Type

Part Number*	Features	Absolute Maximum Ratings ($T_a = 25°C$)			Electrical Characteristics ($T_a = 25°C$)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (µs) (Typ.)	t_f (µs) (Typ.)
PS2501-1 PS2501L-1	4 pin DIP 1 channel	5 k	80	50	80 to 600	3	5
PS2501-2 PS2501L-2	8 pin DIP 2 channels						
PS2501-4 PS2501L-4	16 pin DIP 4 channels						
PS2502-1 PS2502L-1	4 pin DIP 1 channel	5 k	80	200	200 to	100	100
PS2502-2 PS2502L-2	8 pin DIP 2 channels	5 k	80	160	200 to	100	100
PS2502-4 PS2502L-4	16 pin DIP 4 channels						
PS2503-1 PS2503L-1	4 pin DIP 1 channel	5 k	50	30	100 to 400	8 ($R_L = 10$ kΩ)	60 ($R_L = 10$ kΩ)

*L suffix designates lead formed (gullwing) package for surface mount applications.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

Multichannel Type (cont.)

Part Number*	Features	Absolute Maximum Ratings ($T_a = 25°C$)			Electrical Characteristics ($T_a = 25°C$)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2503-2 PS2503L-2	8 pin DIP 2 channels	5 k	50	30	100 to 400	8 ($R_L = 10$ kΩ)	60 ($R_L = 10$ kΩ)
PS2503-4 PS2503L-4	16 pin DIP 4 channels						
PS2505-1 PS2505L-1	4 pin DIP 1 channel	5 k	±80	50	80 to 600	3	5
PS2505-2 PS2505L-2	8 pin DIP 2 channels						
PS2505-4 PS2505L-4	16 pin DIP 4 channels						
PS2506-1 PS2506L-1	4 pin DIP 1 channel	5 k	±80	200	200 to	100	100
PS2506-2 PS2506L-2	8 pin DIP 2 channels	5 k	±80	160	200 to 100		100
PS2506-4 PS2506L-4	16 pin DIP 4 channels						

*L suffix designates lead formed (gullwing) package for surface mount applications.

Surface Mount Type

Part Number**	Features	Absolute Maximum Ratings ($T_a = 25°C$)			Electrical Characteristics ($T_a = 25°C$)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2701-1 PS2701-1-E3	Surface mount 1 channel	2.5 k	50	80	50 to 300	3	5
PS2701-2	Surface mount 2 channels						
PS2701-4	Surface mount 4 channels						
PS2702-1 PS2702-1-E3	Surface mount 1 channel	2.5 k	50	200	200 to	100	100
PS2702-2	Surface mount 2 channels	2.5 k	50	160	200 to	100	100
PS2702-4	Surface mount 4 channels						
PS2703-1 PS2703-1-E3	Surface mount 1 channel	2.5 k	50	30	50 to 4000	10 ($R_L = 1$ kΩ)	10 ($R_L = 1$ kΩ)
PS2703-2	Surface mount 2 channels						

**E3, E4 suffix denote tape and reel versions. Please consult data book.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

Surface Mount Type

Part Number**	Features	Absolute Maximum Ratings ($T_a = 25°C$)			Electrical Characteristics ($T_a = 25°C$)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_c (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2703-4	Surface mount 4 channels	2.5 k	50	30	50 to 400	10 ($R_L = 1$ kΩ)	10 ($R_L = 1$ kΩ)
PS2705-1 PS2705-1-E3	Surface mount 1 channel	2.5 k	±50	80	50 to 300	3	5
PS2705-2	Surface mount 2 channels						
PS2705-4	Surface mount 4 channels						
PS2706-1 PS2706-1-E3	Surface mount 1 channel	2.5 k	±50	200	200 to	100	100
PS2706-2	Surface mount 2 channels	2.5 k	±50	160	200 to	100	100
PS2706-4	Surface mount 4 channels						
PS2707-1 PS2707-1-E3	Surface mount 1 channel	2.5 k	50	30	50 to 400	10 ($R_L = 1$ kΩ)	10 ($R_L = 1$ kΩ)
PS2707-2	Surface mount 2 channels						
PS2707-4	Surface mount 4 channels						

**E3, E4 suffix denote tape and reel versions. Please consult data book.

6 Pin Type

Part Number*	Features	Absolute Maximum Ratings ($T_a = 25°C$)			Electrical Characteristics ($T_a = 25°C$)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_c (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2601 PS2601L	with base pin	5 k	80	50	80 to 600	3	5
PS2602 PS2602L							
PS2603 PS2603L	with base pin	5 k	80	200	200 to	100	100
PS2604 PS2604L							
PS2605 PS2605L	with base pin	5 k	±80	50	80 to 600	3	5
PS2606 PS2606L							
PS2607 PS2607L	with base pin	5 k	±80	200	200 to	100	100
PS2608 PS2608L	with base pin	5 k	±80	200	200 to	100	100
PS2621 PS2621L	with base pin	5 k	150	50	20 to 50	3	5
PS2622 PS2622L							

*L suffix designates lead formed (gullwing) package for surface mount applications.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

6 Pin Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_o (mA)	CTR (%)	t_{PHL} (µs) (Typ.)	t_{PHL} (µs) (Typ.)
PS2625 PS2625L	with base pin	5 k	± 150	50	20 to 50	3	5
PS2626 PS2626L							
PS2633 PS2633L	with base pin	5 k	80	150	1000 to 15000	100	100
PS2634 PS2634L							
PS2651	with base pin	5 k	80	50	50 to 400	3	5
PS2652							
PS2653	with base pin	5 k	80	200	200 to	100	100
PS2654							

*L suffix designates lead formed (gullwing) package for surface mount applications.

Photo SCR Coupler

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)	
		BV ($V_{r.m.s.}$)	V_{DRM} (V)	I_T (mA)	I_{FT} (mA)	t_{on} (µs) (Typ.)
PS3001 (1)	6 pin	2.5 k	200	300	to 12	20 I_{FT} = 50 mA R_{GK} = 27 kΩ V_D = 6 V R_L = 10 Ω
PS3002 (1)	6 pin	2.5 k	400	300	to 12	

Fiber Optic Link

Part Number		Characteristics	Symbol	Conditions	Rating	Unit
PLT101 PLT102 PLR101 PLR102	Link	Data Rate	—	NRZ, T_a = 25°C	DC to 6	Mb/s
		Transmission Distance	—	APF, R_L = 8.2 kΩ, T_a = 25°C	0.2 to 5	m
		Propagation Delay Time (Low to High)	t_{PLH}	APF*1 = 1 m, T_a = 25°C	250 MAX.	ns
		Propagation Delay Time (High to Low)	t_{PHL}	APF = 1 m, T_a = 25°C	250 MAX.	ns
		Pulse Width Distortion	Δt_W	PW = 165 ns, Duty 50%, T_a = 25°C	± 30 MAX.	ns
	Trans-mitter	Supply Current	I_{CC}	R_L = 8.2 kΩ*2	25 MAX.	mA
		Output Power	P_t	APF = 1 m, R_L = 8.2 kΩ, T_a = 25°C	− 15 to − 21	dBm
	Receiver	Supply Current	I_{CC}	—	40 MAX.	mA
		Input Power Level	—	6 Mb/s (NRZ), T_a = 25°C	− 14.5 to − 24	dBm
PLT1101 PLR1101 PLD201	Link	Data Rate	—	NRZ, T_a = 25°C	DC to 6	Mb/s
		Transmission Distance	—	APF, R_L = 1 to 8.2 kΩ, T_a = 25°C	0.1 to 50	m
		Propagation Delay Time (Low to High)	t_{PLH}	APF*1 = 1 m, T_a = 25°C	250 MAX.	ns
		Propagation Delay Time (High to Low)	t_{PHL}	APF = 1 m, T_a = 25°C	250 MAX.	ns
		Pulse Width Distortion	Δt_W	PW = 165 ns, Duty 50%, T_a = 25°C	± 60 MAX.	ns
	Trans-mitter	Supply Current	I_{CC}	R_L = 8.2 kΩ*2	25 MAX.	mA
		Output Power	P_t	APF = 1 m, R_L = 8.2 kΩ, T_a = 25°C	− 11 to − 18	dBm
	Receiver	Supply Current	I_{CC}	—	40 MAX.	mA
		Input Power Level	—	6 Mb/s (NRZ), T_a = 25°C	− 14.5 to − 24	dBm

*1) APF : All Plastic Fiber *2) R_L (Resistance for control of LED current) is connected from pin 2 to pin 3

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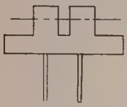
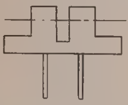
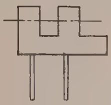
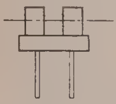
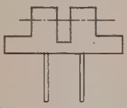
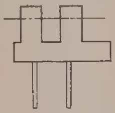
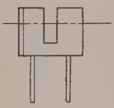
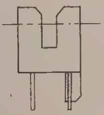
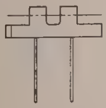
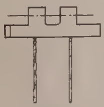
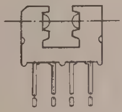
OPTOELECTRONIC DEVICES

Photo Interrupters

Transistor Output Type

Part Number	Outline	Characteristics ($T_a = 25°C$)			Features
		CTR (%)	I_F	V_{CE}	
PS4001		20 to	10 (mA)	2 (V)	Darlington Tr. Aperture: 1 mm□ 4 pin
PS4003		15 to	10	2	Darlington Tr. 4 pin
PS4005		20 to	10	2	Darlington Tr. 4 pin
PS4007		20 to	10	2	Darlington Tr. 4 pin
PS4008		0.5 to	10	2	Single Tr. High speed (t_r, $t_f = 5$ µs) 4 pin
PS4009		20 to	10	2	Darlington Tr. 4 pin
PS4010		20 to	10	2	Darlington Tr. 4 pin
PS4011		20 to	10	2	Darlington Tr. Aperture: 1 mm□ 4 pin
PS4501		2.5 to	10	2	Single Tr. Aperture: 0.5 mm slit 4 pin
PS4502		200 to	5	2	Darlington Tr. Aperture: 0.5 mm slit High CTR 4 pin
PS4601		1.5 to	10	2	One-piece molded Single Tr. 4 pin

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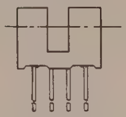
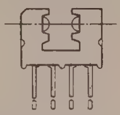
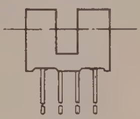
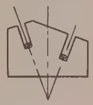
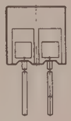
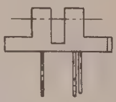
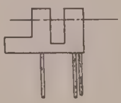
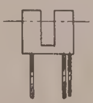
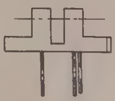
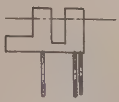
OPTOELECTRONIC DEVICES

Photo Interrupters (cont.)

Transistor Output Type

Part Number	Outline	Characteristics ($T_a = 25°C$)			Features
		CTR (%)	I_F	V_{CE}	
PS4602		1.5 to	10	2 (V)	One-piece molded PS4601 with a light-shielded case Single Tr. 4 pin in-line
PS4651		40 to	5	2	One-piece molded Darlington Tr. 4 pin
PS4652		40 to	5	2	One-piece molded PS4651 with a light-shielded case Darlington Tr. 4 pin
PS6001A		100 (μA) to	≈30 speculum reflecting surface	5	Photo Reflective Sensor Single Tr. 4 pin
PS6002		400 (μA) Typ.	10 white reflecting surface	2	Photo Reflective Sensor Single Tr. High sensitivity 4 pin

IC Output Type

Part Number	Outline	Characteristics ($T_a = 25°C$)		Features
		I_{FLH} (mA)	(V_{CC} (V)	
PS5001HC		to 5	5 $R_L = 280\ \Omega$	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5002HC		to 5	5 $R_L = 280\ \Omega$	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5003HC		to 5	5 $R_L = 280\ \Omega$	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5001HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5002HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin

See NECEL's other products in Sections 1500, 2450 and 4500.

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NEC

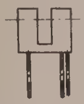
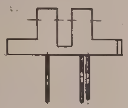
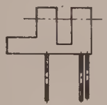
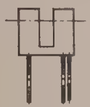
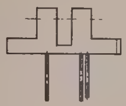
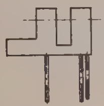
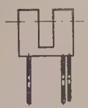
NEC Electronics Inc.
475 Ellis St., Mountain View, CA 94039-7241
Telephone: 1-800-366-9782 FAX #: 1-800-729-9288

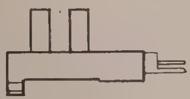
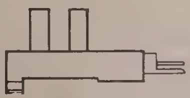
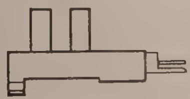
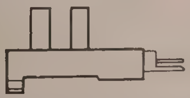
OPTOELECTRONIC DEVICES

Photo Interrupters (cont.)

IC Output Type (cont.)

**CONNECTOR: EI 3 pin series 17825-3 made by AMP

Part Number	Outline	Characteristics ($T_a = 25°C$) I_{FLH} (mA)	Characteristics ($T_a = 25°C$) (V_{CC} (V)	Features
PS5003HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5001LC		to 5	5 $R_L = 280\ \Omega$	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5002LC		to 5	5 $R_L = 280\ \Omega$	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5003LC		to 5	5 $R_L = 280\ \Omega$	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5001LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5002LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin
PS5003LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm$^{\square}$) 5 pin

Part Number	Outline	Characteristics ($T_a = 25°C$) V_{OH} (mA)	Characteristics ($T_a = 25°C$) Condition	Features
PS5501HC-1		$V_{CC} \times 0.8$ to	opened aperture $R_L = 47\ k\Omega$	Built-in Schmitt Trigger circuit Housing with a connector** Active "HIGH" Open collector output Aperture: 0.5mm slit; 3 pin
PS5501HR-1		$V_{CC} \times 0.8$ to	opened aperture	Built-in Schmitt Trigger circuit Housing with a connector** Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit; 3 pin
PS5501LC-1		$V_{CC} \times 0.8$ to	closed aperture $R_L = 47\ k\Omega$	Built-in Schmitt Trigger circuit Housing with a connector** Active "LOW" Open collector output Aperture: 0.5mm slit; 3 pin
PS5501LR-1		$V_{CC} \times 0.8$ to	closed aperture	Built-in Schmitt Trigger circuit Housing with a connector** Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit; 3 pin

See NECEL's other products in Sections 1500, 2450 and 4500.

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PHILIPS DISCRETE SEMICONDUCTORS

TEMPERATURE SENSORS

TEMPERATURE SENSORS

TYPE	PACKAGE OUTLINE	TEMPERATURE RANGE (°C)	RESISTANCE		SENSOR ACCURACY at T_{amb}		SENSOR CURRENT (mA)
			R (Ω)	at T_{amb} (°C)	(°C)	(°C)	
KTY81-110	SOD-70	– 55 to 150	990 to 1010	25	± 1.3	25	1
KTY81-120 (note 1)	SOD-70	– 55 to 150	980 to 1020	25	± 2.5	25	1
KTY81-121	SOD-70	– 55 to 150	980 to 1000	25	± 1.3	25	1
KTY81-122	SOD-70	– 55 to 150	1000 to 1020	25	± 1.3	25	1
KTY81-150 (note 2)	SOD-70	– 55 to 150	950 to 1050	25	± 6.3	25	1
KTY81-151	SOD-70	– 55 to 150	950 to 1000	25	± 3.2	25	1
KTY81-152	SOD-70	– 55 to 150	1000 to 1050	25	± 3.2	25	1
KTY81-210	SOD-70	– 55 to 150	1980 to 2020	25	± 1.3	25	1
KTY81-220 (note 1)	SOD-70	– 55 to 150	1960 to 2040	25	± 2.5	25	1
KTY81-221	SOD-70	– 55 to 150	1960 to 2000	25	± 1.3	25	1
KTY81-222	SOD-70	– 55 to 150	2000 to 2040	25	± 1.3	25	1
KTY81-250 (note 2)	SOD-70	– 55 to 150	1900 to 2100	25	± 6.3	25	1
KTY81-251	SOD-70	– 55 to 150	1900 to 2000	25	± 3.2	25	1
KTY81-252	SOD-70	– 55 to 150	2000 to 2100	25	± 3.2	25	1
KTY82-110	SOT-23	– 55 to 150	990 to 1010	25	± 1.3	25	1
KTY82-120 (note 1)	SOT-23	– 55 to 150	980 to 1020	25	± 2.5	25	1
KTY82-121	SOT-23	– 55 to 150	980 to 1000	25	± 1.3	25	1
KTY82-122	SOT-23	– 55 to 150	1000 to 1020	25	± 1.3	25	1
KTY82-150 (note 2)	SOT-23	– 55 to 150	950 to 1050	25	± 6.3	25	1
KTY82-151	SOT-23	– 55 to 150	950 to 1000	25	± 3.2	25	1
KTY82-152	SOT-23	– 55 to 150	1000 to 1050	25	± 3.2	25	1
KTY82-210	SOT-23	– 55 to 150	1980 to 2020	25	± 1.3	25	1
KTY82-220 (note 1)	SOT-23	– 55 to 150	1960 to 2040	25	± 2.5	25	1
KTY82-221	SOT-23	– 55 to 150	1960 to 2000	25	± 1.3	25	1
KTY82-222	SOT-23	– 55 to 150	2000 to 2040	25	± 1.3	25	1
KTY82-250 (note 2)	SOT-23	– 55 to 150	1900 to 2100	25	± 6.3	25	1
KTY82-251	SOT-23	– 55 to 150	1900 to 2000	25	± 3.2	25	1
KTY82-252	SOT-23	– 55 to 150	2000 to 2100	25	± 3.2	25	1
KTY83-110	DO-34	– 55 to 175	990 to 1010	25	± 1.3	25	1
KTY83-120 (note 1)	DO-34	– 55 to 175	980 to 1020	25	± 2.6	25	1
KTY83-121	DO-34	– 55 to 175	980 to 1000	25	± 1.3	25	1
KTY83-122	DO-34	– 55 to 175	1000 to 1020	25	± 1.3	25	1
KTY83-150 (note 2)	DO-34	– 55 to 175	950 to 1050	25	± 6.6	25	1
KTY83-151	DO-34	– 55 to 175	950 to 1000	25	± 3.3	25	1
KTY83-152	DO-34	– 55 to 175	1000 to 1050	25	± 3.3	25	1
KTY84-130	DO-34	– 40 to 300	970 to 1030	100	± 4.8	100	2
KTY84-150 (note 2)	DO-34	– 40 to 300	950 to 1050	100	± 8.0	100	2
KTY84-151	DO-34	– 40 to 300	950 to 1000	100	± 4.0	100	2
KTY84-152	DO-34	– 40 to 300	1000 to 1050	25	± 4.0	100	2
KTY85-110	SOD-80	– 40 to 125	990 to 1010	25	± 1.3	25	1
KTY85-120 (note 1)	SOD-80	– 40 to 125	980 to 1020	25	± 2.6	25	1
KTY85-121	SOD-80	– 40 to 125	980 to 1000	25	± 1.3	25	1
KTY85-122	SOD-80	– 40 to 125	1000 to 1020	25	± 1.3	25	1

continued...

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PHILIPS DISCRETE SEMICONDUCTORS

TEMPERATURE SENSORS, MAGNETIC FIELD SENSORS, SENSOR HYBRID MODULES

TEMPERATURE SENSORS continued

TYPE	PACKAGE OUTLINE	TEMPERATURE RANGE (°C)	RESISTANCE		SENSOR ACCURACY at T_{amb}		SENSOR CURRENT (mA)
			R (Ω)	at T_{amb} (°C)	(°C)	(°C)	
KTY85-150 (note 2)	SOD-80	– 40 to 125	950 to 1050	25	± 6.6	25	1
KTY85-151	SOD-80	– 40 to 125	950 to 1000	25	± 3.3	25	1
KTY85-152	SOD-80	– 40 to 125	1000 to 1050	25	± 3.3	25	1
KTY86-205	SOD-103	– 40 to 150	1990 to 2010	25	± 0.7	25	0.1
KTY87-205	SOD-103	– 40 to 125	1990 to 2010 3327 to 3361	25 100	± 0.7 ± 0.8	25 100	0.1 0.1

Notes

1. Contains the groups – 21 and – 22, which are marked accordingly.
2. Contains the groups – 51 and – 52, which are marked accordingly.

MAGNETIC FIELD SENSORS

TYPE	PACKAGE OUTLINE	FIELD RANGE (kA/m) (note 1)	SUPPLY VOLTAGE (V)	T_{amb} (°C)	SENSITIVITY mV/V kA/m	BRIDGE RESISTANCE (kΩ)
KM110B/1	SOT-195	– 2.0 to 2.0	5	– 40 to 150	1.7	2.1
KMZ10A	SOT-195	– 0.5 to + 0.5	5	– 40 to 150	16	1.2
KMZ10A1	SOT-195	– 0.5 to + 0.05 (note 2)	5	– 40 to 150	22 (note 2)	1.3
KMZ10B	SOT-195	– 2.0 to + 2.0	5	– 40 to 150	4	2.1
KMZ10C	SOT-195	– 7.5 to + 7.5	5	– 40 to 150	1.5	1.4

Notes

1. In air, 1kA/m corresponds to approximately 12.5 G or 1.25 mT.
2. With switched Hx.

SENSOR HYBRID MODULES

Sensor for rotational speed measurement and reference- mark detection

TYPE	PACKAGE OUTLINE	SENSING DISTANCE (mm) (note 1)	SENSING FREQUENCY (Hz)	MOUNTING DIRECTION RELATIVE TO GEAR WHEEL	DETERMINATION OF ROTATIONAL DIRECTION
KM110BH/11	fig. 1	2.5	0 to 3000	tangential	N
KM110BH/12	fig. 1	3.5	1 to 3000	tangential	N
KM110BH/13	fig. 2	2.5	0 to 3000	radial	N
KM110BH/14	fig. 2	3.5	1 to 3000	radial	N
KM110BH/31	fig. 3	3.0	2 to 50,000	radial	Y

Note

1. Gear wheel: pitch diameter = 44 mm; width = 16 mm; module 2; material; steel (1.0715).

Sensor modules for angle measurement

TYPE	PACKAGE OUTLINE	ANGLE RANGE (deg)	OUTPUT VOLTAGE (note 1) (V)	SUPPLY VOLTAGE (V)	T_{amb} (°C)
KM110BH/2130	fig. 4	30	0.5 to 4.5; linear	5	– 40 to 125
KM110BH/2190	fig. 4	90	0.5 to 4.5; sinusoidal	5	– 40 to 125

Note

1. Sensor signal is generated by a magnetic field H = 100 kA/m. For example: rare earth magnet, 11.2 × 5.5 × 8.0 mm, distance 2.5 mm from KMZ chip.

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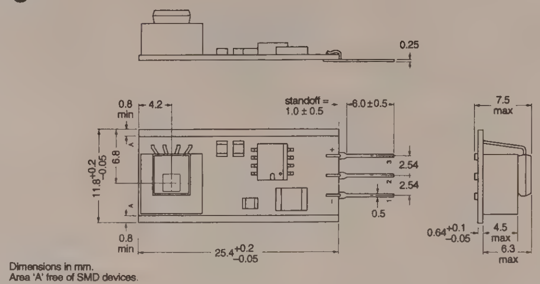
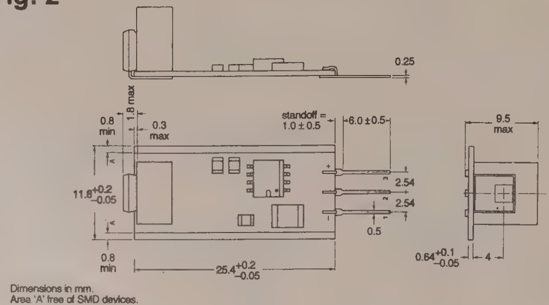
Fig. 1


0.25
0.8 min
4.2
standoff = 1.0 ± 0.5
6.0±0.5
7.5 max
11.8 +0.2 −0.05
6.8
2.54
2.54
0.5
0.8 min
25.4 +0.2 −0.05
0.64 +0.1 −0.05
4.5 max
6.3 max
A

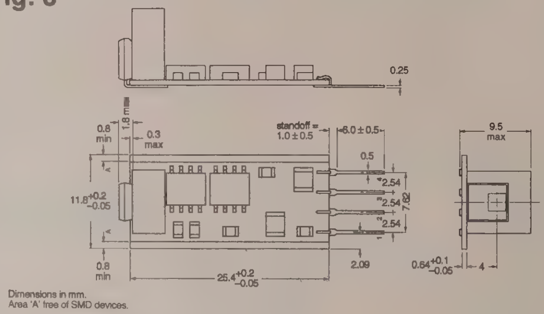
Dimensions in mm.
Area 'A' free of SMD devices.

Fig. 2


0.25
1.8 max
0.8 min
0.3 max
standoff = 1.0 ± 0.5
6.0±0.5
9.5 max
11.8 +0.2 −0.05
2.54
2.54
0.5
0.8 min
25.4 +0.2 −0.05
0.64 +0.1 −0.05
4
A

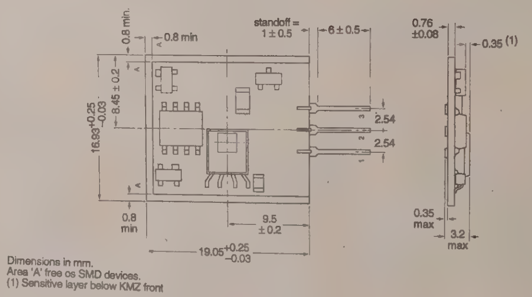
Dimensions in mm.
Area 'A' free of SMD devices.

Fig. 3


0.25
1.8 max
0.8 min
0.3 max
standoff = 1.0 ± 0.5
6.0±0.5
9.5 max
0.5
2.54
2.54
2.54
7.62
11.8 +0.2 −0.05
0.8 min
25.4 +0.2 −0.05
2.09
0.64 +0.1 −0.05
4
A

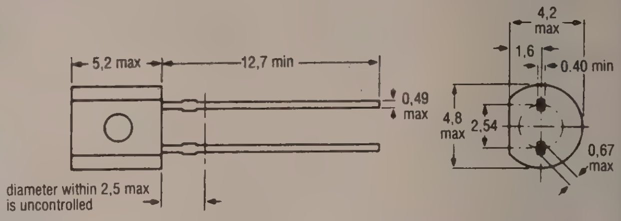
Dimensions in mm.
Area 'A' free of SMD devices.

Fig. 4

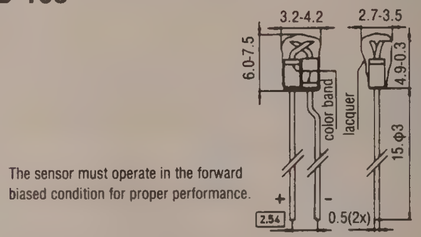

0.8 min.
0.8 min
standoff = 1 ± 0.5
6 ± 0.5
0.76 ±0.08
0.35 (1)
16.93 +0.25 −0.03
8.45 ± 0.2
2.54
2.54
0.8 min
9.5 ±0.2
19.05 +0.25 −0.03
0.35 max
3.2 max
A

Dimensions in mm.
Area 'A' free os SMD devices.
(1) Sensitive layer below KMZ front

SOD-70

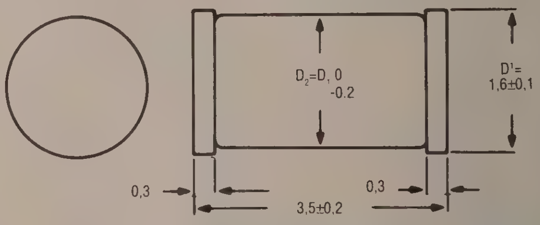

5,2 max
12,7 min
0,49 max
diameter within 2,5 max is uncontrolled
4,2 max
1,6
0,40 min
4,8 max
2,54
0,67 max

SOD-103

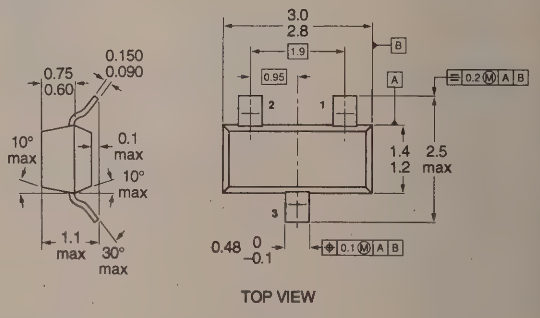

3.2-4.2
2.7-3.5
6.0-7.5
4.9-0.3
color band
lacquer
15 ф3
+
−
2.54
0.5(2x)

The sensor must operate in the forward biased condition for proper performance.

SOD-80

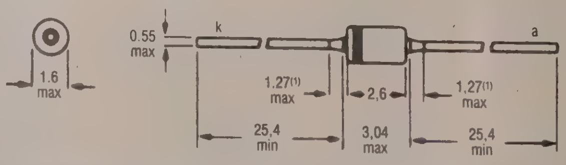

D₂=D, 0 -0.2
D¹= 1,6±0,1
0,3
0,3
3,5±0,2

SOT-23

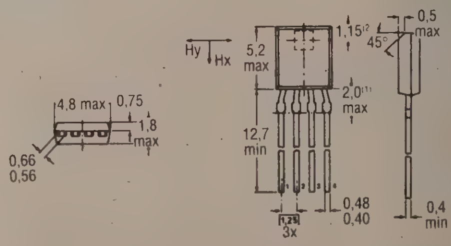

0.75 0.60
0.150 0.090
10° max
0.1 max
10° max
1.1 max
30° max
3.0 2.8
1.9
0.95
B
A
0.2 Ⓜ A B
2
1
1.4 1.2
2.5 max
3
0.48 0 −0.1
0.1 Ⓜ A B
TOP VIEW

Dimensions in mm.
Weight: 0.01 g.

DO-34


0.55 max
k
a
1.6 max
1.27(1) max
2,6
1.27(1) max
25,4 min
3,04 max
25,4 min

SOT-195


Hy
Hx
4,8 max
0,75
1,8 max
0,66 0,56
5,2 max
1,15
45°
0,5 max
2,0 max
12,7 min
0,48 0,40
0,4 min
1,27 3x

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Cds/CdSe PHOTOCONDUCTIVE CELLS • OPTICALLY COUPLED ISOLATORS • SILICON PHOTODIODES AND PHOTODIODE ARRAYS • INFRARED LEDS • PHOTOTRANSISTORS • OPTOELECTRONIC ASSEMBLIES

CdS & CdSe PHOTOCELLS

Cell Type No.	Spectral Response Peak nm	Typical 2.0 Ftc. Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt	Max. Power mW.	Description
NSL-4440	515	67.0	50.0	1000	1000	1" Cell in Hermetically sealed
NSL-4450	515	14.5	15.0	1000	1000	package. Plastic Encapsulated
NSL-4460	515	6.5	5.0	1000	1000	versions available.
NSL-4470	515	3.0	0.500	1000	1000	
NSL-4960	515	9.5	4.0	320	500	TO-8 Hermetically sealed package.
NSL-4970	515	4.10	0.540	320	500	Additional resistance ranges
NSL-4980	515	64.00	100.0	320	500	available.
NSL-5910	550	1.5	0.100	170	500	
NSL-5920	550	3.0	0.200	170	500	
NSL-6910	690	0.25	0.067	170	500	
NSL-6940	690	1.50	1.0	170	500	
NSL-7910	615	7.50	1.5	250	500	
NSL-9910	550	11.00	7.3	170	500	
NSL-4932	515	0.95	0.400	80	250	TO-8 Plastic Encapsulated Package.
NSL-4942	515	0.40	0.050	80	250	Additional resistance ranges
NSL-4952	515	22.50	32.0	320	250	available.
NSL-5912	550	1.50	0.100	170	250	
NSL-5932	550	6.00	0.400	250		
NSL-5942	550	9.0	0.600	250	250	
NSL-6922	690	0.51	0.300	170	250	
NSL-6952	690	2.70	0.720	170	250	
NSL-9912	550	11.00	7.3	170	250	
NSL-3510	725	2.70	18.0	120	200	TO-5 Hermetically sealed package.
NSL-4510	515	24.0	65.0	120	200	Additional resistance ranges
NSL-4520	515	10.5	15.0	120	200	available.
NSL-5510	550	3.3	0.220	120	200	
NSL-5520	550	10.0	0.670	120	200	
NSL-6510	690	0.6	0.400	120	200	
NSL-6520	690	1.2	0.800	120	200	
NSL-7510	615	2.7	0.450	120	200	
NSL-7530	615	10.0	6.7	120	200	
NSL-9510	550	30.0	20.0	120	200	
NSL-4532	515	4.5	1.8	120	125	TO-5 Plastic Encapsulated Package.
NSL-4542	515	1.9	0.250	120	125	Additional resistance ranges
NSL-4552	515	185.0	200.0	320	125	available.
NSL-5532	550	165.0	11.0	320	125	
NSL-5542	550	30.0	20.0	120	125	
NSL-6522	690	1.2	0.800	120	125	
NSL-6532	690	30.0	20.0	320	125	
NSL-7542	615	100.0	67.0	250	125	
NSL-7552	615	600.0	400.0	320	125	
NSL-9512	550	32.0	20.0	120	125	
NSL-3110	725	6.0	40	100	50	TO-18 Hermetically sealed package.
NSL-4120	515	42.0	10	80	50	Additional resistance ranges
NSL-4140	515	8.0	0.200	80	50	available.
NSL-5110	550	10.0	0.670	100	50	
NSL-5130	550	84.0	5.6	100	50	
NSL-6110	690	2.0	1.3	100	50	
NSL-6120	690	4.0	2.6	100	50	
NSL-7110	615	6.0	1.0	100	50	
NSL-7120	615	66.0	11.0	100	50	
NSL-9110	550	15.0	10.0	60	50	
NSL-4152	515	310.0	100.0	320	50	TO-18 Plastic Encapsulated Package.
NSL-4162	515	146.0	100.0	320	50	Additional resistance ranges
NSL-4172	515	62.0	50.0	320	50	available.
NSL-4182	515	28.0	5.0	160	50	
NSL-5152	550	15.0	10.0	70	50	
NSL-5162	550	100.0	67.0	100	50	
NSL-6112	690	2.0	1.3	100	50	
NSL-7142	615	4.5	3.0	70	50	
NSL-7152	615	24.0	16.0	100	50	
NSL-9122	550	100.0	67.0	100	50	

UV SENSITIVE LDRs

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt	Max. Power MW	Description
NSL-21UV/3	1.7	0.2	80	200	0.5" Plastic Case
NSL-21UV/6	17.0	1	320	200	with Phosphor-Coated
					Quartz Window

PIN PHOTODIODES

NSL Type No.	Light Current* MA	Dark Current nA	Rise Time nS	Fall Time nS	Description
NSL-530	0.3	10	3	6	TO-18 Package
NSL-580	1.5	.30	5	8	TO-5

*At 500 Ftc (25 MW/cm²) 2870°K Source

PHOTODETECTOR LAMP/LED ASSEMBLIES

	Emitter		Detector				
Module Type No.	Volts	Current mA	MAX ON Res. Ω	MAX OFF Res. Ω	MAX Volts	MAX Power mV	Description
PLT-10384	10	15	250	10	80	100	Tube Package.
PLT-10387	10	15	3000	50	320	100	Axial Leads.
PLT-2H384	200	02	500	10	80	100	
PLT-2H387	200	02	10000	50	320	100	
NSL-26		16	2000	10	120	200	Tube Package.
NSL-28		16	400	10	100	50	Axial Leads.
NSL-32		20	500	0.500	60	50	
NSL-34		16	1.2Meg	1000	3.5K	400	
NSL-36		40	400	0.500	220	200	
NSL-37		16	200	3.0	120	175	
NSL-39		16	500	1.0	100	125	

INFRARED EMITTING DIODES

Cell Type No.	λpK (nm)	Typical Output Power Po (mW)	Description
SLED-561L	940	3.0	GaAs IR LED in a lensed or
SLED-561F	940	3.0	flat window hermetic package
SLED-562L	880	4.5	GaAlAs IR LED in a lensed or
SLED-562F	880	4.5	flat window hermetic package

Special Selections Available

SILICON NPN PLANAR EPITAXIAL PHOTOTRANSISTORS

Cell Type No.	Light Current 5mW/cm²	BV_{CEO} @ .1mA	Dark Current I_D (nA)	Description
SLT-50L1	≥.6mA	≥40V	25	NPN planar epitaxial
SLT-50L2	≥1.2	≥40	25	phototransistors in a
SLT-50L3	≥2.4	≥40	25	hermetic package with
SLT-50L4	≥4.0	≥40	40	lensed window
SLT-50L5	≥6.0	≥40	40	
SLT-50L6	≥12.0	≥40	40	
SLT-50F1	≥.2mA	≥40V	50	NPN Planar epitaxial
SLT-50F2	≥.4	≥40	50	phototransistors in a
SLT-50F3	≥1.0	≥40	50	hermetic package with
SLT-50F4	≥2.5	≥40	50	flat window

Special Selections Available

SILICON NPN PLANAR EPITAXIAL PHOTODARLINGTONS

Cell Type No.	Light Current 2.0mW/cm²	Light Current 0.2mW/cm²	BV_{CEO} @.1mA	Dark Current I_D (nA)	Description
SLR-50F1	≥2mA		≥40V	100	TO-18 flat lensed
SLR-50F2	≥6mA		≥40	100	hermetic package
SLR-50L1		0.5mA	≥40	100	TO-18 high profile
SLR-50L2		2.0mA	≥40	100	lensed hermetic package

SILICON SOLDERABLE PLANAR PHOTODIODES

Cell Type No.	Min. Short Ct.* Curr. mA	Min. Open Ct.* Volt	Dark Curr. uA @ 5V @ 25°C	Reverse Voltage Recom. Max	Description
SLSD-71N1-9	0.4	0.35	2.0	25	9 element cell, 0.1" pitch
SLSD-71N2	0.6	0.35	3.0	20	.2" x .2" chip with leads
SLSD-71N3	1.6	0.35	5.0	15	.2" x .4" chip with leads
SLSD-71N4	1.5	0.35	5.0	15	.1" x 1" chip with leads
SLSD-71N5	3.0	0.35	3.0	15	.4" x .4" chip with leads
SLSD-71N6	3.5	0.35	3.0	15	.2" x 1" chip with leads
SLSD-71N7	5.0	0.35	5.0	15	.760" x .354" chip with leads

*AT 500 Ftc (25mW/cm²) 2870°K Source

SILICON PLANAR PHOTODIODES

Cell Type No.	Short Ck. Current 5mW/cm² (μA)	Dark Current @ – 100mV (nA)	Junction Cap.max. (pF)	Area (cm²)	Description
SLD-69C1	150	100	400	0.193	Featuring high linearity,
SLD-70C1	20	25	50	0.025	low dark current and fast
SLD-70C2	75	50	200	0.126	response in a low cost
SLD-52C1	25	10	50	0.025	ceramic package. Available with visible blocking epoxy
SLD-53C1	100	25	200	0.126	filter or BG filter.

SILICON PLANAR PHOTODETECTORS

Cell Type No.	mA	(V)	uA @ 5V @ 25°C	Break-down Voltage (V)	Description
SLD-65HF	800	0.35	20	30	TO-8 Flat window
SLD-67HF	600	0.35	10	30	TO-5 Flat window
SLD-67HF3	400	0.35	10	40	TO-5 Flat window
SLD-67BG	70	0.33	10	40	TO-5 BG Flat window
SLD-68HL	150	0.30	10	40	TO-18 High Lens
SLD-68HF	30	0.30	10	40	TO-18 Flat Window
SLD-68LBG	25	0.30	10	40	TO-18 BG Lens
SLD-68FBG	15	0.30	10	40	TO-18 BG Flat Window

*AT 500 Ftc (25mW/cm²) 2870°K Source

SILONEX inc

331 Cornelia St.
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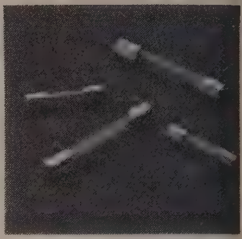
FUSE PRODUCTS



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bel...defining a degree of excellence in quality and service for over 40 years in the electronics industry. bel is your full line fuse source, worldwide. bel specializes in:

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- **Pre-assembled Fuses & Clips**
- **Locking Fuse Clips**
- **"Euroform" Micro Fuse**
- **UL /Semko Approved Fuses**

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91893 Orsay, France
Tel: 331-694-10402
Fax: 331-694-13320

CIRCUIT BREAKERS/ CIRCUIT PROTECTORS

Manufacturer	Starting EEM Page No.	Circuit Breakers		Surge Limiters/ Protectors,	Transient Voltage Suppressors	Data Line Protectors	Conformance						
		Thermal	Magnetic				UL	CSA	DEMKO	SEMKO	SEV	VDE	MIL
Altech Corp.	B•1342	√		√			√	√	√	√		√	
Amber Industries	B•1343			√									
Carlingswitch Inc.	B•1350		√				√	√				√	
Corcom	B•1352				√								
ETA Circuit Breakers	B•1353	√	√				√	√	√	√	√	√	√
Heinemann Products	B•1360	√	√				√	√			√	√	√
ISKRA Electronics	B•1364												
KCK America, Inc.	B•1365			√	√		√						
Littelfuse Electronic Div.	B•1366	√				√	√						
MGG Electronics	B•1368			√	√	√							
Mechanical Products	B•1369	√				√	√		√		√	√	
Philips Technologies	B•1378	√				√	√			√		√	
Polyphaser Corp.	B•1379	√	√	√			√						
Potter & Brumfield	B•1380	√	√				√	√	√		√	√	
PPD Inc.	B•1383			√	√								
Raychem Corp.	B•1384	√					√	√					
Therm-O-Disc	B•1389	√				√	√	√	√	√	√		
Weber U.S. Inc.	B•1391	√				√	√	√	√	√	√		
Wickmann U.S.A.	B•1394			√	√		√						
World Products	B•1399			√	√	√	√						

FUSES

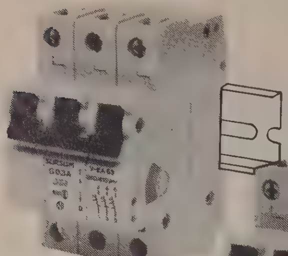
Manufacturer	Starting EEM Page No.	Normal Action	Slow Blowing	Fast Action	Failure Indicating	Rectifier	Miniature Submin.	Clips & Holders	Conformance						
									UL	CSA	DEMKO	SEMKO	SEV	VDE	MIL
Bel Fuse Inc.	B•1344	√	√	√			√	√	√	√		√			
Carlingswitch	B•1350								√	√	√	√	√	√	
FIC Corp.	B•1359	√	√	√	√	√	√	√	√	√	√	√		√	√
Littelfuse Electronic Div.	B•1366	√	√	√	√	√	√	√	√	√		√		√	√
Panel Components	B•1376	√	√	√			√	√	√	√		√			
Raychem Corp.	B•1384	√	√												
Schurter Inc.	B•1386	√	√	√	√		√	√	√	√	√	√	√	√	
Wickmann U.S.A.	B•1394	√	√	√	√		√	√	√	√		√		√	
World Products	B•1399	√		√					√	√					

Altech Corp.

35 Royal Road • Flemington, NJ 08822-6000
Phone (908) 806-9400 • Fax (908) 806-9490

CIRCUIT PROTECTION DEVICES, 35mm DIN Rail Mount

Energy Limiting Circuit Breakers


3G

2G

1G

Altech/Sursum V-EA miniature circuit breakers provide reliable and cost effective circuit and equipment protection against overload (thermal trip), short circuit (magnetic trip) and energy let-through (current limiting). Enhance the value of your product or system by using circuit breakers instead of fuses, or use in addition to existing fuses to provide tighter protection and fuse-saving selectivity.

One, two, three and four pole mini circuit breakers snap easily onto standard 35mm DIN rail, saving space and assembly time. No need to drill mounting holes. They are available in six standard European trip characteristics: CENELEC Euro-norm ("B" and "C") with VDE stamp typically used for household applications; CENELEC ("D") for industrial motor/transformer; ("G") for traditional industrial applications; ("Z") for semiconductor protection; and ("L") for special purpose applications.

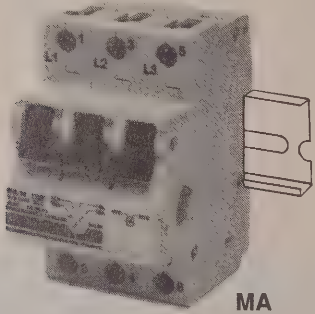
Excellent European ratings, including breaking capacity > 10kA to DIN/VDE0641 and 15kA/P-2 to VDE0660/IEC 157-1, rated voltages 415/240V AC, 48VDC one pole, and 110VDC two pole, etc. Rated current range: 0.3A to 63A (refer to Altech Catalog No. 310).

Ask about one and three pole plus neutral, four pole versions and accessory devices.

V-EA-G			
Rated Current (Amps)	1G One Pole Type	2G Two Pole Type	3G Three Pole Type
.3	1G0.3	2G0.3	3G0.3
.5	1G0.5	2G0.5	3G0.5
.75	1G0.75	2G0.75	3G0.75
.8	1G0.8	2G0.8	3G0.8
1.0	1G1.0	2G1.0	3G1.0
1.6	1G1.6	2G1.6	3G1.6
2.0	1G2.0	2G2.0	3G2.0
2.5	1G2.5	2G2.5	3G2.5
3.0	1G3.0	2G3.0	3G3.0
3.5	1G3.5	2G3.5	3G3.5
4.0	1G4.0	2G4.0	3G4.0
5.0	1G5.0	2G5.0	3G5.0
6.0	1G6.0	2G6.0	3G6.0
8.0	1G8.0	2G8.0	3G8.0
10	1G10	2G10	3G10
12	1G12	2G12	3G12
12.5	1G12.5	2G12.5	3G12.5
15	1G15	2G15	3G15
16	1G16	2G16	3G16
20	1G20	2G20	3G20
25	1G25	2G25	3G25
30	1G30	2G30	3G30
32	1G32	2G32	3G32
40	1G40	2G40	3G40
50	1G50	2G50	3G50
60	1G60	2G60	3G60
63	1G63	2G63	3G63

UL Testing: V-EA-G motor starting and group fusing applications at up to 480V/277VAC are part of an extensive, on-going UL testing program. UL Recognition should be achieved before publication date. Contact Altech for testing and US/UL applications data.

Three Phase Motor Protector


MA

Altech/Sursum DIN rail mount MA Three Phase Motor Protectors feature an adjustable thermal trip for fine tuning (overload protection), fixed magnetic short-circuit protection, energy (current let-through) limiting, and manual ambient temperature compensation.

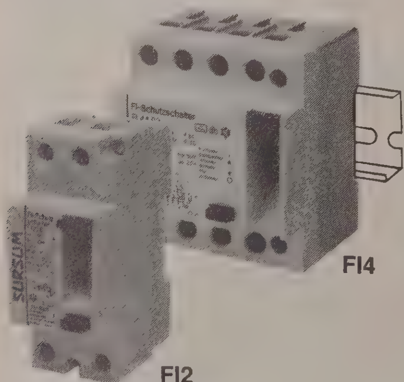
Use of the MA allows finalization of design and procurement even though motor nameplate FLAs are not precisely known, as tight overload protection can be dial-set at start-up.

Overload trip is at 115% of the dial-set current (<1 hour) and magnetic trip is at a nominal 1100% of the maximum dial-set current (IEC-292-1). Screw-cage clamp terminals accept up to 3 AWG wire, and power feed can be to either top or bottom terminals. Maximum operating voltage and rated insulation voltage is 500V AC.

Rated Current FLA Dial Range (20°C and 40°C)	Short Circuit Rating With Back-up Fuse		Type
	380-415V	500V	
0.1 to 0.16A	•	•	MA0.16
0.16 to 0.25	•	•	MA0.25
0.25 to 0.40	•	•	MA0.40
0.40 to 0.63	•	•	MA0.63
0.63 to 1.0	•	•	MA1.0
1.0 to 1.6	•	•	MA1.6
1.6 to 2.5	•	6kA/63A	MA2.5
2.5 to 4.0A	•	6kA/63A	MA4.0
4.0 to 6.3A	•	6kA/80A	MA6.3
6.3 to 10.0A	•	6kA/80A	MA10
10.0 to 16.0A	10kA/100A	6kA/80A	MA16
16.0 to 20.0A	10kA/100A	6kA/80A	MA20
20.0 to 25.0A	10kA/100A	6kA/80A	MA25
25.0 to 32.0A	10kA/100A	6kA/80A	MA32
32.0 to 40.0A	10kA/100A	6kA/80A	MA40

UL Testing: Applications in group motor circuits with high available fault currents are part of an extensive, on-going testing program. UL Listing should be achieved before the publication date. Contact Altech for testing and US/UL applications data.

Earth Leakage Circuit Breakers


FI4

FI2

Compact DIN rail mount Earth Leakage Circuit Breakers detect and interrupt ground faults. They are VDE approved for the European system of protecting people, animals, equipment and property from dangerous line-to-ground and shock hazard currents.

Trip-capable on decayed line voltage, marked approval of DIN/VDE 10kA interrupt rating, marked "Snowflake" temperature range, marked trip sensitivity to pulsed as well as sinusoidal fault currents, integral test circuit, insensitive to vibration, etc.

US applications include ground fault protection of equipment (GFPE) using the 10mA and 30mA fault current ratings, especially when high distributed capacitance or other leakages cause excessive nuisance trips at lower fault currents. Applications for the 300mA rating are equipment protection and fire prevention by limiting the energy of a fault to less than the minimum ignition energy for many materials.

FI2 Two Pole Single Phase			FI4 Four Pole Two/Three Phase		
Rated Current	Max. Voltage	Max. Fuse[1]	Rated Current	Max. Voltage	Max. Fuse[1]
16A	240V AC	63A	25A	415V AC	80A
25A	240V AC	80A	40A	415V AC	80A
40A	240V AC	80A	63A	415V AC	100A
Rated Current Line	Fault Trip Current	Type	Rated Current Line	Fault Trip Current	Type
16A	10mA	F121.01			
25A	30mA	F122.03	25A	30mA	F142.03
25A	30mA*	F122.03Y	25A	30mA*	F142.03Y
25A	300mA	F122.30	25A	300mA	F142.30
40A	30mA	F123.03	40A	30mA	F143.03
40A	30mA*	F123.03Y	40A	30mA*	F143.03Y
40A	300mA	F123.30	40A	300mA	F143.30
			63A	30mA	F144.03
			63A	30mA*	F144.03Y
			63A	300mA	F144.30

* with integral Auxiliary Switch.

[1] 10kA interrupt rating based on series fuses.

We can only show a small sampling of our extensive circuit breaker product line here. Please request our catalog.

SEE OUR ENCLOSURES IN SECTION C•1400 / SEE OUR TERMINAL BLOCKS IN SECTION C•2100

AII

AMBER INDUSTRIES, INC.

3312 Wiley Post Road - Carrollton, Texas 75006 - P.O. Box 802822 - Dallas, Texas 75380 - (214) 490-9801

AC POWER LINE AND DATA LINE TRANSIENT SUPPRESSORS

SINGLE PHASE PROTECTION

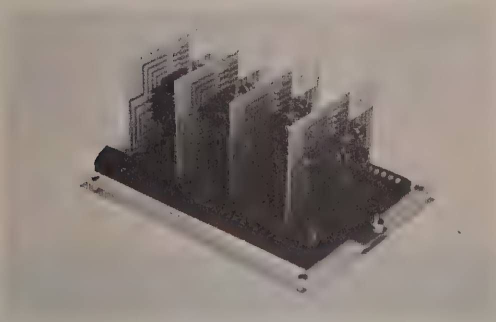
Both the OEM series and CM series AC transient suppressors attenuate spikes and fill notches throughout the full 360 degrees of the AC sinewave. Unlike other suppressors which merely clamp a transient hundreds of volts above or below reference, Amber operates within +/- 1 volt variation of the sinewave instantaneous voltage. The CM series adds common mode protection (hot to ground and neutral to ground). Both OEM and CM series are UL 1449 approved (file #E103476). Models are available with either screw terminals or wire leads. Models are also available for DC power and "line cord" protection. Not only does Amber outperform other approaches in both categories of IEEE-587; it also outperforms the competition in the new (1992) IEC and ANSI standards.

THREE PHASE PROTECTION

Amber's three phase protection is available for either the OEM or full facilities protection. The small size and mounting profile allow them to be used in many locations where mounting larger units would be impractical or impossible. These protectors are designed so as to be installed in either the user's electrical panel or the equipment manufacturer's enclosure. The 1135 models have built-in self diagnostics and alert of any fault. Both OEM and facilities models are available for all service types and voltages. Amber's three phase protectors are among the most cost effective on the market today. The OEM version of the three phase protector is UL approved to 1449 (file #E103476).

DATA LINE PROTECTION

The Amber ACS system protects digital data lines, sensor and transducer lines, plus 4-20mA current loops. Each ACS enclosure will protect up to 32 single-ended data lines or 16 differential pairs or 4-20mA loops or 8 RS-232 sets. A Nema type 1 enclosure is standard, with type 4 or type 12 available as options. Each line is separately protected up to 3000 surge amps with only 10 ohms maximum impedance. The modular construction of the ACS system allows different data types to be protected in the same enclosure.



THE AMBER DIFFERENCE

Amber Industries Inc. is a technology leader in single phase, three phase and data line surge suppression. We invite you to let us know what your specific requirements are. Our applications and engineering departments will work directly with your engineers to assure a quality design based on the most up-to-date suppression technology available.

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(214) 490-9801

or write: P.O. Box 802822
Dallas, TX 75380

CAGE #OF816

FUSES/UL, CSA & SEMKO 1-1/4" x 1/4" & 1" x 1/4"

TYPE 3AG/3AP NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

	3AG		3AP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3AG100	1/10	250	3AG1.5	1-1/2	250
3AG125	1/8	250	3AG1.6	1-6/10	250
3AG150	15/100	250	3AG1.75	1-3/4	250
3AG175	.175	250	3AG2	2	250
3AG187	3/16	250	3AG2.3	2-3/10	250
3AG200	2/10	250	3AG2.5	2-1/2	250
3AG250	1/4	250	3AG3	3	250
3AG300	3/10	250	3AG3.5	3-1/2	250
3AG375	3/8	250	3AG4	4	250
3AG400	4/10	250	3AG4.5	4-1/2	250
3AG500	1/2	250	3AG5	5	250
3AG600	6/10	250	3AG6	6	250
3AG750	3/4	250	3AG7	7	250
3AG800	8/10	250	3AG8	8	250
3AG1	1	250	3AG10	10	125
3AG1.25	1-1/4	250			

Listed by Underwriters Laboratories and certified by Canadian Standards Association through 10 Amperes.

Type 3AG fuses, described as normal blow, are medium to quick acting protectors for use in general circuit applications. Suitable for most circuits where high surges or transients are not anticipated. Pigtail leads (Type 3AP) are available when direct soldering into circuits is desirable.

TYPE 3WO/3WOP SLOW BLOW GLASS TUBE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

	3WO		3WOP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.039	(1.0)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating
3WO6	6	125
3WO7	7	125
3WO8	8	125
3WO10	10	125
3WO12	12	125
3WO15	15	125

Listed by Underwriters Laboratories and Certified by Canadian Standards Association from 6 to 15 Amperes.

The 3WO fuses, described as slow blow, are suitable for use in microwave ovens and in general circuit applications. Pigtail leads (Type 3WOP) are available when direct soldering into circuits is desired.

TYPE 3SB/3SBP SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

	3SB		3SBP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3SB062	1/16	250	3SB1.25	1-1/4	250
3SB100	1/10	250	3SB1.5	1-1/2	250
3SB125	1/8	250	3SB1.6	1-6/10	250
3SB150	15/100	250	3SB1.8	1-8/10	250
3SB175	.175	250	3SB2	2	250
3SB187	3/16	250	3SB2.25	2-1/4	250
3SB200	2/10	250	3SB2.5	2-1/2	250
3SB250	1/4	250	3SB2.8	2-8/10	250
3SB300	3/10	250	3SB3	3	250
3SB375	3/8	250	3SB3.2	3-2/10	250
3SB400	4/10	250	3SB3.5	3-1/2	250
3SB500	1/2	250	3SB4	4	250
3SB600	6/10	250	3SB4.5	4-1/2	250
3SB700	7/10	250	3SB5	5	250
3SB750	3/4	250	3SB6	6	250
3SB800	8/10	250	3SB7	7	250
3SB1	1	250	3SB8	8	250
3SB1.2	1-2/10	250			

Listed by Underwriters' Laboratories through 8 amperes. Certified by Canadian Standards Association through 8 amperes.

Type 3SB fuses, described as slow blow, are designed to prevent unnecessary blowing in circuits where transient surges are anticipated. Protection against short circuit or continued overload is still maintained. Pigtail leads (Type 3SBP) are available when direct soldering into circuits is desired.

TYPE 3SF/3SFP QUICK ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	$2I_n$	$2.75I_n$		$4I_n$		$10I_n$
	Max.	Min.	Max	Min.	Max	Max.
50 to 100 mA inclusive	20 s	2 ms	200 ms	1 ms	30 ms	5 ms
Above 100 mA to 10 A	20 s	20 ms	1500 ms	8 ms	400 ms	80 ms

MECHANICAL DIMENSIONS

	3SF		3SFP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3SF050	.05	250	3SF800	.800	250
3SF063	.063	250	3SF1	1	250
3SF080	.080	250	3SF1.25	1.250	250
3SF100	.100	250	3SF1.6	1.600	250
3SF125	.125	250	3SF2	2	250
3SF160	.160	250	3SF2.5	2.500	150
3SF200	.200	250	3SF3.15	3.15	150
3SF250	.250	250	3SF4	4	150
3SF315	.315	250	3SF5	5	60
3SF400	.400	250	3SF6.3	6.3	60
3SF500	.500	250	3SF8	8	60
3SF630	.630	250	3SF10	10	60

Approved by SEMKO from 315 mA through 10 A.

Type 3SF fuses are designed to meet the electrical and mechanical requirements of IEC 127, CEE 4, Standard Sheet IV. They carry the SEMKO mark in the values specified as SEMKO approved. They are mechanically interchangeable with Type 3AG, the 1/4 × 1-1/4 normal blow fuse. However, since the fusing characteristics specified in IEC 127 and UL 198G are different, it is important that the designer carefully compare the blowing curves of the two types before substituting one for the other. They permit manufacturers of equipment built to United States/Canadian standards to substitute a fuse acceptable and available in the European market without changing board layouts or fuse mountings. Pigtail leads (3SFP) are available when direct soldering into circuits is desired.

TYPE 8AG/8AP NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	8AG Inches (mm)	8AP Inches (mm)	Pigtail Leads Inches (mm)
Diameter	.250 (6.35)	.270 (6.9)	.032 (.813)
Length	1.00 (25.4)	1.03 (26.2)	1.5 (38.1)

Catalog Number		Ampere Rating	Voltage Rating
8AG100	8AP100*	1/10	250
8AG125	8AP125	1/8	250
8AG250	8AP250	1/4	250
8AG375	8AP375	3/8	250
8AG500	8AP500	1/2	250
8AG750	8AP750	3/4	250
8AG1	8AP1	1	250
8AG1.5	8AP1.5	1-1/2	250
8AG2	8AP2	2	250
8AG2.5	8AP2.5	2-1/2	125
8AG3	8AP3	3	125
8AG4	8AP4	4	125
8AG5	8AP5	5	125
8AG6	A8P6	6	125
8AG7	8AP7	7	125

*Pigtail (AP)

Listed by Underwriters' Laboratories through 7 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 8AG is designated as a normal blow fuse for use in general circuit protection. Their smaller size permits use where space limitations prevent use of Type 3AG. Pigtail leads (Type 8AP) are available when direct soldering into circuits is desired.

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

FUSES/UL, CSA & SEMKO 5mm x 20mm

TYPE 5MF FAST ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MF100	1/10	250	5MF1	1	250
5MF125	1/8	250	5MF1.25	1-1/4	250
5MF200	2/10	250	5MF1.6	1-6/10	250
5MF250	1/4	250	5MF2	2	250
5MF300	3/10	250	5MF2.5	2-1/2	250
5MF400	4/10	250	5MF3	3	250
5MF500	1/2	250	5MF4	4	125
5MF600	6/10	250	5MF5	5	125
5MF700	7/10	250	5MF6	6	125
5MF800	8/10	250	5MF7	7	125
			5MF8	8	125

Listed by Underwriters' Laboratory from 50 mA to 8 amperes. Certified by Canadian Standards Association through 8 amperes.

Type 5MF fuses, described as fast acting are manufactured to meet the requirements of UL 198G and CSA 22.2. They permit European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. Pigtail leads (5MFP) are available when direct soldering into circuits is desired.

TYPE 5MT TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	2 minutes, maximum
1000%	10 milliseconds, minimum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5 (0.197)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MT100	1/10	250	5MT1	1	125
5MT125	1/8	250	5MT1.25	1-1/4	125
5MT200	2/10	250	5MT1.6	1-6/10	125
5MT250	1/4	250	5MT2	2	125
5MT300	3/10	250	5MT2.5	2-1/2	125
5MT400	4/10	250	5MT3	3	125
5MT500	1/2	250	5MT4	4	125
5MT600	6/10	250	5MT5	5	125
5MT700	7/10	250	5MT6	6	125
5MT800	8/10	250	5MT7	7	125

Listed by Underwriters' Laboratories from 50 mA to 5 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 5MT fuses, described as time lag offer additional surge protection for circuits where momentary transients are anticipated. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. Pigtail leads (5MTP) are available when direct soldering into circuits is desired.

TYPE 5SF QUICK ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Max.
32 to 100 mA inclusive	30 min	10 ms	500 ms	3 ms	100 ms	20 ms
Above 100 mA to 6.3A	30 min	50 ms	2 s	10 ms	300 ms	20 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5SF032	.032	250	5SF500	1/2	250
5SF040	.040	250	5SF630	.630	250
5SF050	1/20	250	5SF800	8/10	250
5SF063	1/16	250	5SF1	1	250
5SF080	.080	250	5SF1.25	1-1/4	250
5SF100	1/10	250	5SF1.6	1-6/10	250
5SF125	1/8	250	5SF2	2	250
5SF160	.160	250	5SF2.5	2-1/2	250
5SF200	2/10	250	5SF3.15	3.15	250
5SF250	1/4	250	5SF4	4	250
5SF315	.315	250	5SF5	5	250
5SF400	4/10	250	5SF6.3	6-3/10	250

Approved by SEMKO for 80 mA, 125 mA, and from 250 mA through 6.3A.

Type 5SF fuses, described as quick acting, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet II (Type F). Used throughout Europe, they carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are not anticipated. Pigtail leads (5SFP) are available when direct soldering into circuits is desired.

TYPE 5ST TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Min.	10 I_n Max.
32 to 100 mA inclusive	2 min	200 ms	10 s	40 ms	3 s	10 ms	300 ms
Above 100 mA to 6.3A	2 min	600 ms	10 s	150 ms	3 s	20 ms	300 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5ST032	.032	250	5ST500	1/2	250
5ST040	.040	250	5ST630	.630	250
5ST050	1/20	250	5ST800	8/10	250
5ST063	1/16	250	5ST1	1	250
5ST080	.080	250	5ST1.25	1-1/4	250
5ST100	1/10	250	5ST1.6	1-6/10	250
5ST125	1/8	250	5ST2	2	250
5ST160	.160	250	5ST2.5	2-1/2	250
5ST200	2/10	250	5ST3.15	3.15	250
5ST250	1/4	250	5ST4	4	250
5ST315	.315	250	5ST5	5	250
5ST400	4/10	250	5ST6.3	6-3/10	250

Approved by SEMKO from 63 mA through 6.3A.

Type 5ST fuses, described as time lag, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet III (Type T). They carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are anticipated. Pigtail leads (5STP) are available when direct soldering into circuits is desired.

TYPE 5TT SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum (3 seconds minimum for fuses with rating over 3 amp)

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5TT100	1/10	250	5TT1	1	250
5TT125	1/8	250	5TT1.25	1-1/4	250
5TT200	2/10	250	5TT1.6	1-5/10	250
5TT250	1/4	250	5TT2	2	250
5TT300	3/10	250	5TT2.5	2-1/2	250
5TT400	4/10	250	5TT3	3	250
5TT500	1/2	250	5TT4	4	125
5TT600	6/10	250	5TT5	5	125
5TT700	7/10	250	5TT6	6	125
5TT800	8/10	250	5TT7	7	125

Listed by Underwriters' Laboratories from 50mA to 5 amperes and certified by CSA through 5 amperes.

Type 5TT fuses, described as slow blow, are designed to withstand higher surge currents occurring at switching during the normal life of equipment than the 5MT series. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration.

Pigtail leads (5TTP) are available when direct soldering into circuits is required.

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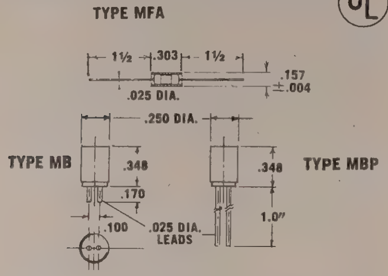
TYPE MB/MBP/MFA MICROBEL MICRO FUSE SERIES


TYPE MFA
1½
.303
1½
.157
±.004
.025 DIA.
.250 DIA.
TYPE MB
.348
.170
.100
.025 DIA.
LEADS
.348
TYPE MBP
1.0"

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
*150%	10 minutes, maximum
200%	5 sec. max.

*Not applicable to MFS

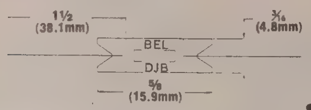
Catalog Number			Ampere Rating	Voltage Rating
MB125	MBP125	MFA125	1/8	125
MB250	MBP250	MFA250	1/4	125
MB375	MBP375	MFA375	3/8	125
MB500	MBP500	MFA500	1/2	125
MB750	MBP750	MFA750	3/4	125
MB1	MBP1	MFA1	1	125
MB1.5	MBP1.5	MFA1.5	1-1/2	125
MB2	MBP2	MFA2	2	125
MB2.5	MBP2.5	MFA2.5	2-1/2	125
MB3	MBP3	MFA3	3	125
MB3.5	MBP3.5	MFA3.5	3-1/2	125
MB4	MBP4	MFA4	4	125
MB5	MBP5	MFA5	5	125
MB7	MBP7	MFA7	7	125

MFA is UL listed through 7A while MB/MBP are UL listed and CSA certified through 7A.

MFA type fuses are subminiature and are color coded for current rating identification.

MB/MBP are designed for applications where space is a critical factor.

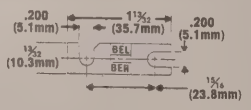
TYPE DJB FLAT PACK FUSE


1½
(38.1mm)
³⁄₁₆
(4.8mm)
BEL
DJB
⅝
(15.9mm)

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
160%	25 seconds, maximum

TYPE BER FLAT PACK FUSE


.200
(5.1mm)
1⁹⁄₃₂
(35.7mm)
.200
(5.1mm)
¹³⁄₃₂
(10.3mm)
BEL
BER
¹⁵⁄₁₆
(23.8mm)

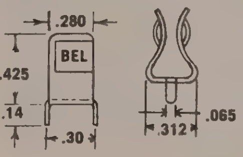
ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
135%	1 hour, maximum
200%	1 minute, maximum

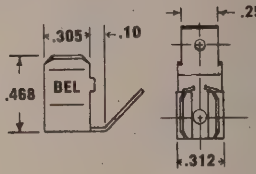
Catalog Number		Ampere Rating	Catalog Number		Ampere Rating
DJB250	BER250	1/4	DJB2	BER2	2
DJB300	BER300	3/10	DJB2.25	BER2.25	2-1/4
DJB400	BER400	4/10	DJB2.5	BER2.5	2-1/2
DJB500	BER500	1/2	DJB2.75	BER2.75	2-3/4
DJB600	BER600	6/10	DJB3	BER3	3
DJB750	BER750	3/4	DJB3.5	BER3.5	3-1/2
DJB875	BER875	7/8	DJB4	BER4	4
DJB1	BER1	1	DJB5	BER5	5
DJB1.25	BER1.25	1-1/4	DJB8	BER8	8
DJB1.5	BER1.5	1-1/2	DJB10	BER10	10

Fuse Clips Reel And Rail Packaging

CLIPS

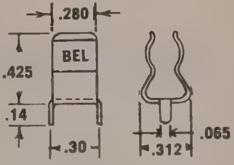

.280
BEL
.425
.14
.30
.312
.065

TYPE FC-101
3AG Clip
PC Board Mount
(Ear Stops)

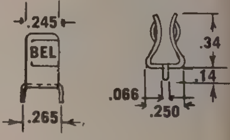

.250
.305
.10
.468
BEL
.312

TYPE FC-107
3AG Clip
Hole Mount
(.250 Quick
Connect)

TYPE FC-102
3AG Clip
PC Board Mount
(Earless)

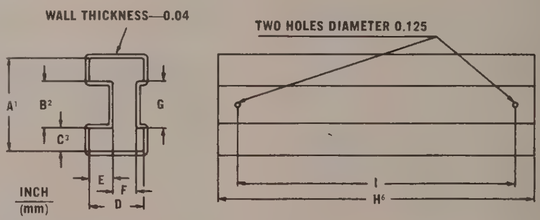

.280
BEL
.425
.14
.30
.312
.065

TYPE FC-201
5mm Clip
PC Board Mount
(Ear Stops)


.245
BEL
.265
.34
.14
.066
.250

All Bel Fuse clips are manufactured from .020 phosphor bronze stock and specially hardened to assure long life and minimum contact resistance. They are bright tin plated to facilitate soldering and prevent oxidation. In addition to the stock designs illustrated, clips can be quickly tooled to meet customer specifications.

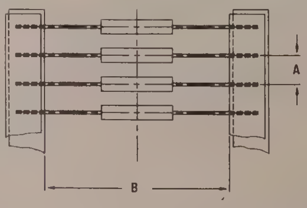
RAIL PACKAGING


WALL THICKNESS—0.04
TWO HOLES DIAMETER 0.125
A¹
B²
C³
G
E
F
D
INCH
(mm)
I
H⁶

Fuse Type	A	B	C	D	E	F	G	H	I
5mm x 20mm	1.00 +.02 −.00	.34 ±.01	.330	.55 +.02 −.00	.280	.20 +.02 −.00	.300 ±.010	13.2	12.60
	(25.4 +0.5 −.0)	(8.6 ±0.3)	(8.4)	(14.0 +0.5 −.0)	(7.1)	(5.1 +0.5 −.0)	(7.6 ±0.3)	(335.2)	(320.0)
¼ inch x 1¼ inch	1.45 +.03 −.00	.64 ±.01	.405	.73 +.025 −.000	.365	.26 +.025 −.000	.600 ±.010	15.75	15.08
	(36.8 +0.8 −.0)	(16.3 ±0.3)	(10.3)	(18.5 +0.6 −.0)	(9.3)	(6.6 +0.6 −.0)	(15.2 ±0.3)	(400.1)	(383)

To minimize assembly costs cartridge fuses can be supplied with clips attached. They are shipped in rails. Rail sizes are given above.

REEL PACKAGING



Specifications Subject To Change Without Notice.

Leaded fuses can be supplied taped and reeled to assist in automatic assembly. Reeled fuses are supplied in quantity increments of 2500 pieces for microfuses and 1000 pieces for 1¼×¼ inch, 1500 pieces for 5×20mm fuses.

Fuse Type	A	B
Micro fuses (MF, MFS, MFA)	5.0 mm	52.4 mm
5×20 mm fuses	10.0 mm	85.0 mm
¼×1¼ inch fuses	10.0 mm	97.0 mm

bel BEL FUSE INC. 198 Van Vorst Street Jersey City, NJ 07302 (201) 432-0463 TWX 710-730-5301 FAX (201) 432-9542

MICRO FUSES

MQ QUICK ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	5 seconds, maximum

MQ is recognized under the components program of the UL and certified by the CSA through 15 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MQ125	1/8	125
MQ250	1/4	125
MQ375	3/8	125
MQ500	1/2	125
MQ750	3/4	125
MQ1	1	125
MQ1.5	1.5	125
MQ2	2	125
MQ2.5	2.5	125
MQ3	3	125
MQ3.5	3.5	125
MQ4	4	125
MQ5	5	125
MQ7	7	125
MQ10	10	125
MQ12	12	125
MQ15	15	125

Marking

Current rating, voltage rating, MQ designation and Bel Fuse logo are printed on each fuse in white ink.

Lead diameter 0.025″ except for 10, 12 and 15 Ampere fuses which have a lead diameter of 0.032″.

MS SLOW ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	30 sec., maximum
800%	12 millisecond, minimum

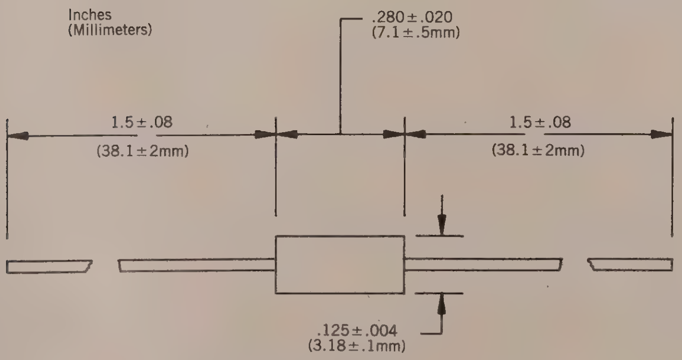
MS is recognized under the components program of the UL and certified by the CSA through 7 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MS250	1/4	125
MS375	3/8	125
MS500	1/2	125
MS750	3/4	125
MS1	1	125
MS1.5	1.5	125
MS2	2	125
MS2.5	2.5	125
MS3	3	125
MS3.5	3.5	125
MS4	4	125
MS5	5	125
MS7	7	125

Marking

Current rating, voltage rating, MS designation and Bel Fuse logo are printed on each fuse in green ink.

Lead diameter 0.032″.



Specifications Subject To Change Without Notice

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

TYPE 5HF/5HFP QUICK ACTING HBC CERAMIC FUSE

ELECTRICAL CHARACTERISTICS

	1.5 In	2.1 In	2.75 In		4 In		10 In
Rated Current	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Max.**
1 - 3.15A inclusive	1 hr	30 min.	10ms	2s	3ms	300ms	20ms
Above 3.15A to 6.3A	1 hr	30 min.	10ms	3s	3ms	300ms	20ms

Catalog Number	Ampere Rating	Voltage Rating
5HF1	1	250
5HF1.25	1.25	250
5HF1.6	1.6	250
5HF2	2	250
5HF2.5	2.5	250
5HF3.15	3.15	250
5HF4	4	250
5HF5	5	250
5HF6.3	6.3	250

MECHANICAL DIMENSIONS

Dimensions	5HF		5HFP		Pigtail Leads	
	Inches	**(mm)**	**Inches**	**(mm)**	**Inches**	**(mm)**
Diameter	0.2	(5.1)	0.217	(5.5)	0.032	(0.813)
Length	0.787	(20)	0.827	(21)	1.5	(38.1)

Type 5HF fuses are SEMKO approved and UL recognized.

Type 5HF fuses are quick acting, high breaking capacity, in accordance with specifications of IEC-127-2, Standard sheet 1 (type F).

Pigtail fuses are not covered in IEC-127-2, therefore, type 5HFP fuses are not eligible for SEMKO approval. Type 5HFP do meet the electrical characteristics of IEC-127-2, standard sheet 1 (Type F).

Both 5HF & 5HFP are UL Component recognized for the electrical characteristics in IEC 127-2.

PACKAGING

Cartridge fuses can be provided pre-assembled in clips.

Pigtail fuses can be provided:
1. In bulk.
2. On Axial Tape & Reel.
3. Radial Formed & Cut
4. With Heat Shrink Tubing over body.

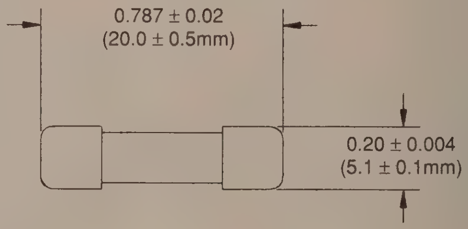
FUSE MARKINGS

"bel",

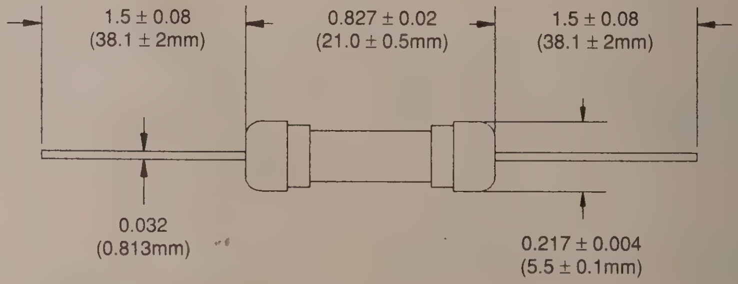
"F, Current Rating, 250V"

Specification Subject To Change Without Notice.

5HF



5HFP



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TYPE 5HF/5HFP
TIME LAG HBC CERAMIC FUSE SERIES

ELECTRICAL CHARACTERISTICS Ⓢ

	1.5 In	2.1 In	2.75 In		4 In		10 In	
Rated Current	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
1 - 3.15A inclusive	1 hr	30 min.	1s	80s	95ms	5s	10ms	100ms
Above 3.15A to 6.3A	1 hr	30 min.	1s	80s	150ms	5s	20ms	100ms

Catalog Number	Ampere Rating	Voltage Rating
5HT1	1	250
5HT1.25	1.25	250
5HT1.6	1.6	250
5HT2	2	250
5HT2.5	2.5	250
5HT3.15	3.15	250
5HT4	4	250
5HT5	5	250
5HT6.3	6.3	250

MECHANICAL DIMENSIONS

Dimensions	5HT		5HTP		Pigtail Leads	
	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.2	(5.1)	0.217	(5.5)	0.032	(0.813)
Length	0.787	(20)	0.827	(21)	1.5	(38.1)

Type 5HT fuses are SEMKO approved and UL recognized.

Type 5HT fuses are time-lag, high breaking capacity, in accordance with specifications of IEC-127-2, Standard sheet 5 (type T).

Pigtail fuses are not covered in IEC-127-2, therefore, type 5HTP fuses are not eligible for SEMKO approval. Type 5HTP do meet the electrical characteristics of IEC-127-2, standard sheet 5 (Type T).

Both 5HT & 5HTP are UL Component recognized for the electrical characteristics in IEC 127-2.

PACKAGING

Cartridge fuses can be provided pre-assembled in clips.

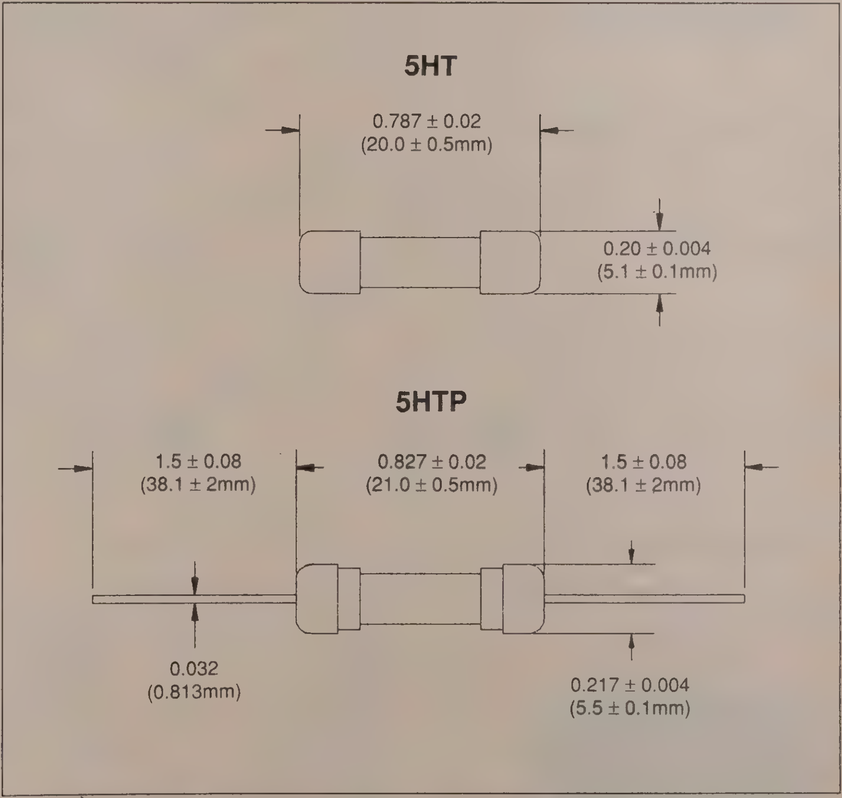
Pigtail fuses can be provided:
1. In bulk.
2. On Axial Tape & Reel.
3. Radial Formed & Cut
4. With Heat Shrink Tubing over body.

FUSE MARKINGS

“bel”, Ⓢ

“T, Current Rating, 250V”

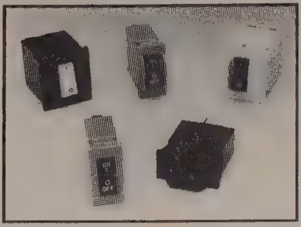
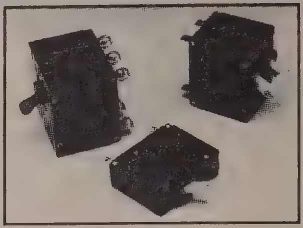
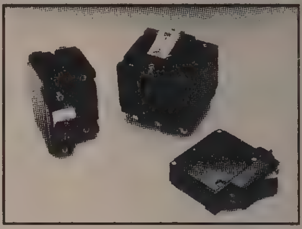
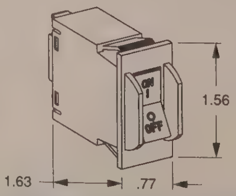
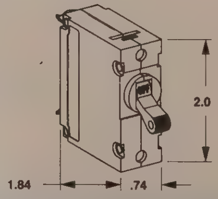
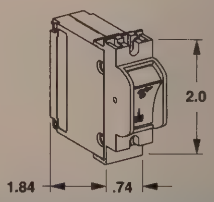
Specification Subject To Change Without Notice.



bel BEL FUSE INC. 198 Van Vorst Street Jersey City, NJ 07302 (201) 432-0463 TWX 710-730-5301 FAX (201) 432-9542

CARLINGSWITCH
QUALITY BY DESIGN

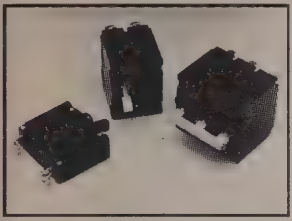
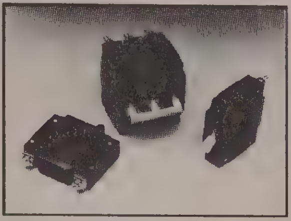
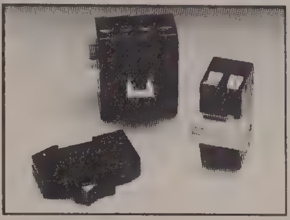
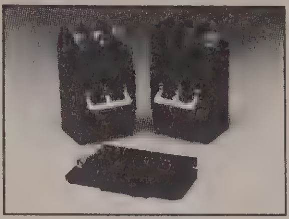
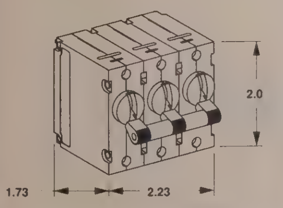
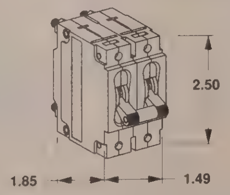
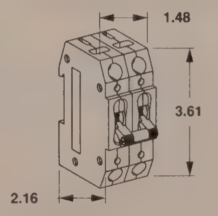
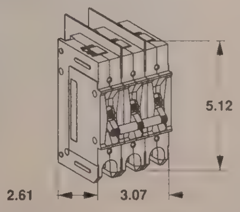
MAGNETIC CIRCUIT BREAKERS

GENERAL PRODUCT GUIDE			
Product Name:	**M-Series**	**A-Series** (Handle Type)	**A-Series** (Rocker Type)
Description:	Miniature rocker breaker for those demanding applications up to 25 amps where space, aesthetics and snap-in front panel mounting are important. LEDs or neon bulbs provide rocker illumination. Rocker guard prevents inadvertent actuation of rocker.	Compact, temperature stable design for precision operation in OEM markets requiring general purpose as well as full load amp applications.	Features the unique Visi-Rocker two-color actuator which can indicate either the ON mode or the TRIPPED/OFF mode. Available in three Visi color combinations and seven Solid colors.
Number of poles:	1-2 poles	1 - 6 poles	1 - 3 poles
Available Delays:	Instant, Short, Medium - AC/DC	Instant, Ultra-Short, Short, Medium and Long (motor loads) AC, DC, AC/DC. High Inrush (AC) - Short, Medium, Long	Instant, Ultra-Short, Short, Medium and Long (motor loads) AC, DC, AC/DC. High Inrush (AC) - Short, Medium, Long
Maximum current & voltage ratings:	0.02-15FLA, 32VDC, 125VAC, 1-pole 15.1-25GPA, 32VDC, 125VAC, 1-pole 0.02-15FLA, 65VDC, 250VAC, 2-pole 15.1-25GPA, 65VDC, 250VAC, 2-pole 0.02-12FLA, 250VAC, 1-pole 0.02-7.5GPA, 50VDC, 1-pole	0.02-30A @ 277VAC, 65VDC 31.0-50A @ 125/250VAC, 32VDC	0.02-30A @ 277VAC, 65VDC 31.0-50A @ 125/250VAC, 32VDC
Maximum interrupting capacity:	1000A @ 65VDC, 2-pole 1000A @ 32VDC,1-pole 1000A @ 250VAC, 2-pole 1000A @ 125VAC,1-pole	3000A @ 65VDC (UL only) 3500A @ 65VDC w/fuse backup 3000A @ 125/250VAC (UL only) 5000A @ 277VAC w/fuse backup	3000A @ 65VDC (UL only) 3500A @ 65VDC w/fuse backup 3000A @ 125/250VAC (UL only) 5000A @ 277VAC w/fuse backup
Auxiliary switch ratings:	7A @ 250VAC 0.1A @ 125VAC (gold contacts) 7A (Res.) @ 28VDC 4A (Ind.) @ 28VDC	10.1A @ 250VAC 0.1A @ 125VAC (gold contacts) 5.0A @ 30VDC	10.1A - 250VAC 0.1A - 125VAC (gold contacts) 5.0A - 30VDC
Available circuits:	Series and Switch Only	Series, Shunt, Relay, Switch Only, Series w/Remote Shutdown, Relay and Shunt Trip Dual Coil	Series, Shunt, Relay, Switch Only, Series w/Remote Shutdown, Relay and Shunt Trip Dual Coil
Terminal options:	.250" Tab/QC	.250" Tab/QC 8-32 & 10-32 Screw	.250" Tab/QC 8-32 & 10-32 Screw
Certifications: **Symbol:**	®UL SA	®UL SA	®UL SA 2495
Agency:	UL CSA	UL CSA	UL CSA VDE
Mounting method:	Snap-In Front Panel	Front Panel	Front Panel
Dimensions: Call for our complete catalog: 1-800-243-8556			

CARLINGSWITCH CIRCUIT BREAKERS • PLAINVILLE, CT 06062-1177 • 1-800-243-8556 • (203) 793-9281 • FAX (203) 793-9231

CARLINGSWITCH
QUALITY BY DESIGN

MAGNETIC CIRCUIT BREAKERS

			
B-Series	**C-Series**	**D-Series**	**E-Series**
Designed specifically for world market applications requiring compliance to VDE and IEC spacing requirements.	Designed for those applications requiring higher current and voltage capability while retaining a compact size. Featuring back connected stud and screw terminals.	Designed for DIN rail mounting on either a 35mm x 7.5mm, or a 35mm x 15mm Symmetrical DIN rail. Available with a handle or Visi-Rocker two-color actuator. Features dead-front, wire-ready screw terminals.	Ideally suited for higher current and voltage applications. Available as a Branch Circuit Breaker, Manual Motor Controller or Supplementary Protector. Features front and back terminals and other mounting options.
1 - 6 poles	1 - 6 poles	1 - 4 poles (Handle), 1 - 3 poles (Rocker)	1 - 6 poles
Instant, Ultra-Short, Short, Medium and Long (motor loads) AC, DC, AC/DC. High Inrush (AC) - Short, Medium, Long	Instant, Ultra-Short, Short, Medium and Long (motor loads) AC, DC, AC/DC. High Inrush (AC) - Short, Medium, Long	Instant, Ultra-Short, Short, Medium and Long (motor loads) AC, DC, AC/DC. High Inrush (AC) - Short, Medium, Long	Instant, Short, Medium and Long (motor loads) AC or DC
0.02-30A @ 277VAC, 65VDC 31.0-50A @ 125/250VAC, 32VDC	0.02-30A @ 480WYE/277VAC 2-pole 1Ø, 3-pole 3Ø 0.02-50A @ 277VAC 0.02-70A @ 250VAC, 80VDC 0.02-100A @ 120/240VAC, 65VDC	0.02-50A @ 277VAC, 65VDC 0.02-30A @ 480WYE/277VAC 2-pole 1Ø, 3-pole 3Ø	**UL Listed** 0.02-100A @ 240VAC, 125VDC **UL Recognized** 0.02-100A @ 277VAC, 125VDC, 1-pole 0.02-100A @ 600VAC, 2-pole 1Ø, 3-pole 3Ø
3000A @ 65VDC (UL only) 3500A @ 65VDC w/fuse backup 3000A @ 125/250VAC (UL only) 5000A @ 277VAC w/fuse backup	7500A @ 80VDC 3000A @ 125/250VAC (UL only) 5000A @ 250VAC w/fuse backup 5000A @ 480WYE/277VAC w/fuse backup	1500A @ 65VDC, 250VAC (VDE only) 5000A @ 65VDC 5000A @ 480WYE/277VAC w/fuse backup 3000A @ 125/250VAC (UL only)	5000A @ 125VDC 5000A @ 277VAC 10,000A @ 600VAC w/fuse backup
10.1A @ 250VAC 0.1A @ 125VAC (gold contacts) 5.0A @ 30VDC	10.1A @ 250VAC 0.1A @ 125VAC (gold contacts) 5.0A @ 30VDC	N/A	10.1A @ 250VAC 0.1A @ 125VAC (gold contacts) 5.0A @ 30VDC
Series, Shunt, Relay, Switch Only, Series w/Remote Shutdown, Relay and Shunt Trip Dual Coil	Series, Shunt, Relay, Switch Only, Series Mid-Trip w/ Alarm Switch, Series w/Remote Shutdown, Relay and Shunt Trip Dual Coil	Series, Switch Only, Series w/Remote Shutdown	Series, Shunt, Relay, Switch Only, Series w/Remote Shutdown
.250" Tab/QC 8-32 & 10-32 Screw	10-32 Stud, 1/4 - 20 Stud 10-32 Screw with Saddle Clamp	Recessed wire ready, pressure plate type screw terminals	10-32 Stud, 1/4 -20 Stud 10-32 Screw, 1/4 - 20 Screw Box Wire Connector
2495	4006	4006	
UL CSA VDE	UL CSA VDE TUV	UL CSA VDE	UL UL CSA
Front Panel	Front Panel	Rear Mounted on DIN Rail or Front Panel Mounted	Rear Mounted or Front Panel Mounted
			

CARLINGSWITCH CIRCUIT BREAKERS • PLAINVILLE, CT 06062-1177 • 1-800-243-8556 • (203) 793-9281 • FAX (203) 793-9231

corcom

Transient Voltage Suppressor

Corcom, Inc.
1600 Winchester Road
Libertyville, Illinois 60048 USA
TEL: 708-680-7400 FAX: 708-680-8169

Electronic design trends toward compact packaging use a high density of small, sensitive components. This increases the likelihood of damage to a design by power surges. Surges have therefore become a necessary consideration when designing electronic systems to guarantee performance and reliability.

Traditional surge suppression products such as MOV's and gas arrestors offer limited protection against voltage variances. There is a trade-off between speed and reliability; MOV's offer quick response but short life; gas arrestors provide a long useful life but slower response time to clamping. Corcom's TS series voltage suppressors combine the characteristics of both to assure the reliability of quick and continuous response. A TS connected between lines immediately returns the surge back to its source, via the other line, when the surge exceeds the line voltage.

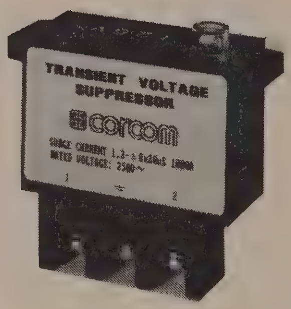
Generally, gas arrestors are slow to react; but by incorporating the varistor *inside* the arrestor, the varistor can absorb the initial impact of the surge. The reaction of the varistor triggers an ionization process of the gas inside the TS suppressor to sustain the duration of the surge without degradation of the varistor.

The TS series transient voltage suppressors are designed to protect single phase normal and common mode circuits. Used in conjunction with capacitors, they provide superb lightning surge suppression. Available for 125 and 250 volt circuits, these products provide the highest reliability for protection of critical electronic designs.

TS125W/TS250W

1
2
TRANSIENT
VOLTAGE
SUPPRESSOR
corcom
1000A

TS125S/TS250S



TS Series suppressors are available with wire leads or screw terminals.

- TS 125 allows 145 VAC maximum line voltage.
- TS 250 allows 300 VAC maximum line voltage.
- Response times for all units 50 nS maximum.
- Maximum discharge current 1000 AMP (8/20 uS).

Screw terminal units feature an indicator light to verify ongoing operation. These products enable manufacturers to meet or exceed the specifications of IEC 801-4 for transient voltage protection and should be used in instances where reliability is essential.

See our pages in Vol. A Section 2700; Vol. C, Section 2100.

corcom Solutions to Power Line Problems.

FAST BUCK or LONG-TERM VALUE.
E-T-A
250V~ 28V==

If your only concern is initial cost, then you'll save a few bucks by choosing fuses over E-T-A Circuit Breakers.

But fuses blow . . . and can drive up your total operational costs including warranties, replacement, service, even product liability.

E-T-A Circuit Breakers, on the other hand, add value to your product. They provide better circuit protection and performance characteristics than fuses. They're trip free and foolproof . . . and can actually lower your total costs.

So forget the fast buck. Go for the long-term value of E-T-A Circuit Breakers . . . 100% quality tested and approved for use worldwide.

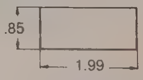
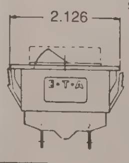
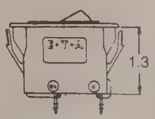
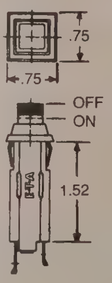
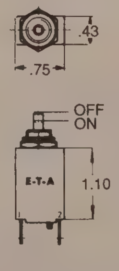
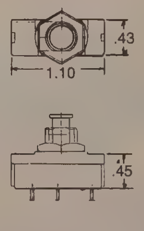
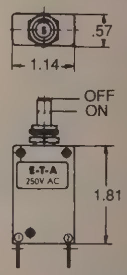
CONDENSED CATALOG
E-T-A

E-T-A®

CIRCUIT BREAKERS GROUP

setting the pace for circuit protection

7400 N. Croname Rd., Niles, IL 60714 • 708-647-8303 • FAX: 708-647-7494
236 Hood Road, Markham, Ontario Canada L3R 3K8 • 416-475-5886 • FAX: 416-475-5889

	ON-OFF Switch Circuit Breakers			Single Pole Overcurrent		
E-T-A® **setting the pace for circuit protection**	-F30/31 -G10	 3120-F621 fits panel cutout Heinemann TX2 and AIRPAX 203-11 2 pole.		41-04 41-05 41-06	 	
Series	**41-10-P10/41-11-P10**	**3120-F321**	**1110-F**	**41-04-PR** **41-05-P30** **41-06-P30**	**1410-G1** **1410-L1**	**45-700-IG1-P10** **45-700-IG1-P10-DD**
Description	Single pole, series trip Rocker, Toggle or Baton handles in many colors. (Illuminiation Optional)	Double pole, identical Snap-in mounting of single pole 41-10/41-11 series (Illumination Optional)	Single pole, series trip B/W button trip indicator Push ON/Push OFF Switching	Series trip, miniature. 41-04-PR: PC Board Mount 41-05-P30: Snap-in Mount 41-06-P30: Panel Mount	Series trip	Series trip -DD has push ON, push OFF switching, B & W reset button for trip indication.
Current ratings	0.1 thru 20A	0.1 thru 16A	0.10 thru 16A	0.05 thru 10A	0.63 thru 6.3	0.05 thru 25A
Maximum voltage ratings	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 48V dc	250V ac or 28V dc	250V ac or 28V DC
Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A.	10 times rated current normal use. UL up to 2000A.	10 times rated current 0.1-2A. 300A for ratings 2.5-16A. UL tested to 2000A.	10 times rated current normal use. UL up to 1000A.	6 times rated current. UL up to 1000A. 5 times for ratings 3.5 thru 5A, 4 times for ratings 6 thru 10A.	8 times rated current of circuit breaker, normal use. UL up to 200A.	10 times rated current of circuit breaker, normal use. UL up to 2000A.
Current capacity of auxiliary contacts, NO, NC.	NA	5A resistive 3, .110" quick connect NO-NC-COM	NA	NA	NA	NA
Life	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 10,000 mechanical	2000 cycles at rated current	300 cycles at rated current	6,000 cycles (UL 1077) 10,000 mechanical
Terminals	.250 quick connect	.250 quick connect	.250 quick connect	.110 quick connect	PCB, solder	.250 quick connect
Shunt circuit— **A3, optional**	Optional; specify—A3	Optional	NA	Optional; specify—A3	NA	Optional; specify—A3
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request.	UL 1077; E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 up to 15A VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 up to 3.5A VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE
Design notes See technical data sheets for data	41-10 is unlighted 41-11 is illuminated	Options: • handle colors • handle marking • illumination • Amp ratings • Dust/water seal	Snap in mounting. Fully trip free. Color trip indicator band upon request.	Smallest full feature circuit breaker. .250 quick-connect avail. non-standard (—P10)	.110 quick-connect available, -G1 only.	Screw terminals available, specify-S10. Version for Class 2 transformers available: Specify 45-700-P10-CL2 3.2 or 5A.
Technical Data Sheet	Catalog Sheet 40129 Catalog Sheet 40130	Catalog Sheet 40136	Catalog Sheet 40142	Catalog Sheet 40127	Catalog Sheet 14109	Catalog Sheet 40119 Catalog Sheet 40132
Physical Dimensions in Inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	 recommended panel cutout Safety shield extension to avoid accidental switching is optional  	 	 	 Shown: 41-06-P30	 Shown: 1410-G1	

E-T-A® CIRCUIT BREAKERS

7400 N. Croname Rd., Niles, IL 60714 • 708-647-8303 • FAX: 708-647-7494
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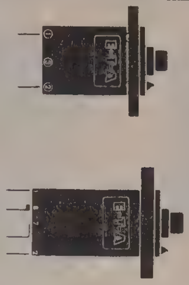
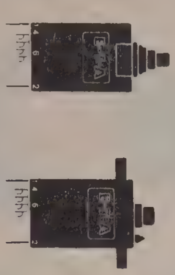
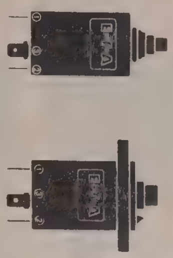
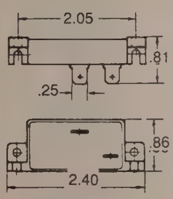
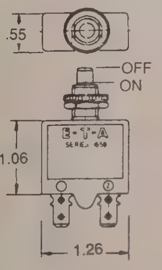
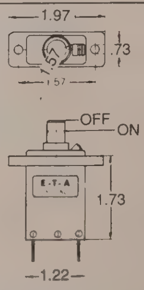
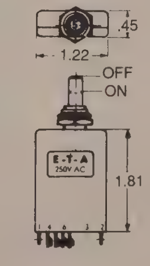
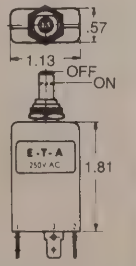
Single Pole Overcurrent Circuit Breakers continued

					E-T-A setting the pace for circuit protection
46-500-P10	**1658-P10**	**45-000-P10-H** **45-400-P10-H**	**46-400-L10-Si** **46-200-L10-Si-H**	**44-800-P10** **44-500-P10-H**	**Series**
Series trip automatic reset	Series trip Direct replacement for MP 1600 and P&B W58	Series trip on-off switching 2 pole: series 45-400	Series trip two auxiliary contacts NO, NC 46-200-L10-Si-H has ON-OFF switch	Two independent circuits (relay-trip) 44-500-P10-H with ON-OFF switch	**Description**
0.1 thru 15A	5 thru 35A	0.05 thru 25A	0.05 thru 16A	0.05 thru 8A	**Current ratings**
250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	**Maximum voltage ratings**
6 times rated current of circuit breaker, 60A maximum	2000A UL tested according to std. 1077	10 times rated current of circuit breaker, normal use. UL up to 2000A	10 times rated current of circuit breaker, normal use. UL up to 2000A	main circuit 100A resistive. Control circuit 8 times rated current	**Maximum interrupting capacity** depending on current rating, UL 1077 approved breakers have been tested to 2000A
NA	NA	NA	1A resistive 4 solder terminals (Std.)	NA	**Current capacity of auxiliary contacts, NO, NC.**
10,000 cycles at 200% rated current	2000 cycles at rated current	6000 cycles (UL 1077) at rated current	6000 cycles at rated current	6000 cycles at rated current	**Life**
.250 quick connect	.250 quick connect	.250 quick connect	Solder terminals	.250 quick connect	**Terminals**
Optional; specify—A3	NA	Optional; specify—A3	Optional; specify—A3	Relay trip, standard	**Shunt circuit—A3, optional**
UL: E29255 CSA: 16186 VDE	UL 1077: E67320 up to 25A CSA: 16186 up to 25A VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE Series 45-400: VDE only	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	CSA: 16186	**Approvals** E-T-A also has European approvals, such as VDE etc. Additional info upon request
Screw terminals 1,2 available (—S20), non-standard	Right angle quick connect or screw terminals available. 7/16 D mounting: -G41 3/8 D mounting: -G21	Screw terminals available, Specify-S10. UL approved for primary ON/OFF switching. 45-400: NC aux. contacts 5A max. continuous.	.250 quick-connect main terminals available, non-standard (—P10)	Screw terminals available non-standard (—S10), series 44-500-P10-H for ON/OFF switching.	**Design notes** See technical data sheets for data
Catalog Sheet 40701	Catalog Sheet 40140	Catalog Sheet 40120	Catalog Sheet 40102	Catalog Sheet 40104	**Technical Data Sheet**
	 Shown: 1658-G41-04-P10	 Shown: 45-000-P10-H	 Shown: 46-400-L10-Si	 SHOWN: 44-800-P10	**Physical Dimensions In Inches** All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.

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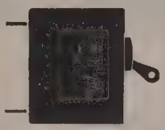
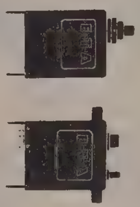
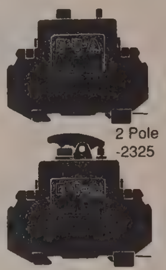
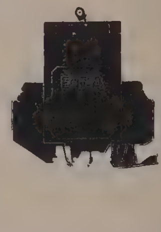
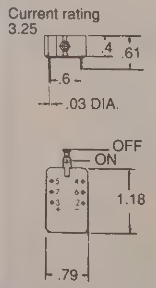
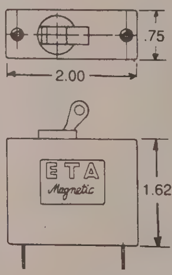
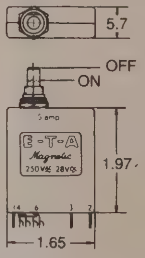
<table>
<tr><th></th><th colspan="2">Magnetic</th><th colspan="3">Thermal-Magnetic Circuit Breakers</th><th>Three Pole Overload</th></tr>
<tr><td>E-T-A®
setting the pace for circuit protection</td><td> </td><td></td><td></td><td> </td><td></td><td>

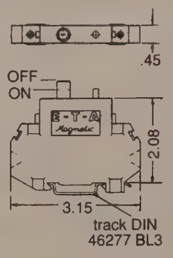
48-300
48-800

</td></tr>
<tr><td>Series</td><td>48-08</td><td>8340-F</td><td>43-400-L10
43-500-L10</td><td>42-01
42-01-2325</td><td>2210-T2</td><td>48-300-S
48-800-S</td></tr>
<tr><td>Description</td><td>Magnetic, undelayed trip, PC board mount, NO and NC contacts. ON-OFF switching.</td><td>Series trip Magnetic hydraulic auxiliary contacts available. 1, 2, 3, or 4 pole configuration available.</td><td>Series trip, UL approved for primary ON-OFF switching.</td><td>Series trip, ON-OFF switching. DIN track 3 mounting. Adapter for DIN track 1 available.</td><td>Series trip,ON-OFF switching. Aux, contacts std. 1, 2, 3 or 4 pole configuration. DIN track or panel mount configurations.</td><td>Series trip, ON-OFF switch (-H) optional, auxiliary contacts NO, NC (suffix-Si) optional. Auto-reset version 0.1-5A: 48-800.</td></tr>
<tr><td>Current ratings</td><td>0.01 thru 3.25A</td><td>0.02 thru 30A</td><td>0.05 thru 15A</td><td>0.1 thru 15A</td><td>0.1 thru 20A*</td><td>0.5 thru 15A</td></tr>
<tr><td>Maximum voltage ratings</td><td>115V ac or 60V dc</td><td>250V ac or 65V dc</td><td>250V ac or 65V dc</td><td>250V ac or 65V dc</td><td>250V ac or 65V dc</td><td>0.5—5A: 500V ac
5.5—15A: 380V ac</td></tr>
<tr><td>Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A</td><td>40A at 115Vac/60V dc
60A at 48V ac/dc
100A at 24V ac/dc</td><td>1000A normal use.
UL up to 5000A.</td><td>200A normal use.
UL up to 1000A.
1500A/250V ac version, current ratings 8-15A. E-T-A series 42-1-P10 (not-Si)</td><td>200A normal use.
UL tested to 1000A.</td><td>500A normal use, not to exceed 100 times rated current</td><td>6 times rated current of circuit breaker.</td></tr>
<tr><td>Current capacity of auxiliary contacts, NO, NC.</td><td>NO contacts: 5A continuous at 24V</td><td>10A resistive 3 terminals, optional</td><td>1A resistive 4 solder terminals optional.</td><td>NA</td><td>1A resistive, 1 set per pole, NO or NC (specify)</td><td>3A resistive at 250V ac, 4 solder terminals, optional</td></tr>
<tr><td>Life</td><td>10,000 cycles at rated current</td><td>10,000 cycles at rated current</td><td>6000 cycles (UL 1077) at rated current</td><td>6000 cycles (UL 1077) at rated current</td><td>10,000 cycles at rated current</td><td>5000 cycles at rated current</td></tr>
<tr><td>Terminals</td><td>PC board pins</td><td>250 quick connect</td><td>Solder terminals</td><td>Screw clamp terminals</td><td>Screw clamp terminals</td><td>Screw terminals</td></tr>
<tr><td>Shunt circuit—A3, optional</td><td>Can be arranged</td><td>Optional</td><td>Optional; specify—A3</td><td>NA</td><td>Panel mount version</td><td>NA</td></tr>
<tr><td>Approvals
E-T-A also has European approvals, such as VDE etc. Additional info upon request.</td><td></td><td>UL 1077: E67320
CSA: 16186
VDE</td><td>UL 1077: E67320
CSA: 16186
VDE</td><td>UL 1077: E67320
CSA: 16186
VDE</td><td>UL 1077: E67320
CSA: 16186
VDE
*approvals to 16A only</td><td>CSA: 16186 up to 3.5A
VDE: up to 10A</td></tr>
<tr><td>Design notes
See technical data sheets for data</td><td>Series 48-08 has extra low impedance.</td><td>Shunt relay trip and impulse delay available. Single hole mount version available.</td><td>Quick connect or screw terminals avail., non-standard. DUAL CONTROL available. UL approved for primary ON-OFF switching.</td><td>Half inch spacing makes this device especially attractive for modern control systems design.</td><td>Fits all popular DIN track. Panel mount version available upon request.</td><td>ON/OFF version available (suffix—H). Quick-connect terminals (—P10) avail. non-std. For tech data 48-800-S see Cat. sheet 40806</td></tr>
<tr><td>Technical Data Sheet</td><td>Catalog Sheet 42433</td><td>Catalog Sheet 834090</td><td>Catalog Sheet 40223
Catalog Sheet 40228</td><td>Catalog Sheet 40237</td><td>Catalog Sheet 40247</td><td>Catalog Sheet 40308 (48-800: Cat. Sheet 40806)</td></tr>
<tr><td>Physical Dimensions in Inches
All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.</td><td>

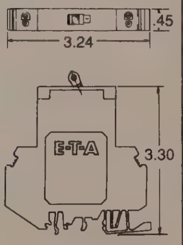
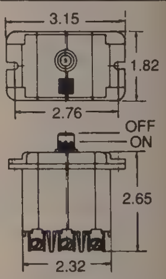
Current rating 3.25
.4
.61
.6
.03 DIA.
OFF
ON
1.18
.79

</td><td> </td><td>

5.7
OFF
ON
5 amp
E-T-A
Magnetic
250V 28V
1.97
1.65

Shown: 43-400-L10-Si</td><td>

.45
OFF
ON
E-T-A
Magnetic
2.08
3.15
track DIN 46277 BL3

Shown: 42-01</td><td> </td><td>
Shown: 48-300-S-H</td></tr>
</table>

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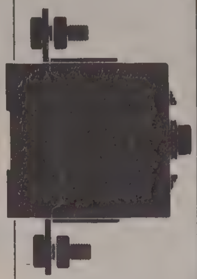
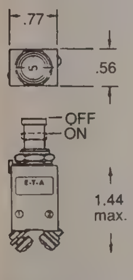
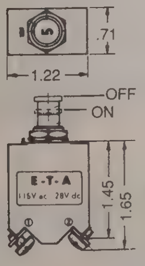
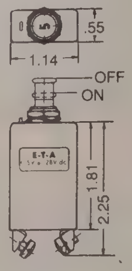
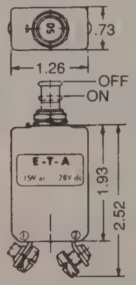
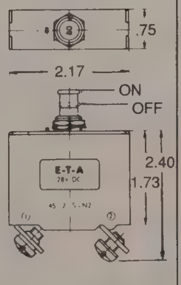
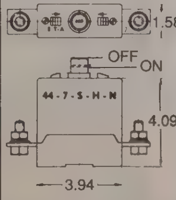
Military Type Circuit Breakers

MS3320 MS14154 						E-T-A® setting the pace for circuit protection
483-G533 **583-G533**	**48-2-S14-LN2**	**41-2-S14-LN2**	**41-3-S14-LN2**	**45-2-S-N2**	**44-7-S-H-N**	**Series**
Series trip, push pull ON-OFF switching. Single or Three pole	Series trip, push-pull ON-OFF switching. Similar devices also avail. for 2 pole (45-62-S) or 3 pole (45-82-S) use.	Series trip, push-pull, ON-OFF switching.	Series trip, push-pull, ON-OFF switching.	Series trip, push-pull, ON-OFF switching.	Series trip, ON-OFF switching.	**Description**
1 thru 25A	3 thru 35A	1 thru 25A	30 thru 70A	60,70,80,90,100A	125,160,225,300,400	**Current ratings**
115V ac or 28V dc	115V ac or 28V dc	115V ac or 28V dc 250V ac upon request	115V ac or 28V dc 250V ac upon request	28V dc ac ratings upon request	28V dc	**Maximum voltage ratings**
Up to 2500A at 115V ac Up to 6000A at 28V dc	500A for current ratings 3-5A. 3500 A for current ratings 7.5 - 35A.	10 times rated current for current ratings 1-5A 1000A for current ratings 8-25A	2000A at 28V dc	8000A at 28V dc 1000A at 250V ac 2000A at 115V ac	10,000A at 28V dc	**Maximum interrupting capacity** depending on current rating, UL 1077 approved breakers have been tested to 2000A
on request	NA	NA	NA	NA	5A resistive 4 screw terminals, optional	**Current capacity of auxiliary contacts, NO, NC.**
10,000 cycles at rated current	5000 cycles at rated current	4000 cycles at 200% rated current	2000 cycles at rated current	1000 cycles at rated current	1000 cycles at rated current	**Life**
Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals	**Terminals**
NA	NA	NA	NA	NA	NA	**Shunt circuit—A3, optional** 1 3 2
MIL-C-5809 MS3320 MS14154	will meet MIL E 5272 C	will meet MIL E 5272 C	will meet MIL E 5272 C	will meet MIL E 5272 C	will meet MIL E 5272 C	**Approvals** E-T-A also has European approvals, such as VDE etc. Additional info upon request
State-of-the-art, temperature compensated, dual chamber construction	Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available. For detailed tech. data 2 & 3 pole:Cat. sht. 40339	Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available.	Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available.	Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available.	Auxiliary circuits NO, NC available, order — Si.	**Design notes** See technical data sheets for data
Catalog Sheet 40145 Catalog Sheet 40146	Catalog Sheet 42521	Catalog Sheet 40103	Catalog Sheet 40112	Catalog Sheet 41813	Catalog Sheet 41814	**Technical Data Sheet**
 Shown: 483	 .71 1.22 OFF ON E-T-A 115V ac 28V dc 1.45 1.65		 .73 1.26 OFF ON E-T-A 15V ac 28V dc 1.93 2.52			**Physical Dimensions in Inches** All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.

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- ▶ HEINEMANN
- ▶ INTERFAN
- ▶ LITTELFUSE
- ▶ POWER DYNAMICS
- ▶ RELIANCE FUSE
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- ▶ UNDERWRITERS SAFETY DEVICE
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■

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- UL Recognized & C.S.A. Certified
- Most Commercial Models are recognized under the Marine Electrical and Fuel System (PEQZ2) as "Ignition Protected Devices"
- Blown Fuse Indicating & Non-Indicating
- High Impact Plastic for Superior Strength
- Dead-Front, Watertight
- Military Versions Meet MIL-F-19207

Commercial Fuseholders All Recognized by Underwriters Laboratories

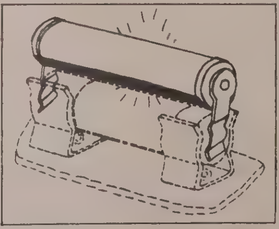
Model	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Voltage AC/DC	UL Recognized Amps	Voltage
5000⁺	¼x1¼"	1	N	250	0-30	250 max
5100⁺	¼x1¼"	3	N	250	0-30	250 max
5200⁺	¼x1¼"	1	N or I	250	0-30	250 max
*5300⁺	¼x1¼"	2	N or I	250	0-30	250 max
*5400⁺	13⁄32x1½"	1	N	600	0-30	600 max
*5500⁺	13⁄32x1½"	3	N	600	0-30	600 max
*5600⁺	13⁄32x1½"	1	N or I	600	0-30	600 max
*5700⁺	13⁄32x1½"	2	N or I	600	0-30	600 max
*5800	9⁄16x2"	1	N or I	600	0-30	250 max
*5900.	13⁄16x3"	1	N or I	600	31-60	250 max

*CSA Certified
⁺Ignition Protected Devices

Indicating models can be modified for use in low voltage applications.

Blown Fuse Indicators

When A Fuse Blows, A Light Glows!®



Several Models To Choose From

- Bolt Down for Rectifier Fuses
- Snap On for Ferrule Fuses
- Top Mounting for Knife Blade Fuses

FIC CORPORATION
P.O. Box 2046
12216 Parklawn Drive
Rockville, MD 20852

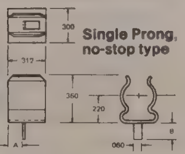
TOLL FREE: 800/638-6594
IN MD: 301/881-8124
TWX: 710-828-9809

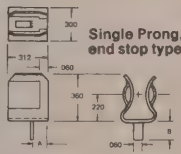
Military Fuseholders

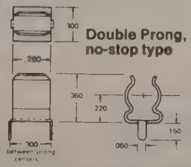
MIL-SPEC	Type	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Amps	Volts	Moisture Protection
19207/1	FHL10U	¼x1¼"	2	I	0-30	90-250	Unsealed
19207/2	FHL11U	¼x1¼"	1	I	0-30	90-250	Unsealed
19207/3	FHL12U	13⁄32x1½"	1	I	0-30	90-500	Unsealed
19207/4	FHL13G	9⁄16x2"	1	I	0-30	90 500	Dripproof
19207/5	FHL14G	13⁄16x3"	1	I	31-60	90-500	Dripproof
19207/6	FHL15G	1 1⁄16x5⅞"	1	I	61-100	90-500	Dripproof
19207/7	FHL16G	1⅝x7⅛"	1	I	101-200	90-500	Dripproof
19207/17	FHN28WB	¼x1¼"	1	N	0-30	250 Max	Watertight Body Sealed
19207/18	FHL29G	¼x1¼"	2	I	0-30	12-90	Dripproof
19207/19	FHL30G	¼x1¼"	1	I	0-30	12-90	Dripproof
19207/21	FHL32W	¼x1¼"	1	I	0-30	90-250	Watertight
19207/22	FHL33W	¼x1¼"	2	I	0-30	90-250	Watertight
19207/23	FHL34W	13⁄32x1½"	2	I	0-30	90-500	Watertight
19207/24	FHL35W	13⁄32x1½"	1	I	0-30	90-500	Watertight
19207/25	FHN41WB	13⁄32x1½"	1	N	0-30	500 Max	Watertight Body Sealed
19207/30	FHN46WB	¼x1¼"	3	N	0-30	250 Max	Watertight Body Sealed
19207/31	FHN47WB	13⁄32x1½"	3	N	0-30	500 Max	Watertight Body Sealed

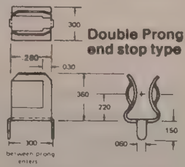
PC BOARD FUSE CLIPS

Low profile clips (.360" high) are soldered to printed circuit boards eliminating eyeletting or riveting. Available in Spring brass, beryllium copper or spring bronze with various platings.


Single Prong, no-stop type


Single Prong, end stop type


Double Prong, no-stop type


Double Prong, end stop type

Heinemann® Circuit Breakers First in Features, First in Quality

Heinemann offers the widest choice of styles and current ratings in high-quality, reliable circuit protectors. Ratings range from 0.01A to as high as 700A. Their applications are as diverse as medical equipment, computers, industrial air conditioners, electric locomotives and telecommunications equipment.

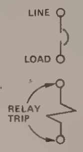
Heinemann can also supply circuit breakers that provide auxiliary functions. For example, a heavy-duty relay, an on/off switch and a hydraulic-magnetic circuit breaker, all in one economical and compact unit.

Use this condensed guide to locate the type of circuit breaker that best meets your requirements. Then write or call us for a copy of the appropriate product bulletin containing detailed specifications and ordering information. Or call one of our technical assistance engineers to dicuss your particular application.

Technical assistance, important features and quality products...three reasons why it pays to look to Heinemann "When your reputation's on the line."

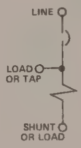
SPECIAL-FUNCTION CIRCUITS

Heinemann circuit breakers (except for PS1, KD, TX and Hector) can be furnished with a number of special-function internal circuits. They permit a single protector to perform the protection and control functions of several components.



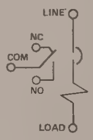
RELAY-TRIP

Permits remote actuation using a separate control circuit. Electrical isolation allows use of a different current or voltage from contact circuit. Both time delay and non-time delay constructions are available.



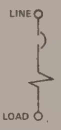
SHUNT/TAP

Use of third terminal permits remote tripping by utilizing line voltage with or without a time delay response. On breakers rated up to 1A, the trip point may be raised by shunting with an external resistor on the shunt/tap terminal.



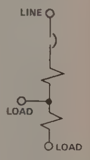
AUXILIARY SWITCH

Used for logic functions, alarms, lights and other circuits. Miniature snap-action SPDT or DPDT switch is mounted on the back of the breaker, mechanically connected to the switching mechanism. Contact capacity: 10A at 125/250 V, 50/60 Hz; 4A resistive at 30 Vdc; 2.5A inductive at 30 Vdc. Minimum operating voltage 6 Vdc or ac, at 3 VA dc or ac.



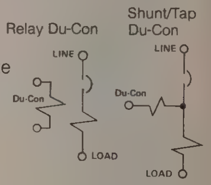
SERIES TRIP (Standard internal circuit)

Ideal for use as both power switch and overload protector. Usually installed in series with line and load terminals to provide circuit interruption in the protected circuit.



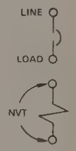
DUAL RATING

Two concentrically-wound sensing coils provide two discrete current ratings in the same breaker. Protects equipment designed to operate at two different current levels or supply voltages within certain limitations.



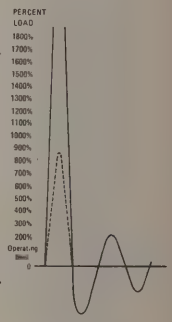
DU-CON™ (DUAL-CONTROL)

Provides sensing of both overcurrent and separate voltage signals in the same pole through a small, non-continuous-duty voltage sensing coil. DU-CON overload and voltage coils must be specified separately.



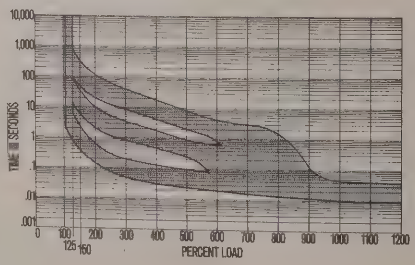
NO-VOLTAGE TRIP

Prevents uncontrolled re-start of equipment after power outage. Used in ground-fault interrupters and other safety applications. Not intended for overload protection without one pole connected in series-trip configuration.



HIGH-INRUSH

Economical protection of high-reactance loads, which draw starting surges often as high as 30 times normal load current in a 50/60 Hz 1/2-cycle pulse, such as ferro-resonant power supplies and distribution transformers. Eliminates nuisance tripping without derating or special circuitry.



Typical Time Delay Curves

Circuit breakers are available in a variety of time-delay curves for applications such as high-inrush, 50/60 Hz and dc as well as with no intentional delay.

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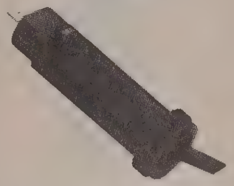
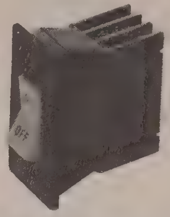
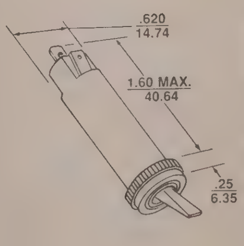
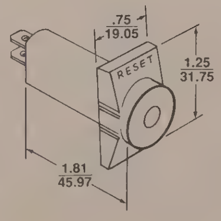
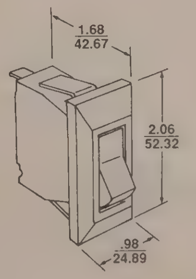
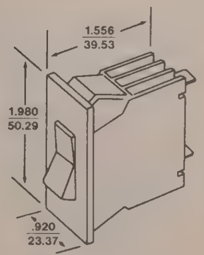
First in Features, First in Quality

	PS1 FUSE-SWITCH	RE-CIRK-IT® SERIES KD1	TYPE TX	SERIES RX
				
	Fuse-Switch provides ON/OFF control and fuse protection in a single low-cost component. Its use eliminates a hole and interconnecting wiring and makes it easy to re-fuse from the front panel. It accepts standard 1/4-inch diameter by 1¼-inch fuses. An adapter is available for 5 mm x 20 mm fuses. Can be supplied for normally open or normally closed operation.	A low-cost, pushbutton supplementary protector for electrical equipment, designed to fit in a standard 5/8-inch round or "D" fuseholder panel cutout. Resettable at up to 1000% of its rated current from 2.5A through 15A, 500% from 0.25A through 2A. Slide-on retaining ring included.	The attractively designed Type TX circuit protector doubles as an economical ON/OFF switch and with an optional lamp as a power indicator. Rocker arms available in a variety of colors; in one and two pole models. Its trip free design cannot be held closed against a fault. Features quick-connect terminals and snap-in mounting.	A compact hydraulic-magnetic circuit breaker featuring snap-in mounting and rocker handle operation. Over-the-center, non-teasable mechanism prolongs contact life by reducing arcing. Available with long, short and no deliberately imposed time delay.
APPLICATIONS	Consumer and industrial products that would otherwise use a separate ON/OFF switch and fuse holder.	Consumer and industrial products, office machines, appliances, power supplies, convenience outlets, electronic games.	Commercial and consumer products, power supplies, medical electronic equipment, office and reproduction equipment, data processing equipment.	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment).
NO. OF POLES	1	1	1 and 2	1 and 2
CURRENT RATINGS	Determined by choice of fuse. To 20A	0.25-15A	2,3,5,7,10,15 and 20A	0.1 to 15A (ac) 0.1 to 20A (dc)
MAX. VOLTAGE	120 Vac @ 20A 250 Vac @ 15A 32 Vdc @ 20A	250 V, 50/60 Hz 50 Vac up to 10A 32 Vdc @ 15A 50 Vdc @ 10A	250 Vac (10A max.) 125 Vac (20A max.) 32 Vdc (20A max.)	250 Vac (7.5A max.) 125 Vac (15A max.) 32 Vdc (20A max.)
INTERRUPTING CAPACITY		1000A @ 250 V, 50/60 Hz 200A @ 32 Vdc and 50 Vdc per UL Std 1077 testing procedures	3500A (ac) with backup fusing 1000A (dc) with backup fusing	1000A 5000A with backup fusing
AGENCY RECOGNITION OR APPROVAL	UL recognized CSA certified SEV approved	UL recognized (Std 1077) CSA certified VDE approved SEV approved	UL recognized, Component Recognition Program CSA certified Suitable for VDE 0730 Equipment	UL recognized (Std 1077) CSA certified SEV, TUV, IEC and VDE approved
DIMENSIONS				

Eaton Corporation
Heinemann Products
P.O. Box 6800, Lawrenceville, NJ 08648-0800
Phone: (609) 896-0009, Fax: (609) 896-1631

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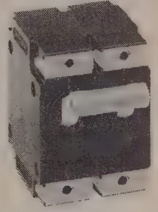
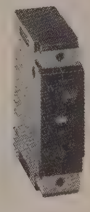
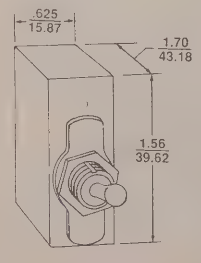
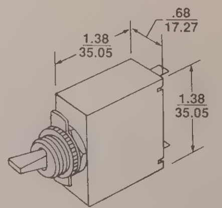
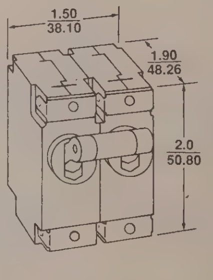
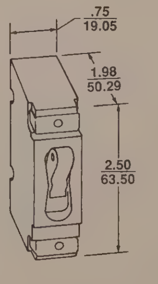
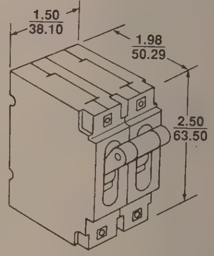
Heinemann® Circuit Breakers First in Features, First in Quality

SERIES HM	SERIES L	SERIES J/S	SERIES AM	SERIES AM-MIL
				
Lightweight, subminiature, multi-frequency circuit breaker designed to withstand severe environmental extremes such as shock, vibration and high humidity. Housed in a corrosion-resistant brass case, nickel plated. Meets MIL-C-39019, is explosion- and fungus-resistant, operates in any position. Silver contacts provide good conductivity with low power loss.	This compact hydraulic-magnetic circuit protector provides the same quality, precision and choice of time delays found in larger Heinemann magnetic circuit breaker. Over-the-center, non-teasable mechanism provides snap-action operation that prolongs contact life by reducing arcing. Handles available in seven different colors for decorative or circuit-identification purposes.	Compact, lightweight, moderately-priced circuit breaker for single or multi-pole OEM applications. Also available with snap-in mounting or rocker handles. Sealed mount models are also available, single pole only. Series J/S breakers are suitable for domestic or world-market applications. Models also available for marine applications.	A low-cost, lightweight breaker available in single or multi-pole configurations, the Series AM features rear-connection studs, a high level of moisture resistance, and a current range up to 100A dc or 60A ac. Qualified under MIL-C-55629 to 50A dc and ac.	Heinemann Series AM-MIL breakers are specifically built and tested in accordance with the requirements of MIL-C-55629. Fungus- and moisture-resistance is provided by treating all ferrous parts with a special finish, and by using special springs and inherently fungus-resistant phenolic cases, covers and handles.
Military programs and commercial products, power supplies, mining and medical applications where hermetically-sealed circuit protection is required.	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment).	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment), control panels, marine equipment, field instrumentation.	OEM (data-processing equipment, mobile applications, humid environments).	OEM (data processing equipment, mobile applications, military equipment subject to humid, tropical environments).
1 and 2	1 and 2	1 to 4	1 to 4	1 to 3
0.050-20A	0.1 to 20A	0.02-50A	0.020-60A (ac) 0.020-100A (dc)	0.020-50A (ac and dc)
240 Vac, 60 or 400 Hz; 50 Vdc	250 Vac (7.5A max.) 125 Vac (15A max.) 32 Vdc (20A max.)	250 Vac (30A max.) 65 Vdc (50A max.) 80 Vdc (15A max.)	250 V, 50/60 or 400 Hz 277 V, 50/60 Hz, 1-phase 480 V, 50/60 Hz, 3-phase "Y" 65 Vdc AC/DC	240 V 50/60 Hz 240 V 400 Hz 50 Vdc
1000A @ 240 V, 60 Hz or 400 Hz and 50 Vdc per UL Std 1077 testing procedures	1000A 5000A with backup fusing	1000A 5000A with backup fusing	1000A 5000A with backup fusing	2000A @ 50 Vdc and 120 Vac 60 Hz 1500A @ 120 Vac, 400 Hz 1000A @ 240 Vac, 60 and 400 Hz
Not UL/CSA recognized or listed. Available as MIL-C-39019 QPL item.	UL recognized (Std 1077) CSA certified SEV approved IEC approved Designed to meet VDE	UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	UL recognized CSA certified	Not required for QPL items
				

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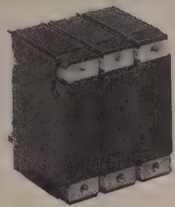
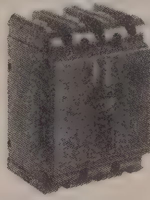
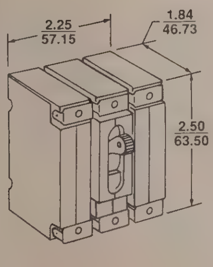
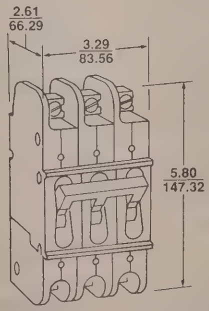
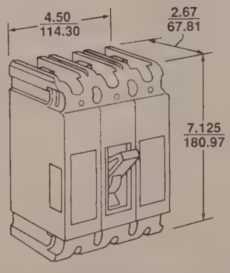
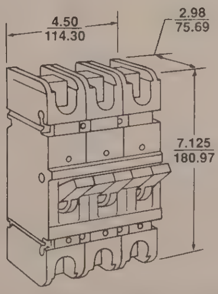
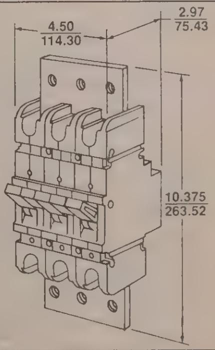
Heinemann® Circuit Breakers First in Features, First in Quality

SERIES AM/S	SERIES CF E-FRAME	SERIES GH EH-FRAME	SERIES GJ	SERIES GJ1P
				
Series AM/S "world class" circuit breakers meet International Standard IEC 380 and German Standard VDE 0730. The 8-mm spacing requirement and dielectric-withstand specification are incorporated into the standard AM breaker housing without changes in size, thereby eliminating mounting procedure modifications or the need for adapter plates.	Priced considerably lower than competitive E-frame breakers, the Series CF is the most compact and versatile circuit breaker available for equipment and branch-circuit protection. Single- and multi-pole models are stocked in a wide range of standard ratings for fast, off-the-shelf delivery.	This rugged new EH-frame breaker offers all the advantages of a completely magnetic, three-pole breaker with 14,000A interrupting capacity for less than most thermal units. Compact, environmentally stable and to 100A at 480 Vac and 250 Vdc.	Where space is at a premium and current capacity up to 250A is called for, the Series GJ is the answer. Available in one-, two-, or three-pole models, it is especially suitable for panelboards, service entrances, and electric vehicles.	GJ1P parralel-pole breakers incorporate Precision Current Equalization (PCE) to automatically distribute current equally through the current-sensing elements. PCE thereby minimizes nuisance tripping which can occur with conventional parallel-pole breakers. An optional shunt permits metering of current. Since shunt output is only 25 mv, light-gauge wiring can be used between shunt and meter.
OEM (data processing equipment, mobile applications, humid environments).	Panelboards, switchboards, branch circuits, EDP equipment, machine tools, environmental systems, single- and three-phase applications.	Motor controls, air conditioning, electric heating, computer main frames, transportation, indoor or outdoor installations.	Commercial, industrial, and residential service — entrance or panelboard applications; lighting, appliance, transformer, electric vehicles, EDP power supplies, heating, air conditioning, and electronic circuit protection.	Telecommunications, transportation, air conditioning, other outdoor "heat-loaded" equipment.
1 to 4	1 to 6	1 to 3	1 to 3	1
0.020-60A (ac) 0.020-100A (dc)	0.01-100A (ac) 1.0-100A (dc)	.5-100A (ac) .5-100A (dc)	100-250A	100-700A (dc)
250 V 50/60 Hz or 400 Hz 277 V 50/60 Hz 1-phase 65 Vdc 480 V 50/60 Hz 3-phase "Y"	240 V, 50/60 or 400 Hz 480 V, 1- and 3-phase 125 Vdc 600 V, 3-phase 125 Vdc	480 V, 50/60 Hz 250 Vdc	240 V, 50/60 Hz 125/250 Vdc	160 Vdc
1000A 5000A with backup fusing	10,000 @ 120 Vac 7500A @ 120/240 Vac 50/60 Hz; 240 Vac 50/60 Hz 5000A @ 120/240 Vac 400 Hz; 240 Vac 400 Hz 125 Vdc	14,000A (ac) 10,000A (dc)	18,000A @ 240 V, 50/60 Hz 10,000A @ 125/250 Vdc 14,000A @ 160 Vdc 25,000A @ 65 Vdc	10,000A @ 160 Vdc 25,000A @ 65 Vdc
UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	240 V, 50/60 Hz and 125 Vdc: UL listed Others: Recognized CSA certified	UL listed (ac) (3-pole) 480 Vac 15-100A	240 V, 50/60 Hz and 125/250 Vdc: UL listed	160 Vdc: UL listed
				

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Phone: (609) 896-0009, Fax: (609) 896-1631

EATON

Iskra CIRCUIT PROTECTION DEVICES

• FERRITES • SUPPRESSION COMPONENTS • DIODES • BRIDGE RECTIFIERS • VARISTORS •

METAL OXIDE VARISTORS

SERIES VXXX KXX

- Very non-linear bidirectional breakdown
- High non-linear exponent (>20)
- Very low leakage current
- High current density capability
- Reliable and Effective Suppression in a small package
- Can be used in place of Filters, Zeners, Selenium Cells
- Applications: Computers, Telecommunications, Consumer Goods, Measuring Devices
- T/R Available on K5 and K7 Sizes
- Lead Forming Available on All Sizes
- Durez or Epoxy Coatings Available
- UL File Number E 103662

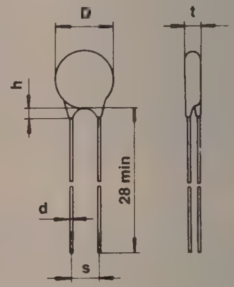
Operating Ambient Temperature	—40°C to +85°C
Voltage Temperature Coefficient	—0.05%/°C
Nominal Voltage Defined at (DC)	K5 (0.1 mA) K7, 10, 14, 20 (1 mA)
Tolerance of V_N	±10%

* Additional Literature Available upon request.
* Custom Designing of Protection Assemblies Also Available. Call us with your design problems.

A metal oxide varistor (MOV) is a voltage dependent non-linear resistor with V-1 curves similar to back-to-back zener diodes. The current through the varistor is exponentially dependent on the voltage. It is intended for safeguarding sensitive electronic components against voltage surges.

ORDERING EXAMPLE:

V 60 K10
- K10 — **Disc Diameter Size Code**
- 60 — **Maximum Allowable Continuous RMS Voltage**
- V — **Varistor**



Note: Non-Standard Voltages, Tolerances, Lead Spacing and Lead Length Available

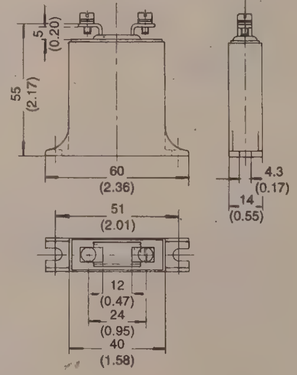
Size Code	Dimensions (mm)					Maximum Allowable Continuous RMS Voltage At 50-60 Hz (V)
	D (max)	s±1	t (max)	h (max)	d	
K5	7.5	5	6	2	0.6	11, 14, 17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320, 350
K7	9.0	5	7	2	0.6	11, 14, 17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320, 350
K10	13.5	7.5	7.5	3	0.8	11, 14, 17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320, 350, 385, 420, 460, 510, 550, 625, 680, 750
K14	17	7.5	7.5	3	0.8	11, 14, 17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320, 350, 385, 420, 460, 510, 550, 625, 680, 750
K20	24	10 or 7.5	14.5	4	0.8	11, 14, 17, 20, 25, 30, 35, 40, 50, 60, 75, 95, 115, 130, 140, 150, 175, 230, 250, 275, 300, 320, 350, 385, 420, 460, 510, 550, 625, 680, 750, 1100

SERIES VXXX E32 / VXXX HE32

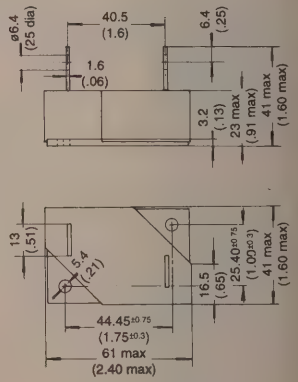
- High Energy Varistors
- Average Power Dissipation 1.2W
- Varistor Voltage Tolerance ±10%
- Peak Current 25000 A

RMS Voltage	DC Voltage	Energy (Joules)	Varistor Voltage	Maximum Clamping Voltage		Capacitance
130V	170V	350J	205V	340V	200A	4400pf
150V	200V	425J	240V	395V	200A	3700pf
230V	300V	650J	360V	595V	200A	2500pf
250V	320V	800J	390V	650V	200A	2200pf
275V	350V	450J	430V	710V	200A	2000pf
320V	420V	1050J	510V	840V	200A	1700pf
385V	505V	1100J	620V	1025V	200A	1400pf
420V	560V	1250J	680V	1120V	200A	1300pf
460V	615V	1400J	750V	1240V	200A	1200pf
510V	670V	1600J	820V	1360V	200A	1100pf
550V	745V	1750J	910V	1500V	200A	1000pf
680V	895V	2150J	1100V	1815V	200A	830pf
750V	1060V	2250J	1200V	2000V	200A	800pf

E



HE



CONTACT FACTORY FOR LITERATURE, SAMPLES AND INFORMATION
ON ANY OF THE ABOVE PRODUCTS.
WE ALSO MAKE CUSTOM ASSEMBLIES FOR CIRCUIT PROTECTION.

ISKRA ELECTRONICS INC.
155 Dupont Street, Plainview, N.Y. 11803 • 516-349-0222 • Toll Free: 800-862-2101 • Fax: 516-349-7642 • TLX: 221527

KCK All the Suppliers You'll Ever Need

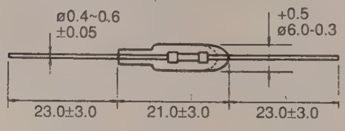
Protection Devices

The DIA Surge Absorber Series

DSA Series

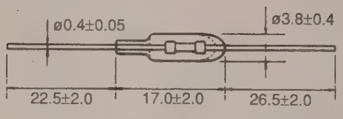
- *Spark Over Voltage:* 300V to 4500V
- *Voltage Tolerance:* ±15%, ±20%
- *Insulation Resistance:* 100MΩ
- *Capacitance:* 2pF MAX
- *Surge Current:* 1500A, 2000A

DSA-A Type


ø0.4~0.6
±0.05
+0.5
ø6.0-0.3
23.0±3.0
21.0±3.0
23.0±3.0

Unit: mm

DSA-S Type
DSA-S-C Type


ø0.4±0.05
ø3.8±0.4
22.5±2.0
17.0±2.0
26.5±2.0

Unit: mm

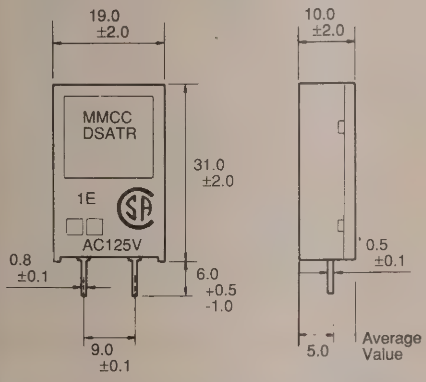
DSATR Series

- *Spark Over Voltage:* 2400V to 3000V
- *UL/CSA:* 125VAC
- *Insulation Resistance:* ±15%, ±20%
- *Capacitance:* 5pF MAX
- *Surge Current:* 1000A

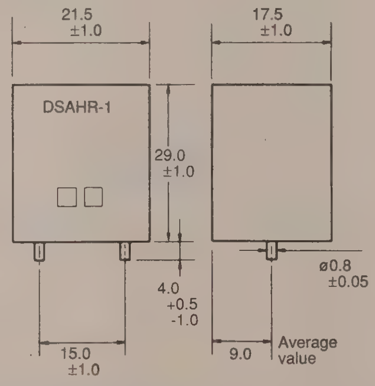
DSANR/DSAHR

- *Spark Over Voltage:* 500V to 800V
- *Insulation Resistance:* 100MΩ
- *Capacitance:* 5pF MAX
- *Surge Current:* 1000A

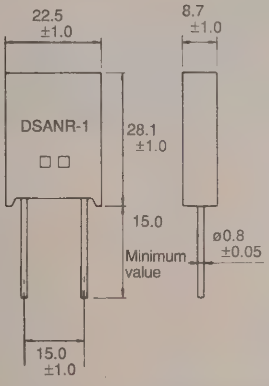
DSATR Type


19.0
±2.0
10.0
±2.0
MMCC
DSATR
1E
AC125V
31.0
±2.0
0.8
±0.1
6.0
+0.5
-1.0
0.5
±0.1
9.0
±0.1
5.0
Average
Value

DSAHR Type


21.5
±1.0
17.5
±1.0
DSAHR-1
29.0
±1.0
4.0
+0.5
-1.0
ø0.8
±0.05
15.0
±1.0
9.0
Average
value

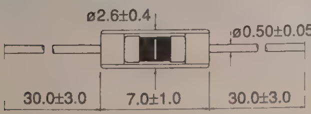
DSANR Type


22.5
±1.0
8.7
±1.0
DSANR-1
28.1
±1.0
15.0
Minimum
value
ø0.8
±0.05
15.0
±1.0

mm Unit: mm

DSP Series

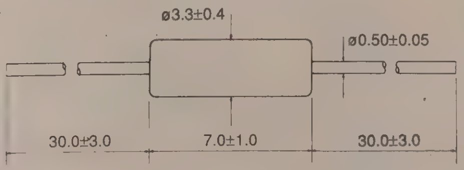
- *Spark Over Voltage:* 120V, 200V, 300V
- *Voltage Tolerance:* ±20%, ±30%
- *Insulation Resistance:* 100MΩ
- *Capacitance:* 1pF MAX


ø2.6±0.4
ø0.50±0.05
30.0±3.0
7.0±1.0
30.0±3.0

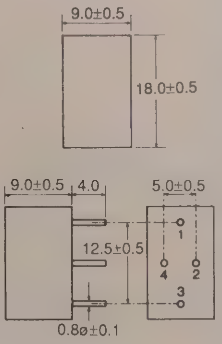
DSS-DSSV Series

- *Spark Over Voltage:* 300V, 400V
- *Voltage Tolerance:* ±15%, ±20%
- *Insulation Resistance:* 100MΩ
- *Capacitance:* 1pF MAX
- *DSSV:* UL1459 Approved

DSS Type


ø3.3±0.4
ø0.50±0.05
30.0±3.0
7.0±1.0
30.0±3.0

DSSV Type


9.0±0.5
18.0±0.5
9.0±0.5
4.0
5.0±0.5
12.5±0.5
1
4
2
3
0.8ø±0.1

mm Unit: mm

KCK America Inc.
4080 Winnetka Avenue, Rolling Meadows, Illinois 60008 U.S.A. • 708/577-0200 • Fax 708/577-0201 • Toll Free 1-800-323-6237

Littelfuse® CIRCUIT PROTECTION DEVICES

PICO™ II 250 Volt
Very Fast-Acting Fuse

ORDERING INFORMATION:

Catalog Number	Ampere Rating	Voltage Rating	Cold Resistance (Ohms)[1]	Hot Resistance (Ohms)[2]	Melting I^2t (A^2s)
263.062	1/16	250	5.500	11.290	0.00015
263.125	1/8	250	1.900	2.600	0.0042
263.250	1/4	250	0.680	0.940	0.016
263.375	3/8	250	0.370	0.520	0.047
263.500	1/2	250	0.240	0.340	0.098
263.750	3/4	250	0.150	0.235	0.063
263001	1	250	0.105	0.165	0.130
26301.5	1½	250	0.064	0.099	0.335
263002	2	250	0.044	0.069	0.660
26302.5	2½	250	0.034	0.051	1.120
263003	3	250	0.027	0.041	1.700
26303.5	3½	250	0.022	0.034	2.400
263004	4	250	0.019	0.028	3.350
263005	5	250	0.015	0.021	5.300

[1] Measured at less than 10% rated current
[2] Measured at 100% rated current

ELECTRICAL CHARACTERISTICS:

% of Ampere Rating	Opening Time
100%	4 Hours, **Minimum**
200%	1 Second, **Maximum**
300%	0.1 Second, **Maximum**

APPROVALS:

Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.

Interrupting Rating:
50 amperes at 250 volts AC

Operating Temperature:
–55°C to 125°C

Materials:
Body: UL94VO Epoxy Coating, Green
Leads: Solder Coated Copper

RECOMMENDED SOLDERING PARAMETERS:

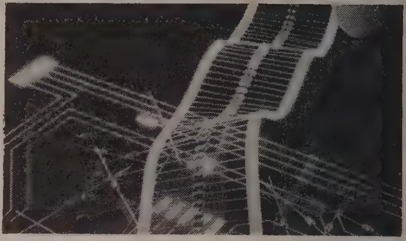
Reservoir Temperature: 500°F Maximum
Dwell Time: 10 Seconds Maximum
Lead Soldering: 1/8 Inch Minimum from Body

PACKAGING:

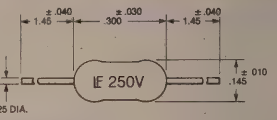
Fuses packaged to comply with EIA Standard 296. To order, add the prefix "R" and the suffix "T1" [52.4mm (2.062") tape spacing]. Contact factory for other packaging options.

PATENTS:

Patented.

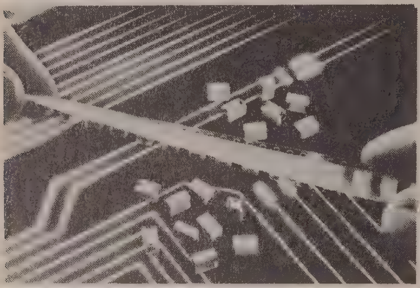


DIMENSIONS:



NOTE: LF logo and amperage rating, laser marked on one side, LF and 250V on the other side.

PICO-SMF™
Very Fast-Acting & Slo-Blo®



ELECTRICAL CHARACTERISTICS:

% of Ampere Rating	Very Fast-Acting Opening Time	Slo-Blo® Opening Time
100%	4 hours, **Minimum**	4 hours, **Minimum**
200%	1 second, **Maximum**	1 second, **Minimum**/ 60 seconds, **Maximum**
300%	0 1 seconds, **Maximum**	0.2 seconds, **Minimum**/ 3 seconds, **Maximum**
800%		0.02 seconds, **Minimum**/ 0.1 seconds, **Maximum**

RECOMMENDED SOLDERING PARAMETERS:

	Very Fast-Acting	Slo-Blo®
Infrared Reflow	500°F (260°C) Maximum Temperature	446°F (230°C) Maximum Temperature
Thru The Wave	500°F (260°C) 10 Seconds Maximum	500°F (260°C) 3 Seconds Maximum

APPROVALS:

Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.

Interrupting Rating:
Very Fast-Acting: 50 Amperes at 125VAC and 300 Amperes at 125VDC.
Slo-Blo®: 50 Amperes at 125VAC and DC.

Operating Temperature:
–55°C to 125°C

Materials:
Body: Molded Thermoplastic
Terminals: Plated Copper

PACKAGING:

Fuses supplied on 12mm tape. 500 fuses per reel for use with automatic placement equipment per EIA Standard 481-1. Contact factory for other packaging options.

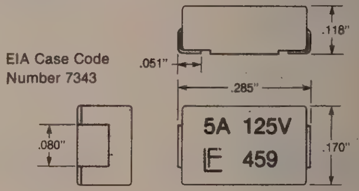
PATENTS:

Patented

ORDERING INFORMATION:

Very Fast-Acting Catalog Number	Slo-Blo® Catalog Number	Ampere Rating	Voltage Rating
R459.062	–	1/16	125V
R459.125	–	1/8	125V
R459.250	–	1/4	125V
R459.375	–	3/8	125V
R459.500	R460.500	1/2	125V
R459.750	R460.750	3/4	125V
R459001	R460001	1	125V
R45901.5	R46001.5	1½	125V
R459002	R460002	2	125V
R45902.5	R46002.5	2½	125V
R459003	R460003	3	125V
R45903.5	R46003.5	3½	125V
R459004	R460004	4	125V
R459005	R460005	5	125V

DIMENSIONS:



PICO™ II
SLO-BLO® PICOFUSE

ORDERING INFORMATION:

Catalog Number	Ampere Rating	Voltage Rating
473.500	½	125
473.750	¾	125
473 001	1	125
473 01.5	1½	125
473 002	2	125
473 02.5	2½	125
473 003	3	125
473 03.5	3½	125
473 004	4	125
473 005	5	125
473 007	7	125

ELECTRICAL CHARACTERISTICS:

% of Ampere Rating	Opening Time
100%	4 Hours, **Minimum**
200%	1 Second, **Minimum**/ 60 Seconds, **Maximum**
300%	0.2 Seconds, **Minimum**/ 3 Seconds, **Maximum**
800%	0.02 Seconds, **Minimum**/ 0.1 Seconds, **Maximum**

APPROVALS:

Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.

Interrupting Ratings:
50 amperes at 125 volts AC
50 amperes at 125 volts DC

Operating Temperature Range:
–55°C to 125°C

Materials:
Body – UL94VO Epoxy Coating, Gold
Leads – Solder Coated Copper Wire

RECOMMENDED SOLDERING PARAMETERS:

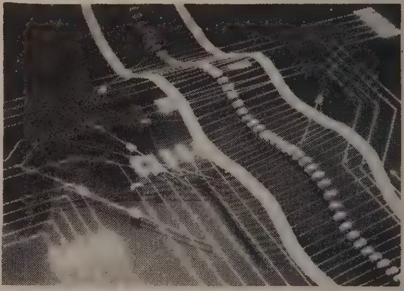
Reservoir Temperature: 500°F Maximum
Dwell Time: 10 Seconds Maximum
Lead Soldering: ⅛ Inch Minimum from Body

PACKAGING:

Fuses packaged to comply with EIA Standard 296. To order, add the prefix "R" and the suffix "T1" [52.4mm (2.062") tape spacing]. Contact factory for other packaging options.

PATENTS:

Patented



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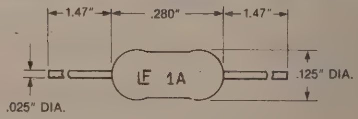
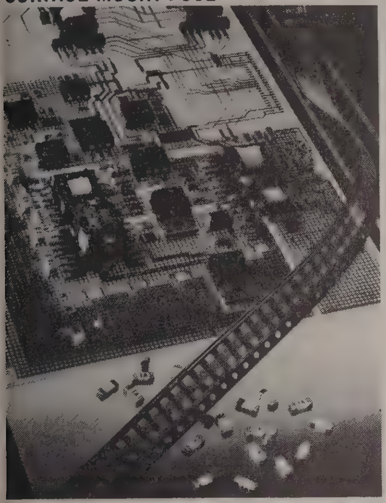


NOTE: LF and amperage rating are laser-marked on two sides.

Littelfuse®

CIRCUIT PROTECTION DEVICES

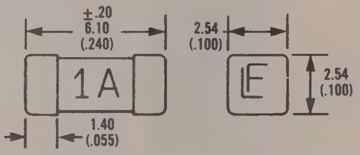
NANO2™ SMF VERY FAST-ACTING SURFACE MOUNT FUSE



ELECTRICAL CHARACTERISTICS:

% of Ampere Rating	Ampere Rating	Opening Time
100%	1/16-15	4 hours, **Min**imum
200%	1/16-10	5 seconds, **Max**imum
200%	12-15	20 seconds, **Max**imum

APPROVALS: Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.
INTERRUPTING RATING: 100 Amperes at 125 Volts AC (1/16A-10A)
50 Amperes at 125 Volts AC (12A-15A)
300 Amperes at 125 Volts DC (1/16A-15A)
OPERATING TEMPERATURE: −55°C to +125°C
MATERIALS: Body—Ceramic, Caps—Tin-Lead Alloy Plated Brass.
RECOMMENDED SOLDERING PARAMETERS:
Infrared Reflow: 500°F (260°C) Maximum
Wave Solder: 500°F (260°C) Maximum, 10 Seconds Maximum
PACKAGING: Fuses supplied on 12mm tape and reel for use with automatic placement equipment per EIA Standard 481. 1000 fuses per reel. Contact factory for details.
PATENTS: Patented



ORDERING INFORMATION:

Catalog Number	Ampere Rating	Voltage
451.062	1/16	125
451.125	1/8	125
451.250	1/4	125
451.375	3/8	125
451.500	1/2	125
451.750	3/4	125
451001	1	125
45101.5	1½	125
451002	2	125
45102.5	2½	125
451003	3	125
45103.5	3½	125
451004	4	125
451005	5	125
451007	7	125
451010	10	125
451012	12	125
451015	15	125

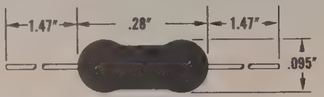
PICO II™ VERY FAST-ACTING FUSE

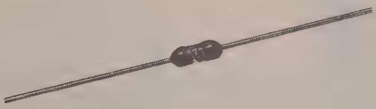
APPROVALS: Recognized under the Components Program of Underwriter Laboratories and Certified by CSA.
INTERRUPTING RATING:
300 amperes at rated voltage DC.
50 amperes at rated voltage AC.
OPERATING TEMPERATURE:
−55°C to 125°C
MATERIALS:
Body: UL94V0 Epoxy Coating, Green.
Leader: Solder Coated Copper.
RECOMMENDED SOLDERING PARAMETERS:
Reservoir Temperature: 500°F Maximum
Dwell Time: 10 seconds Maximum
Lead Soldering: 1/8 inch Minimum from body
PACKAGING:
Fuses packaged to comply with EIA Standard 296. To order tape and reel, add prefix (R) and the suffix "T1" {52.4mm (2.062"), tape spacing}. Contact factory for other packaging options.
PATENTS:
Patented

ELECTRICAL CHARACTERISTICS

% of Ampere Rating	Ampere Rating	Opening Time
100%	1/16 - 15	4 hrs, **Minimum**
200%	1/16 - 7	1 sec, **Maximum**
200%	10	3 sec, **Maximum**
200%	12 - 15	10 sec, **Maximum**

251 Series - Axial Leads

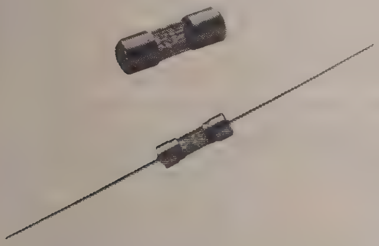




ORDERING INFORMATION:

Catalog Number	Ampere Rating	Voltage
251.062	1/16	125
251.125	1/8	125
251.250	1/4	125
251.375	3/8	125
251.500	1/2	125
251.750	3/4	125
251001	1	125
25101.5	1½	125
251002	2	125
25102.5	2½	125
251003	3	125
25103.5	3½	125
251004	4	125
251005	5	125
251007	7	125
251010	10	125
251012	12	32
251015	15	32

2AG SUBMINIATURE FUSES



Cartridge Size:
.177" Dia. x .58"
Axial Lead Size:
.19" x .60" (leads 1.50" x .025" Dia.)

FAST ACTING TYPE (225 & 224)

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 1 sec. max.
Interrupting Rating:
10,000 amperes at 125 VAC (0.1-10A)
35 amperes at 250VAC (0.1-1A)
100 amperes at 250VAC (1.5-3.5A)

SLO-BLO® TYPE (229 & 230, 229S & 230S)

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 3 sec. min./20 sec. max.
Interrupting Rating:
10,000 amperes at 125 VAC (0.25-3.5A)
400 amperes at 125VAC (4-7A)
35 amperes at 250VAC (0.25-1A)
100 amperes at 250VAC (1.5-3.5A)
Approvals: U.L. Listed and Certified by C.S.A. thru 3.5 amps. U.L. Recognized 4-7 amps.
PATENTS: U.S. Patent 4,409,729 and 4,445,106.

PACKAGING:
224 + 230/230S available on tape and reel to comply with EIA Standard 296. To order, add the prefix "R" and the suffix "T1" for 2.062" (52.4mm) tape spacing. Contact factory for other packaging options.

ORDERING INFORMATION:

Fast-Acting	Slo-Blo	Ampere Rating	Voltage Rating
225.100	—	1/10	250V
225.125	—	1/8	250V
225.250	229.250	1/4	250V
225.375	229.375	3/8	250V
225.500	229.500	1/2	250V
—	229.600	6/10	250V
225.750	229.750	3/4	250V
225001	229001	1	250V
22501.5	22901.5	1-1/2	250V
225002	229002	2	250V
—	2292.25	2-1/4	250V
22502.5	22902.5	2-1/2	250V
225003	229003	3	250V
22503.5	22903.5	3-1/2	250V
225004	229004	4	125V
225005	229005	5	125V
225006	229006	6	125V
225007	229007	7	125V
225008	—	8	125V
225010	—	10	125V

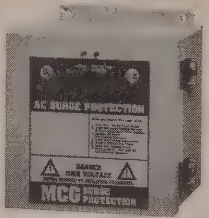
Note: To order fast-acting fuses with axial leads, change **225** to **224**; to order Slo-Blo® fuses with axial leads, change **229** to **230.**

Indicating feature (changes color from clear to yellow/brown), available for **229** and **230** by adding **"S"** after catalog number.

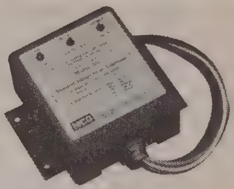
MAXIMUM SURGE PROTECTION

Effective Protection Where It Counts

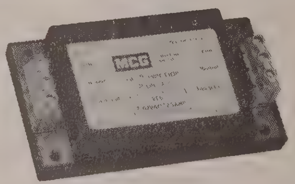
On the AC Power Lines



Service Entrance/Panelboard Protectors - SPC/SPB/SPA+
The SP series are compact, rugged, yet cost-effective shunt-installed panel protectors. Large transient energy absorption, nanosecond fast and modular construction make the SP series a very viable choice for difficult situations. Models available 120VAC to 480VAC, 1 phase and 3 phase service.

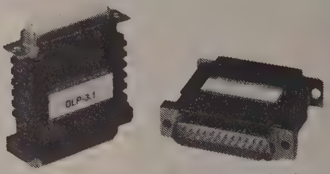


Light Industrial Protection- 160 Series
The 160 series AC voltage surge suppressors are high speed, solid state transient surge protectors designed for up-close protection of sensitive equipment. The 160's ease of installation and sophisticated diagnostics make it ideal for very cost sensitive applications. LED status indicators verify the presence of power and protection. Models available for use on 120VAC, 1 phase and 3 phase service.

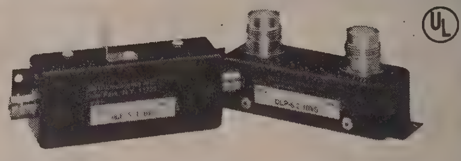


Equipment Level Protectors - 407, 415, 416, 417
The 400 series are compact, low profile protectors installed "within" a piece of equipment. The units employ a sophisticated combination of brute force surge protection and impulse filtering to prevent equipment damage or malfunction. Reaction time is less than 1 nanosecond with automatic reset after the transient has passed. Models available for use on 120VAC and 240VAC, single phase to 25A RMS.

On the Data/Control Lines



Computer/Peripheral Protection - DLP 3 Series
The DLP 3 series protects I/O ports on computers and peripherals from damaging transients caused by lightning and switching surges. Installs in minutes in series with data line permitting a quick retrofit for existing equipment or new installations. Available in a variety of connector combinations, the units protect RS232 lines at +/-25V. Protectors are designed to withstand multiple "hits" without degradation when used within rating. Models are provided with hardware package to permit installation to connectors of either gender.



Wideband Coaxial/Twinaxial Protectors - DLP 5 Series
The DLP 5 series of video/wideband protectors prevent cable from transmitting damaging transients to sensitive loads by shunting the transients to earth ground. The units are ideal for computer systems having long exposed cable runs and where bandwidth vs. attenuation is critical. The protectors are installed in-line by simply plugging your cables into the protector at each end of your system and grounding to chassis.

Multi Signal/Data Line Protection - DLP 10/20/30
The protectors guard computer mainframes, terminals, printers, process controllers, data loggers and other complex instrumentation from damage due to lightning and switching transients. Providing multiple line protection for 2 to 24 wires, the units are hardwired and ready to be installed anywhere. Protection voltage available from 5V to 200V.

Call 1-800-851-1508 for Immediate Application Assistance.

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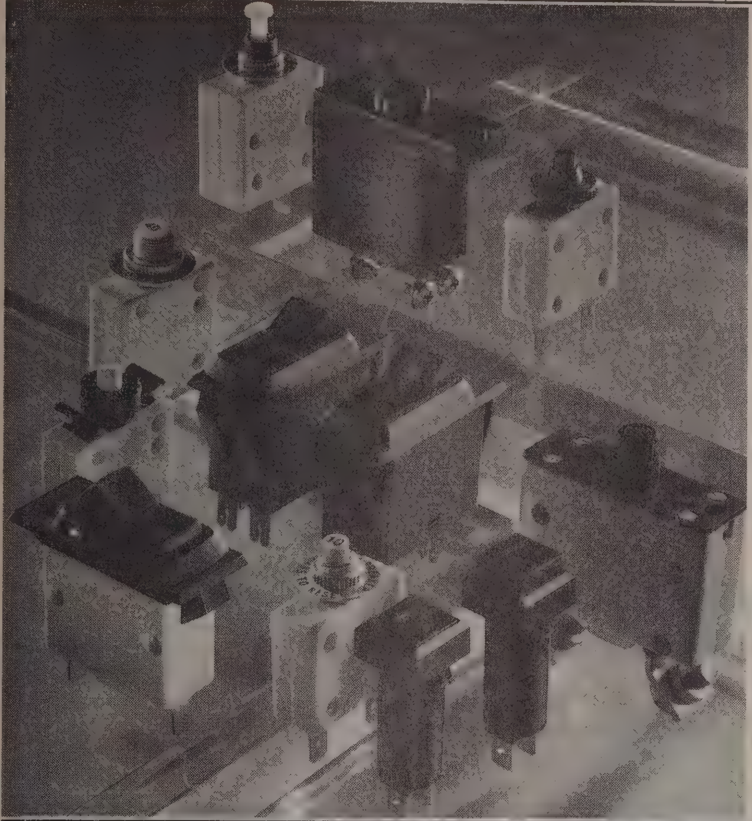
1-800-851-1508
Phone: 516-586-5125 Fax: 516-586-5120



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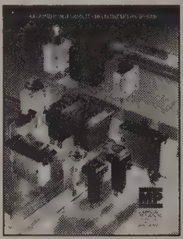
MANUFACTURES A COMPREHENSIVE LINE OF BOTH SWITCHABLE AND PUSH-TO-RESET CIRCUIT BREAKERS

Whether for Aerospace, Defense, Commercial or Consumer applications, MP manufactures reliable, high-quality circuit protection systems. The pages below describe our commercial Switchable product line. On the two pages that follow, you can review the comprehensive family of commercial Push-To-Reset circuit breakers.

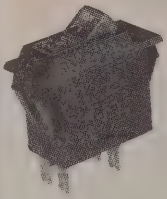
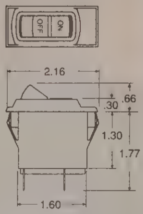
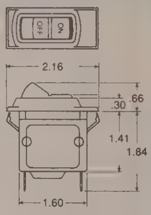
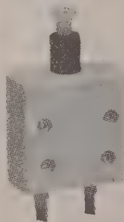
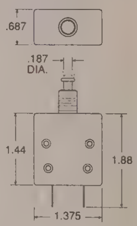
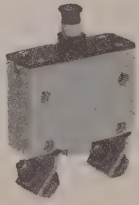
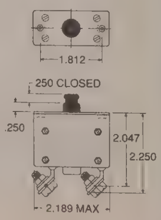
Ask For Our Full-Line Catalog

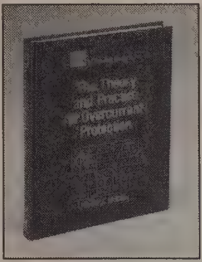
Our 84-page full-line catalog offers detailed support for specifying MP Circuit Protection Devices. Call (517) 782-0391 and request a free copy TODAY.



Switchable Circuit Protectors

For Push-To-Reset Circuit Protection, see the following two pages

SERIES NO(S)	CONFIGURATION	PHYSICAL DIMENSIONS: INCHES	FEATURES	OPERATING CHARACTERISTICS						REGULATORY APPROVAL			
				CALIBRATION @ 25° C.		OVERLOAD TRIP TIME: (in sec.)			INTER-RUPT				
				HOLD	TRIP	200%	500%	1000%		UL	CSA	VDE	OTHER
Series 24			Power "ON/OFF" Switch Combined with Circuit Protection - compact 1 or 2 pole package Lighted actuator options Snap-in Mounting Inductive Load Rated at 250VAC	100%	140%	* Series Composite (see footnote) 8.0 to 40.0	1.0 to 3.0	0.2 to 1.0	2,000A @ 250VAC 1,000A @ 50VDC	1077	CSA	**631	IEC **934
Series 22			Power "ON/OFF" Switch Combined with Circuit Protection Endurance: 50,000 switch cycles at rated load Snap-in Mounting. Inductive Load Rated at 250VAC Meets Class A clearances per UL 1077	100%	125%	* Series Composite (see footnote) 3.0 to 35.0	0.4 to 2.8	0.18 to 1.3	2,000A @ 250VAC 1,000A @ 50VDC	1077	CSA	631	IEC **934
Series 07			"Double Break", High Interrupt, Trip Free Circuit Protector/ Breaker 752 Series is a Listed UL489 Molded Case Circuit Breaker. A minimum of 1/2" needed between terminals and grounded metal parts.	100%	125%	* Series Composite (see footnote) 5.0 to 30.0	0.5 to 3.3	0.15 to 0.9	Model 752 5,000A UL 489	Model 752 489	CSA		
									Models 762/772 A Rating Dependent 1,000/ 5,000A UL 1077	Model 762† 1077	CSA		
Series 260			High Current Capacity Trip Free Circuit Protection Switchable for heavy-duty systems Extra heavy contacts and terminals Trouble free contact life Vibration/shock resistant	100%	150%	* Series Composite (see footnote) 10.0 to 80.0	1.2 to 6.5	0.4 to 2.0	3,000A @ 28VDC 2,500A @ 115VAC				



Patrick J. McCleer, Ph.D., P.E. serves as a consultant to MP. He wrote this book while on the faculty of the University of Michigan, Department of Electrical Engineering and Computer Science.

We Wrote the Book on Circuit Protection

If your need for information extends beyond the limits of the material presented, you may be interested in the book The Theory and Practice of Overcurrent Protection written by Patrick J. McCleer. This 233 page book is an in-depth look at low power circuit protection and the many devices used to meet the industry need.

Contact MP for information regarding this valuable technical resource.

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AMPERE RATING 0.1 3 4 5 9 10 15 20 30 40 50 70 100 125 200	VOLTAGE RATING DC 0 12 32 50	VOLTAGE RATING AC 0 120 240 250 277
0.5 to 16 Amperes	50VDC	250VAC
5 to 25 Amperes	50VDC	250VAC
Model 752 15 Amperes		Model 752 120VAC
Model 762 5 to 9 Amperes	32VDC (Ampere Rating Dependent)	Model 762 5A to 9A 277 VAC
Models 762/772 10 to 40 Amperes		Models 762/772 10A to 40A 120 VAC
Model 260 50 to 100 Amperes Model 270 100 to 200 Amperes	28 VDC	120 VAC

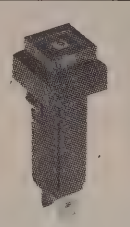
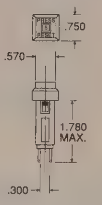
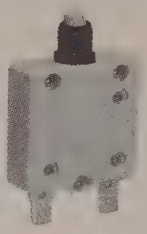
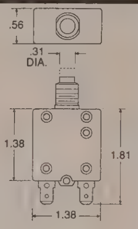
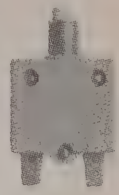
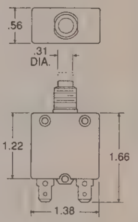
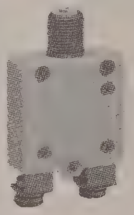
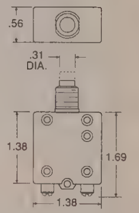
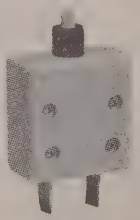
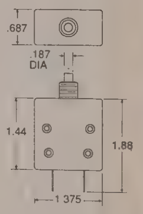
* Trip times shown represent composite response of product family over a range of amperage ratings. For specific trip times, please consult the product section of the main catalog.

** Designed to meet these standards. Please consult factory for approval status.

† Model 772 has not been specifically approved by UL or CSA.

Push-To-Reset Circuit Protectors

For Switchable Circuit Protection, see the preceeding pages

SERIES NO(S)	CONFIGURATION	PHYSICAL DIMENSIONS: INCHES	FEATURES	OPERATING CHARACTERISTICS						REGULATORY APPROVAL			
				CALIBRATION @ 25° C.		OVERLOAD TRIP TIME: (in sec.)			INTER-RUPT				
				HOLD	TRIP	200%	500%	1000%		UL	CSA	VDE	OTHER
Series 20			Unique, Low Cost, Front Panel, Fuse Holder Replacement, Circuit Protector Snap-in mount fits panel thicknesses 0.020 to 0.075. Mounting sizes incl. 5/8" dia. double D and square holes. Inductive Load Rated at 120VAC (240VAC ≤10A)	100%	135%	* Series Composite (see footnote) 2.2 to 15.0	0.35 to 1.1	0.12 to 0.4	1000A UL 1077	UL	CSA		
Series 16 Low			Low Ampere "Snap-Acting." Circuit Protector Various mounting sizes and termination styles available including "Snap-in"	100%	0.05A to 1.0A 145% 0.5A to 4.5A 125%	* Series Composite (see footnote) 10.0 to 45.0	2.4 to 6.2	NA	1000A UL 1077	UL	CSA	VDE	
Series 16 Mid			Low cost, "Snap Acting," Circuit Protection Various mounting sizes and termination styles available including "Snap In". Series, Shunt, Relay and Dual Voltage Options	100%	125%	* Series Composite (see footnote) 5.0 to 30.0	0.5 to 2.8	0.15 to 0.78	1000A UL 1077	UL	CSA	VDE	
Series 16 High			Heavy Duty, High Ampere Circuit Protector Standard screw terminals.	100%	140%	* Series Composite (see footnote) 5.0 to 30.0	0.5 to 2.8	0.15 to 0.78	1000A UL 1077	**	**	**	**
Series 02 252 600 601			"Double Break", High Interrupt. Circuit Protection/Breaker The 252 is a UL recognized (UL489). Molded Case Circuit Breaker. A minimum of 1/2" is needed between terminals and grounded metal parts.	100%	125%	* Series Composite (see footnote) 0.5 to 3.3	5.0 to 30.0	0.15 to 0.9	Model 252 5000A UL489	Model 252 UL 489	CSA		
									Model 600* 5000A UL1077	Model 600** UL 1077	CSA**		

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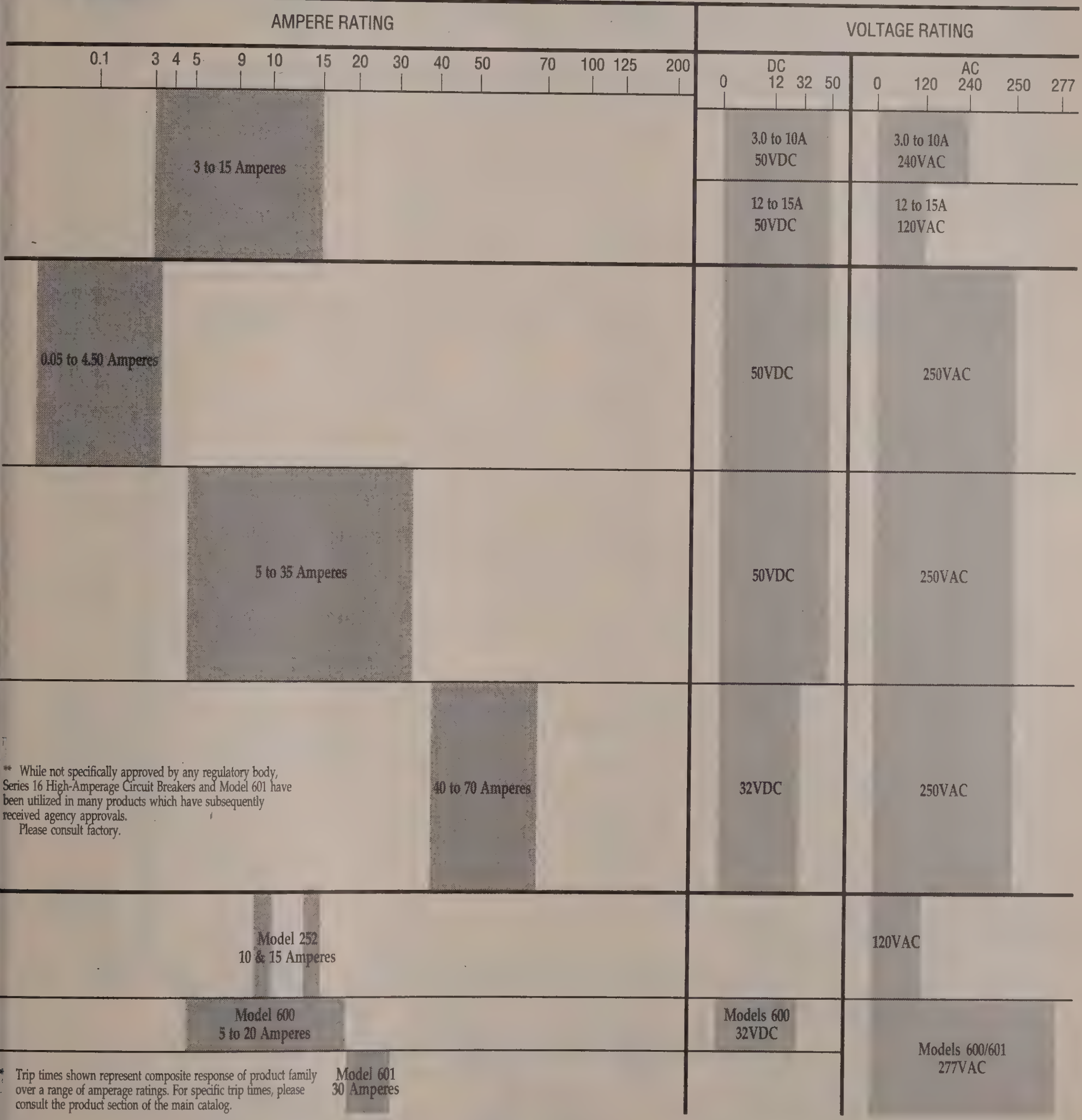
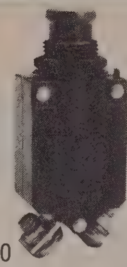
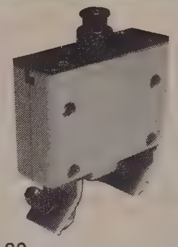
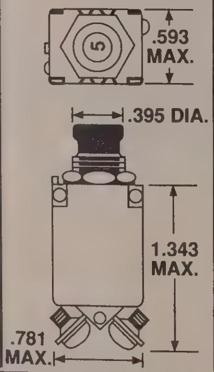
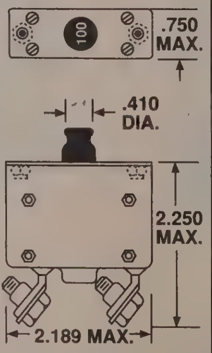
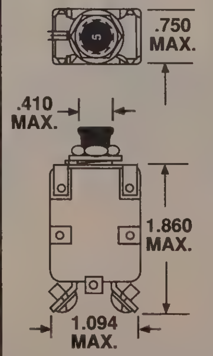
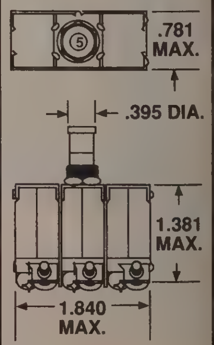


** While not specifically approved by any regulatory body, Series 16 High-Amperage Circuit Breakers and Model 601 have been utilized in many products which have subsequently received agency approvals.
Please consult factory.

* Trip times shown represent composite response of product family over a range of amperage ratings. For specific trip times, please consult the product section of the main catalog.

MP Mechanical Products, Inc.	MILITARY / AEROSPACE			
	SINGLE PHASE, SWITCHABLE			THREE PHASE, SWITCHABLE
Note: Reference information only. Specific technical data is contained in catalogs by series. Additional military and aerospace-approved products available. For more information consult factory.				
SERIES NO(S):	4310	160	700	4330
DESCRIPTION:	Subminiature, Lightweight, Hi-Rel Circuit Breaker	Rugged, High Current, Hi-Rel Circuit Breaker	Miniature, High Interruption Rated, Hi-Rel Circuit Breaker	Lightweight, Miniature, Hi-Rel, 3Ø Circuit Breaker
CURRENT RATING:	1 to 25 Amperes	50 to 100 Amperes	5 to 50 Amperes	1 to 20 Amperes
VOLTAGE RATING:	115 VAC 400 Hz; 28 VDC	115 VAC 400 Hz; 28 VDC	115 VAC 400 Hz; 28 VDC	200 VAC 400 Hz L – L. 115 VAC 400 Hz L – N.
CALIBRATION @ 25° C. (PERCENT OF RATING)	115% Hold 138% Trip-within one hour (ambient temp compensated.)	105% Hold 138% Trip-within one hour	115% Hold 138% Trip-within one hour	110% Hold 145% Trip-within one hour (ambient temp compensated.)
OVERLOAD TRIP TIME: (in sec. @ 25°C) 200%	5.0 to 20.0	15.0 to 65.0	15.0 to 55.0	4.0 to 20
500%	0.5 to 2.0	1.2 to 7.0	1.4 to 4.0	0.4 to 2.0
1000%	0.12 to 0.53	0.5 to 2.5	0.4 to 1.3	0.10 to 0.53
INTERRUPTION:	115 VAC-2000 to 3500 Amperes. 28 VDC-6000 Amperes.	115 VAC-3500 Amperes. 28 VDC-6000 Amperes.	115 VAC-3500 Amperes. 28 VDC-6000 Amperes.	1Ø 2000A L – N. 3Ø 1200A L – L.
MIL SPEC:	MS3320. 1 to 20 Amperes.	MS25361	MS25244, MS25244-P MS25244-PT. 5 to 35 Amperes.	MS14154. 1 to 20 Amperes.
NOTES:	Available with auxiliary switch and variations in termination and mounting. 1.5 & 25 Ampere rating: not MIL Spec approved. This series is long button and high vibration (V-level) qualified.	High vibration (V-level) qualified.	Available with auxiliary switch. P-Bracket allows variation of mounting.	Single hole mount. This series is long button and high vibration (V-level) qualified. Available with variation in termination and mounting.
PHYSICAL DIMENSIONS: (INCHES)				

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International "Touchproof" Fuseholders

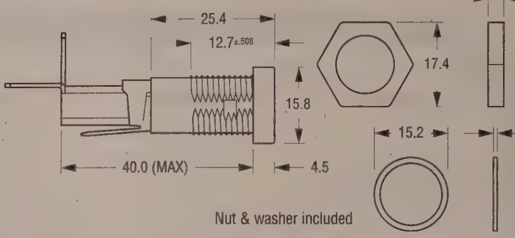
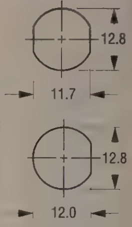
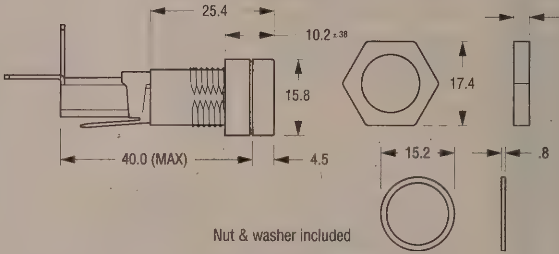
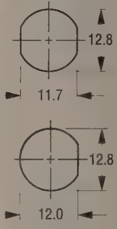
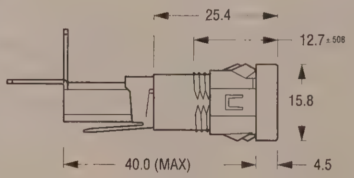
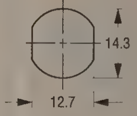
Interpower™ fuseholders accept both sizes of fuses that are used in the world today: the North American 3AG (1/4 x 1-1/4"/6.3 x 32mm) and the international 5x20mm fuses. International "touchproof" fuseholders have four important characteristics: 1) Fuseholder is accessible with a tool only; 2) Contacts are recessed and protected; 3) Fuse carrier is insulated; 4) Fuse carrier is retained in a spring-loaded carrier.

Three body styles are available, each with four contact styles. Order fuse carriers and fuses separately.

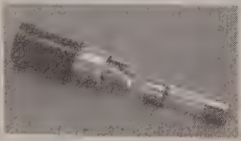
Maximum panel thickness: .762mm (.30")
Materials: Body molded from polyphenylene sulfide thermoplastic resin; contacts, tin-plated brass. UL 94-V0 flammability rating.
Markings: All parts are marked "80910"
Approvals, Ratings & Approval File Numbers:

UL recog.	20A/250V	File #E126146
CSA cert.	16A/250V	File #073106
VDE	10A/250V	File #12344-1370-1700/A1
SEMKO	10A/250V	File #9023030

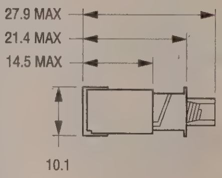
Dimensions are in mm

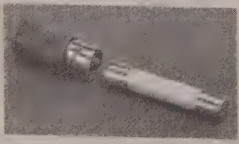
Body Style	Part Number	Contact style	Drawings	Mounting
Low Profile • Rear Hex Nut	80910010 80910020 80910030 80910040	4.8mm solder/QD angled 4.8mm solder/QD 6.3mm solder/QD angled 6.3mm solder/QD	 25.4 12.7±.508 15.8 40.0 (MAX) 4.5 17.4 15.2 3.2 .8 Nut & washer included	 12.8 11.7 12.8 12.0
High Profile • Rear Hex Nut	80910050 80910060 80910070 80910080	4.8mm solder/QD angled 4.8mm solder/QD 6.3mm solder/QD angled 6.3mm solder/QD	 25.4 10.2±.38 15.8 40.0 (MAX) 4.5 17.4 15.2 3.2 .8 Nut & washer included	 12.8 11.7 12.8 12.0
Low Profile • Snap-in	80910090 80910100 80910110 80910120	4.8mm solder/QD angled 4.8mm solder/QD 6.3mm solder/QD angled 6.3mm solder/QD	 25.4 12.7±.508 15.8 40.0 (MAX) 4.5	

Fuse Carriers (order separately)

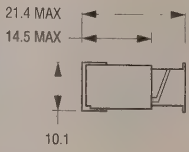


80910310: carrier for international 5x 20mm fuse


27.9 MAX
21.4 MAX
14.5 MAX
10.1

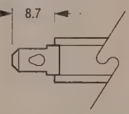


80910300: carrier for North American 3AG fuse

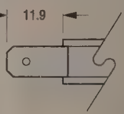

21.4 MAX
14.5 MAX
10.1

Contact Styles

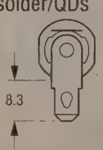
In-line 4.8mm solder/QDs



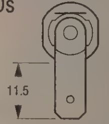
In-line 6.3mm QDs



Angled 4.8mm solder/QDs



Angled 6.3mm QDs



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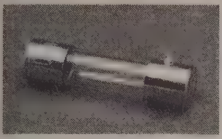
Interpower™ IEC 127 Int'l 5 x 20mm Fuses

Fuses conform to IEC 127. SEMKO approved. Rated at 250VAC. Contact us for performance characteristics. Minimum order: 1 box.

Quick-acting, low-breaking capacity



IEC 127–II; DIN 41661; SEMKO 104-1976; 250VAC. Glass tube.

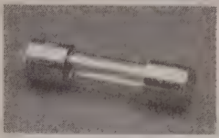
Model Number	Rated Current I_n	Break. Cap. at 250V cosφ1
81411101	32* mA	35 A
81411181	71	
81411221	100	
81411241	125	
81411261	160	
81411281	200	
81411301	250	
81411321	315	
81411341	400	
81411361	500	
81411381	630	
81411401	800	
81411421	1 A	
81411441	1.25	
81411461	1.4	
81411481	1.6	
81411501	2	
81411521	2.5	
81411541	3.15	
81411561	4	10 I_n.
81411581	5	
81411601	6.3	
81411621*	8*	
81411641*	10*	

Quick-acting, high-breaking capacity

IEC 127–I; DIN 41660; SEMKO 104-1976; 250VAC. Ceramic, sand.

Model Number	Rated Current I_n	Break. Cap. at 250V cosφ1
81413421	1 A	1500A: at 250V, 50Hz, cosφ0.7-0.8
81413441	1.25	
81413481	1.6	
81413501	2	
81413541	3.15	
81413601	6.3	
81413621*	8*	
81413641*	10*	

Time-lag, low-breaking capacity



IEC 127–III; DIN 41662; SEMKO 104-1976; 250VAC. Glass tube.

Model Number	Rated Current I_n	Break. Cap. at 250V cosφ1
81412161	63 mA	35 A
81412181	71	
81412221	100	
81412241	125	
81412261	160	
81412281	200	
81412301	250	
81412321	315	
81412341	400	
81412361	500	
81412381	630	
81412401	800	
81412421	1 A	
81412441	1.25	
81412461*	1.4*	
81412481	1.6	
81412501	2	
81412521	2.5	
81412541	3.15	
81412561	4	10 I_n.
81412581	5	
81412601	6.3	
81411621*	8*	
81411641*	10*	

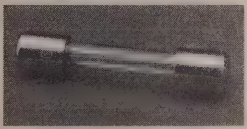
** not included in IEC 127 and do not carry SEMKO approval*

North American 1/4 x 1-1/4" fuses

Fuses conform to UL 498, CSA C22.2 No. 59. UL listed (or recognized), CSA certified fuses; contact us for performance characteristics.

Non-time delay

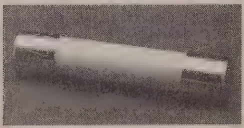
UL & CSA, 250V; glass



Model Number	Rated Current I_n
813AGC-1/8	1/8A
813AGC-1/4	1/4
813AGC-1/2	1/2
813AGC-3/4	3/4
813AGC-1	1
813AGC-1-1/2	1-1/2
813AGC-2	2
813AGC-3	3
813MTH-4	4
813MTH-5	5
813MTH-6	6
813GLH-10	10 (125V)

Time delay

UL & CSA, 250V; ceramic



Model Number	Rated Current I_n
813ABC-1/2	1/2
813ABC-1	1
813ABC-2	2
813ABC-3	3
813ABC-5	5
813ABC-6	6
813ABC-8	8
813ABC-10	10
813ABC-15	15
813ABC-20	20*

*15A, CSA

Time delay

UL & CSA, 250V; ceramic

Model Number	Rated Current I_n
813MDA-1/2	1/2
813MDA-3/4	3/4
813MDA-1	1
813MDA-2	2
813MDA-3	3
813MDA-4	4
813MDA-5	5
813MDA-7	7
813MDA-8	8
813MDA-10*	10
813MDA-15*	15
813MDA-20*	20

* UL recognized

Time delay

UL & CSA listed, 250V; glass*

Model Number	Rated Current I_n
813MSL-1/4	1/4
813MSL-1/2	1/2
813MSL-3/4	3/4
813MSL-1	1
813MSL-2	2
813MSL-3	3
813MSL-4	4
813MSL-5	5
813MSL-6	6
813MSL-8	8

* spiral wound element for moderate inrush I.

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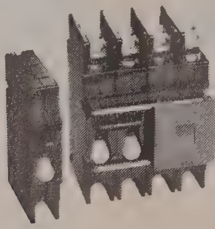
Models AP and UP**

Hermetically sealed. DC, 50/60 Hz or 400 Hz versions. Various delays to meet your needs. UP version has wide glass terminals.
Specifications: 1 to 3 poles. Ratings: 0.05-20A, 240 VAC, 50 VDC, Interrupting capacity: AP MIL, 500A @120 VAC, 50 VDC; 300A @ 240 VAC. UP 1000A @ 32 VDC, 240 VAC.
Approval: Ⓒ Ⓢ ЯU QPL: MIL-C-39019

**(UP, single pole, series only)

Models SNAPAK®, IEG, IEL, and IML (Midtrip)

All conform to VDE and IEC spacing requirements.
Specifications: SNAPAK: 1 or 2 pole ratings. 7.6 to 20A at 32 VDC/125 VAC, 0.10 to 7.6A at 65 VDC/240 VAC.
2-pole only (2-pole breaking) and ratings: 7.6 to 20A at 125/240 VAC, 32/65 VDC. Interrupting capacity: 1000A at 125 VAC, 240 VAC, 32 VDC and 65 VDC
Approval: IEC VDE*
IEG and IEL Ratings: 0.05-50A, 277 VAC, 80 VDC (Model IEG). 0.05-100A, 277 VAC, 80 VDC (Model IEL, IML). Interrupting capacity: 3500A, 277 VAC max., 5000A, 80 VDC (Model IEG). 5000A, 277 VAC max., 7500A, 80 VDC (Model IEL, IML).
Approval: Ⓒ Ⓢ ЯU VDE*



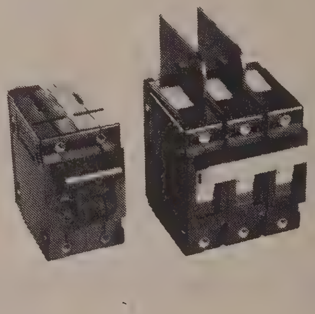
Model 209

Ideal for branch circuits. Mounts in switch boards, panel enclosures, panel boards, junction boxes. Series includes 219 manual motor controller, 229 appliance controller. 229D marine UL 1500, 259 marine power selectors.
Specifications: 1 to 6 poles. Ratings: 0.10-100A, 125 VDC; 0.10-77A, 600 VAC; 0.10-100A, 120, 240, 277 and 480 VAC. Interrupting capacity: 5000A.
Approval: Ⓒ Ⓢ ЯU

*Limited approvals, consult factory

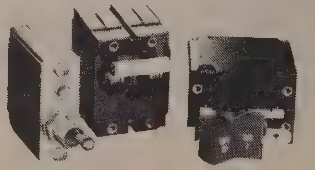
Model IELHR

IELHR designed for 35 mm symmetrical DIN rail; quick mouning, easy removal. Handle assembly available in 7 colors.
Specifications: Ratings: 0.05-70A, 80VDC and 277 VAC.
Operating temperature: –40°C to + 85°C.
Approval: Ⓒ ЯU VDE



Models APL/UPL and 205

These breakers offer precision operation for critical service. Series, shunt and relay configuration options. Choice of delays, ratings. 205 is dust-sealed for harsh environments.
Specifications: 1 to 9 poles. Model APL/UPL Ratings: 0.05-20A, 277 VAC; 0.05-50A, 240 VAC; 0.05-100A, 65 VDC. Interrupting capacity: 5000A, 120 VAC; 3000A, 65 VDC. Model 205 Ratings: 0.05-30A, 277/480 VAC; 0.05-50A, 240 VAC; 0.05-100A, 65 VDC. Interrupting capacity: 5000A, 277/480 VAC; 5000A, 240 VAC; 3000A, 65 VDC.
Approval: Ⓒ Ⓢ ЯU QPL: MIL-C-55629



Models APG/UPG/IPG

Low-cost, precision operation. Multi-pole assemblies, single or multi-handle. For data processing, broadcast equipment, vending machines, controllers, etc.
Specifications: 1 to 4 poles. Ratings: 0.02-30A, 277 VAC, (Model IPG, 240 VAC), 65 VDC, 31-50A, 50 VDC. Interrupting capacity: 1000A, 277 VAC; (Models IPG, 240 VAC), 2000A, 65 VDC; and at 5000A, max. ratings of 30 A 120 VAC, 20A at 240 VAC, 10A at 277 VAC, (Model IPG, 240 VAC).
Approval: Ⓒ Ⓢ ЯU QPL: Mil-C-55629 Model IPG-VDE*

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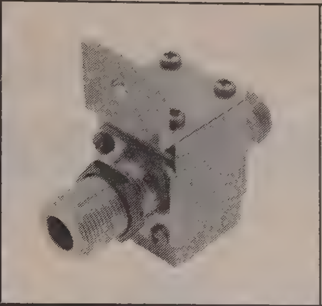
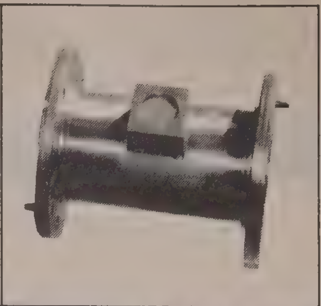
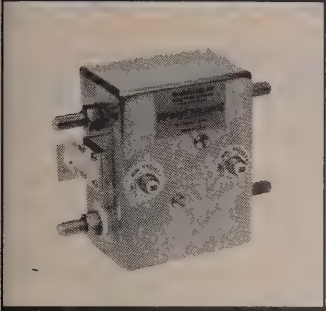


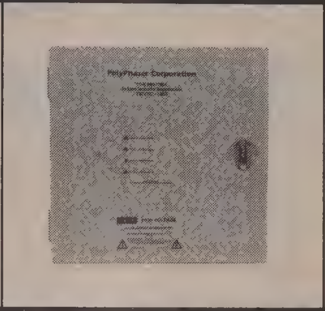
COAX TO 6GHz



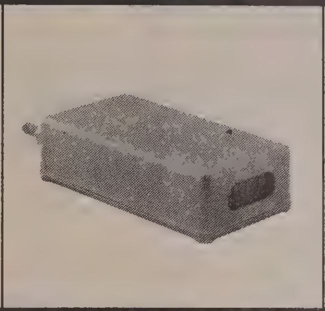
BROADCAST & MILITARY TO 80 KW



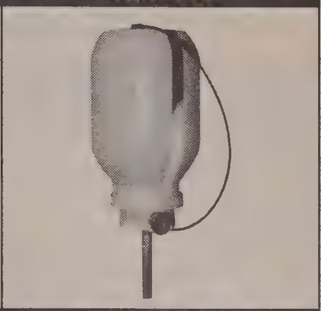
12-80VDC @ 50A



3ϕ POWER TO 480VAC

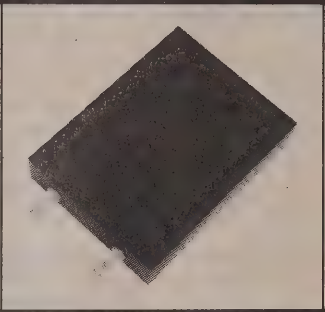


STRIKE COUNTERS TOWER/POWER/PHONE

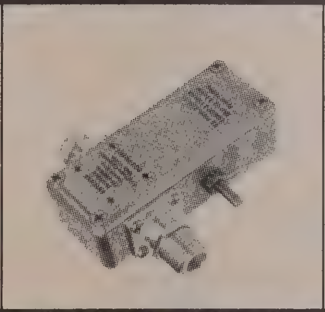


CHEMICAL GROUND SYSTEMS

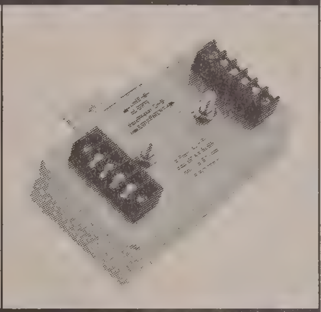
BREAKDOWN TESTERS



HIGH CURRENT/ENERGY LOW CAPACITANCE SHUNT



4-23 GHz MICROWAVE DOWNCONVERTERS



TWISTED PAIR (TO DS-3 RATES)

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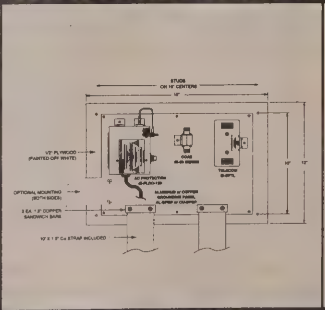
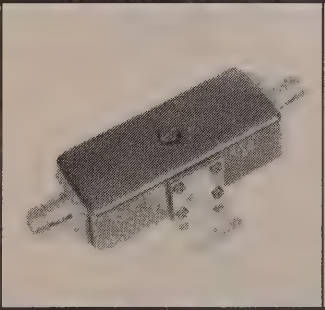
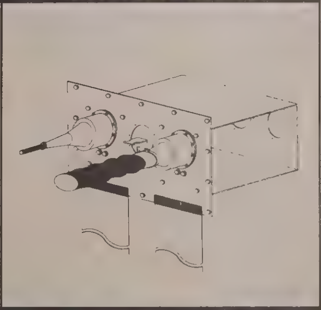


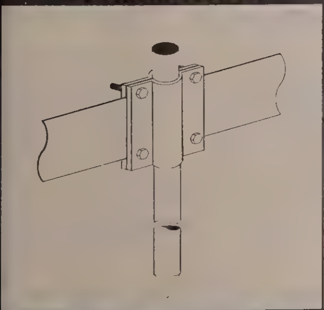
SINGLE POINT GROUND PANEL



LAN/VIDEO



ENTRANCE PANELS



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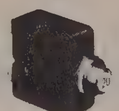
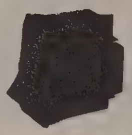
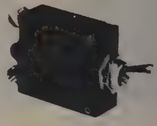
Circuit Breakers

			NEW 		
Series	**W28**	**W58**	**W33**	**W23**	**W31**
Type	Thermal	Thermal	Thermal	Thermal	Thermal
No. of Poles	1	1	1 or 2	1	1
Circuit Function Options	Series Trip	Series Trip	Series Trip, both poles or Series Trip, one pole: Switch only, one pole	Series Trip	Series Trip
Current Rating	0.25-20 Amps	1-35 Amps	2-20 Amps	0.5-50 Amps	0.5-50 Amps
Max. Operating Voltage	32VDC 250VAC	50VDC 250VAC	50VDC 250VAC	50VDC 250VAC	50VDC 250VAC
Trip Time at 200% of Rating	0.25-2A Models – 4.5 to 28 Sec. 3-15A Models – 2.2 to 15 Sec.	1-4A Models – 10 to 45 Sec. 5-35A Models – 6 to 30 Sec.	10 to 30 Sec.	1-4A Models – 11 to 30 Sec. 5-35A Models – 6 to 22 Sec.	1-4A Models – 11 to 30 Sec. 5-35A Models – 6 to 22 Sec.
Interrupt Capacity	1,000A @ 32VDC or 250VAC	2,000A @ 50VDC 1,000A @ 250VAC	1,000A @ 50VDC 2,000A @ 250VAC	0.5-25A Models – 2,000A @ 50VDC 1,000A @ 250VAC 30-50A Models – 1,000A @ 50VDC or 250VAC	0.5-25A Models – 2,000A @ 50VDC 1,000A @ 250VAC 30-50A Models – 1,000A @ 50VDC or 250VAC
Actuator Options	Push-to-Reset Button	Push-to-Reset Button	Rocker, Lighted Rocker	Push/Pull Button	Toggle
Approximate Dimensions	.54" x .63" x 1.54"d (13.7 x 15.9 x 39.0d)	.66" x 1.38" x 1.38"d (16.8 x 34.9 x 34.9d)	.98" x 1.89" x 1.72"d (24.9 x 48 x 43.8d)	.69" x 1.38" x 1.6"d (17.5 x 34.9 x 40.6d)	.69" x 1.38" x 1.6"d (17.5 x 34.9 x 40.6d)
Terminal Options	.250" (6.35) Quick Connect	.250" (6.35) Quick Connect, #6-32 Screw	250" (6.35) Quick Connect, Solder	#8-32 Screw	#8-32 Screw
Mounting Options	Snaps into 5/8" (15.9) panel cutout from the front	7/16"–28 Threaded Bushing, 15/32"–32 Threaded Bushing	Snaps into .875 x 1.75" (22.2 x 44.5) panel cutout from the front	3/8"–24 Threaded Bushing	15/32"–32 Threaded Bushing
Component Recognition	ЯU CSA Ⓢ Ⓓ △	ЯU CSA	ЯU CSA Designed to meet IEC and VDE Requirements	ЯU CSA	ЯU CSA

Specifications are subject to change without notice. Specifications and/or agency recognitions do not necessarily apply to all models within a particular series.

Potter & Brumfield A Siemens Company

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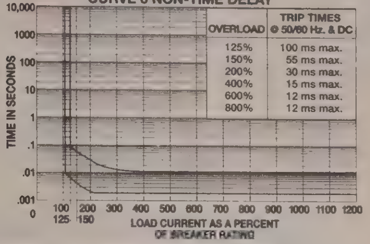
Circuit Breakers

Series	**W6**	**W9**
Type	Magnetic	Magnetic
No. of Poles	1 through 4	1 through 4
Circuit Function Options	Series Trip w/ or w/o Aux. Switch, Shunt Trip, Relay Trip, Dual Coil Series Trip, Dual Coil Shunt Trip	Series Trip w/ or w/o Aux. Switch, Shunt Trip, Relay Trip, Dual Coil Series Trip, Dual Coil Shunt Trip
Current Rating	0.25-50 Amps	0.25-50 Amps
Max. Operating Voltage	65VDC 277VAC	65VDC 277VAC
Trip Time at 200% of Rating	30ms to 150 Sec. depending upon trip curve specified.	30ms to 150 Sec. depending upon trip curve specified.
Interrupt Capacity	0.25-20A Models – 2,000A @ 65VDC 5,000A @ 277VAC 21-50A Models – 2,000A @ 50VDC 2,500A @ 277VAC	2,000A @ 65VDC 5,000A @ 277VAC
Actuator Options	Toggle, Rocker	Toggle
Approximate Dimensions	.75" x 2.0" x 1.5"d (19.1 x 50.8 x 38.1d)	.75" x 2.5" x 2.0"d (19.1 x 63.5 x 50.8d)
Terminal Options	.250" (6.35) Quick Connect, #8-32 Screw, #10-32 Screw	#10-32 Stud
Mounting Options	#6–32 Tapped Holes, M3 Tapped Holes, Snaps into panel cutout from the front	#6–32 Tapped Holes, M3 Tapped Holes
Component Recognition		

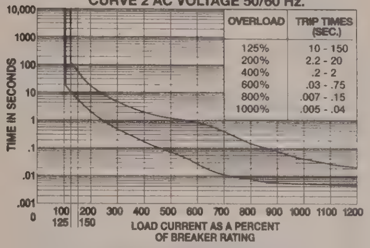
TIME VS. CURRENT TRIP CURVES FOR STOCK W6/W9 SERIES BREAKERS

CURVE 0 NON-TIME DELAY



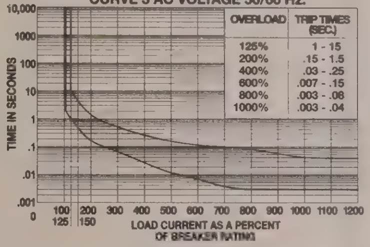
OVERLOAD	TRIP TIMES @ 50/60 Hz. & DC
125%	100 ms max.
150%	55 ms max.
200%	30 ms max.
400%	15 ms max.
600%	12 ms max.
800%	12 ms max.

CURVE 2 AC VOLTAGE 50/60 Hz.



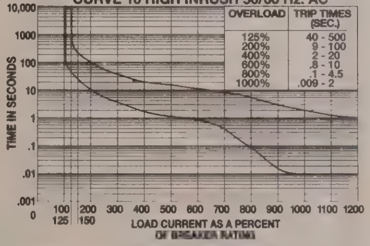
OVERLOAD	TRIP TIMES (SEC.)
125%	10 - 150
200%	2.2 - 20
400%	.2 - 2
600%	.03 - .75
800%	.007 - .15
1000%	.005 - .04

CURVE 3 AC VOLTAGE 50/60 Hz.



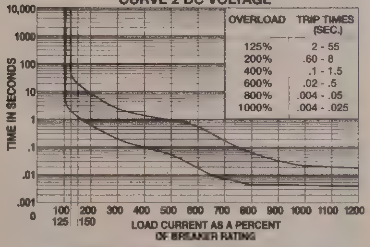
OVERLOAD	TRIP TIMES (SEC.)
125%	1 - 15
200%	.15 - 1.5
400%	.03 - .25
600%	.007 - .15
800%	.003 - .08
1000%	.003 - .04

MOTOR START
CURVE 10 HIGH INRUSH 50/60 Hz. AC



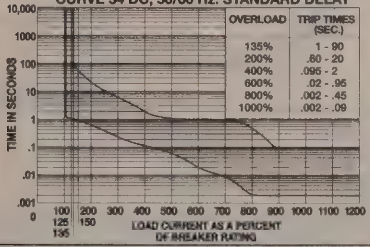
OVERLOAD	TRIP TIMES (SEC.)
125%	40 - 500
200%	9 - 100
400%	2 - 20
600%	.8 - 10
800%	.1 - 4.5
1000%	.009 - 2

CURVE 2 DC VOLTAGE



OVERLOAD	TRIP TIMES (SEC.)
125%	2 - 55
200%	.60 - 8
400%	.1 - 1.5
600%	.02 - .5
800%	.004 - .05
1000%	.004 - .025

CURVE 34 DC, 50/60 Hz. STANDARD DELAY



OVERLOAD	TRIP TIMES (SEC.)
135%	1 - 90
200%	.60 - 20
400%	.095 - 2
600%	.02 - .95
800%	.002 - .45
1000%	.002 - .09

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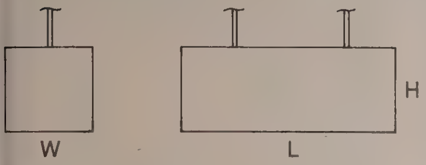
PPD ARC ⚡ SURGE suppressor

SINGLE PHASE



Dimensions

Box: H = 0.935" W = 0.6" L = 1.25"
TERMINATIONS: Stranded Copper 18 ga. × 6" INSULATED.
OPTIONAL Solid Copper wire, 20 ga. × 0.75" long
OPERATING TEMPERATURE −35°C to +85°C.

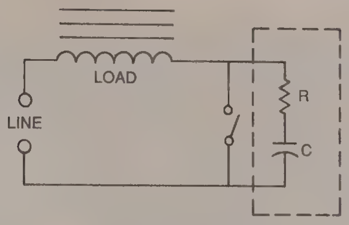
Applications:

Use PPD ARC/SURGE SUPPRESSORS TO PREVENT:

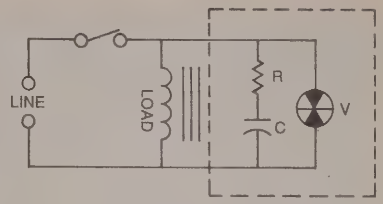
(1) ARCING and VOLTAGE SURGES when disconnecting RELAYS, CONTACTOR COILS, & SOLINOID VALVES

(2) Breakdown of DIODES, SCRs, and TRIACs.

(3) Transient overvoltages in COMPUTERS, and ELECTRONIC CONTROLLERS.



ARC SUPPRESSION



VOLTAGE SURGE LIMITING

CONSTRUCTION:

A 0.47 MFD Metallized Film Capacitor, in series with a Carbon composition 0.5W Resistor, in the 22-680 Ohm range. This assembly, with or without a VARISTOR, is sealed with Flame Retardant Epoxy resin in a molded plastic box.

Electrical Ratings

PPD VOLTAGE CODE		12	22	24
V1 No Varistor	Rated Volts	120 vac 250 vdc	220 vac 400 vdc	240 vac 600 vdc
V2 W/Varistor	Allowable Volts	130 vac 170 vac	250 vac 320 vdc	240 vac 350 vdc
V3 Clamp Volts **A** Clamp Amps	Max	340-v 10A	650 v 10A	710 v 10A
J Watt Seconds (Joules)	Max.	10J	10J	10J

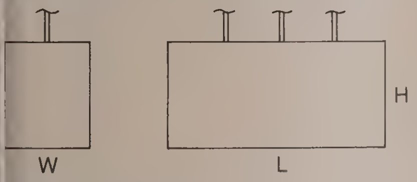
PART NUMBER FOR ORDERING:
EXAMPLE: −0.47 MFD 180 OHM. 120VAC,. Varistor. 6" Wire Leads Single Phase.

1 12 47 6 180 V

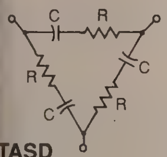
Phase
120 VAC
0.47 MFD
Varistor
180 OHMS
6" Stranded Wire

---

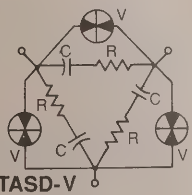
3 PHASE



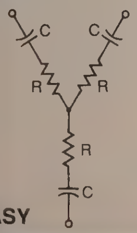
Box: L=5" W=2" H=3"
Stranded Copper 16 ga. × 30" insulated



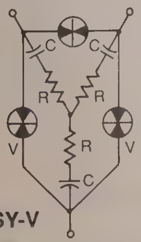
TASD



TASD-V



TASY



TASY-V

ELECTRICAL SPECIFICATIONS

Input voltage:	600vac MAX.@60Hz.	
Capacitance:	.47uf ±10%	
Resistance	100–220 Ω±10%	10 WATT

Performance with Optional Varistor.

Input Volts	**220VACV**	**480VAC**	**600VAC**
Max. Allowable Voltage:	250 vac	510v ac	660 vac
Max. Clamp Voltage:	650 vac	1350 vac	1820 vac
Peak Current 8/20usec:	4500 amps	4500 amps	4500 amps
Energy (watt second)	72 joules	110 joules	140 joules

Temperature Range: −40°C to 85°C
Terminals: 16ga Insulated Stranded Tinned copper

NOTE: Specially designed to withstand environments that are extremely humid.

PART NUMBER FOR ORDERING:
EXAMPLE: 0.47MFD 220 OHM. 480VAC. Varistor. 30" Wire Leads 3 Phase

3 48 47 D 30 22 V

Phase
480 VAC
0.47 MFD
Varistor
220 OHMSΩ22=220Ω
30" Stranded Wire
D = Delta (480 VAC Only)
Y= WYE (600 VAC Only)

220 VAC = 22
480 VAC = 48
600 VAC = 60

PPD

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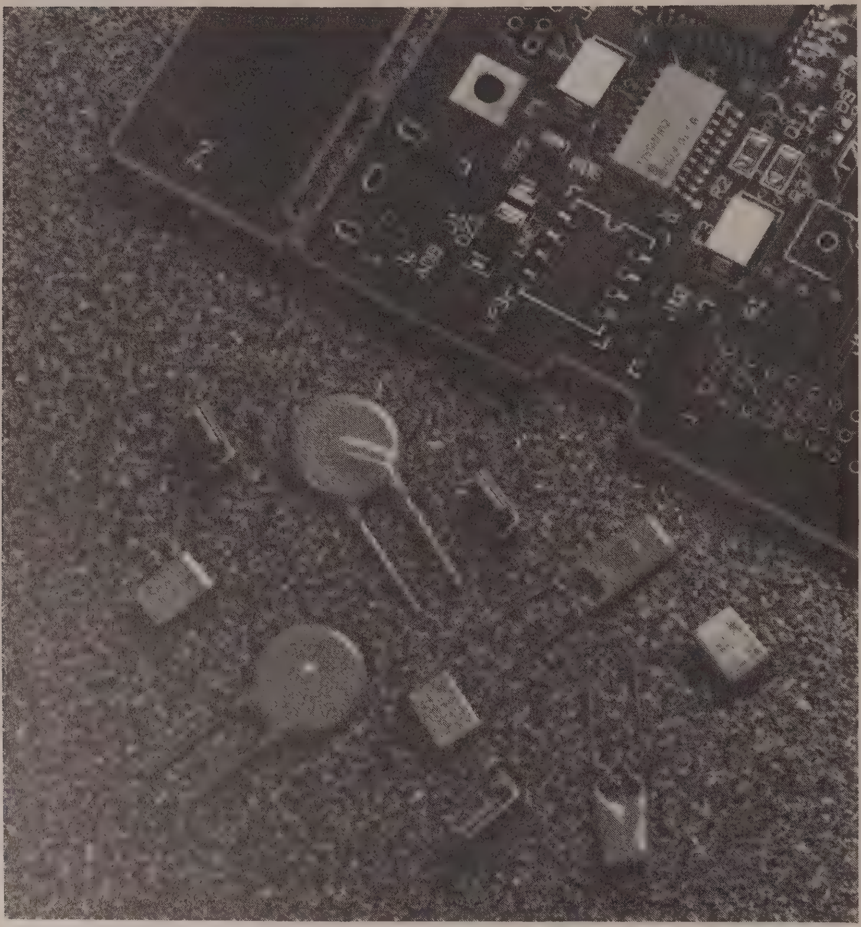
Raychem

PolySwitch® **Resettable** Fuse Devices



PolySwitch® "Resettable fuses" protect the DC Power Circuit and provide fail safe protection against short circuit of the motherboard.

PolySwitch devices are used in a variety of applications:

- Instrumentation and control
- Security systems
- Medical equipment
- Batteries
- Computers and peripherals
- Audio visual equipment
- Toys
- Telecommunications networks
- Modems
- Transformers

PolySwitch devices have distinct advantages over other methods of circuit protection:

- Remotely resettable, they can automatically reset themselves thousands of times, thus eliminating unnecessary product downtime.
- Low resistance means low voltage drops in power circuits.
- UL, TUV, and CSA recognized components.
- Radial-leaded and surface-mount packaging make installation easy.

PolySwitch circuit protection devices protect electrical and electronic circuits against excessive current, voltage, and temperature. Like fuses and circuit breakers, PolySwitch devices interrupt the flow of dangerously high currents, whether due to excessive voltage or to a fault condition within the circuit. But unlike fuses and circuit breakers, PolySwitch circuit protectors automatically reset themselves after the fault that caused them to trip is corrected.

PolySwitch devices are positive temperature coefficient (PTC) resistors that rapidly increase resistance in response to excessive currents or temperature. When the current flowing through a PolySwitch circuit protector is within its maximum rating, its "base" resistance is very low. If the current rises above its rated current, the PolySwitch device's resistance abruptly rises. Then, as circuit resistance is increased, the current decreases until thermal equilibrium is achieved.

Depending upon the PolySwitch model and the amount of current, the trip time required to reduce the current can be as short as one-tenth of a second. Once power to the protected circuit is removed, the PolySwitch device's resistance begins to drop towards its normal value, in essence resetting the device so that normal operation can resume when the fault is corrected and the power reapplied.

See Our Additional Data Pages In Sections A • 4800 - B • 5300 - D • 3900

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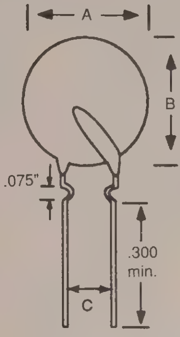
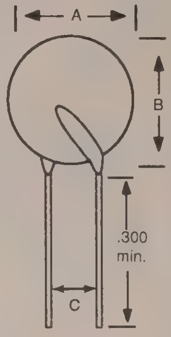
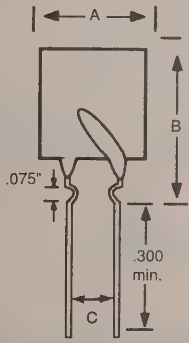
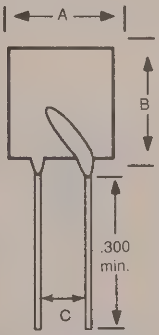
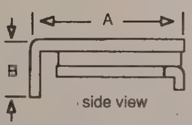
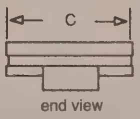
For technical support and complete catalog call **800-2-RAYCHEM x6900 • FAX: 800-227-4866**

Raychem

PolySwitch® **Resettable** Fuse Devices

Part Number	Maximum Voltage	Rated Current (20°) (amps)			Max. Initial R (ohms)	Recognized By	Max. Dim.		Typ.	Diagram
		Hold	Trip	Max			A	B	C	
RXE010	60	0.10	0.20	40	4.50	UL, TUV, CSA	.29	.50	.231	 RXE010-RXE090  RXE110-RXE375
RXE017	60	0.17	0.34	40	5.20	UL, TUV, CSA	.29	.50	.231	
RXE020	60	0.20	0.40	40	2.84	UL, TUV, CSA	.29	.48	.231	
RXE025	60	0.25	0.50	40	1.94	UL, TUV, CSA	.29	.50	.231	
RXE030	60	0.30	0.60	40	1.36	UL, TUV, CSA	.29	.51	.231	
RXE040	60	0.40	0.80	40	0.85	UL, TUV, CSA	.30	.53	.231	
RXE050	60	0.50	1.00	40	0.76	UL, TUV, CSA	.31	.54	.231	
RXE065	60	0.65	1.30	40	0.48	UL, TUV, CSA	.38	.57	.231	
RXE075	60	0.75	1.50	40	0.39	UL, TUV, CSA	.41	.60	.231	
RXE090	60	0.90	1.80	40	0.30	UL, TUV, CSA	.46	.62	.231	
RXE110	50	1.10	2.20	40	0.24	UL, TUV, CSA	.51	.71	.231	
RXE135	50	1.35	2.70	40	0.19	UL, TUV, CSA	.57	.77	.231	
RXE160	50	1.60	3.20	40	0.14	UL, TUV, CSA	.64	.84	.231	
RXE185	50	1.85	3.70	40	0.12	UL, TUV, CSA	.70	.90	.231	
RXE250	50	2.50	5.00	40	0.08	UL, TUV, CSA	.84	1.04	.431	
RXE300	50	3.00	6.00	40	0.06	UL, TUV, CSA	.98	1.18	.431	
RXE375	50	3.75	7.50	40	0.04	UL, TUV, CSA	1.12	1.32	.431	
RUE090	30	0.90	1.80	40	0.12	UL, Pend CSA	.26	.48	.200	 RUE090-RUE250  RUE300-RUE900
RUE110	30	1.10	2.20	40	0.10	UL, Pend CSA	.26	.56	.200	
RUE135	30	1.35	2.70	40	0.08	UL, Pend CSA	.35	.53	.200	
RUE160	30	1.60	3.20	40	0.07	UL, Pend CSA	.35	.60	.200	
RUE185	30	1.85	3.70	40	0.06	UL, Pend CSA	.40	.62	.200	
RUE250	30	2.50	5.00	40	0.04	UL, Pend CSA	.45	.72	.200	
RUE300	30	3.00	6.00	40	0.05	UL, Pend CSA	.45	.68	.200	
RUE400	30	4.00	8.00	40	0.03	UL, Pend CSA	.55	.79	.200	
RUE500	30	5.00	10.00	40	0.03	UL, Pend CSA	.55	.98	.400	
RUE600	30	6.00	12.00	40	0.02	UL, Pend CSA	.65	.98	.400	
RUE700	30	7.00	14.00	40	0.02	UL, Pend CSA	.75	1.05	.400	
RUE800	30	8.00	16.00	40	0.02	UL, Pend CSA	.85	1.15	.400	
RUE900	30	9.00	18.00	40	0.01	UL, Pend CSA	.95	1.17	.400	
SMD030	60	0.30	0.60	10	2.40	UL, TUV, CSA	.31	.125	.21	 
SMD050	60	0.50	1.00	10	0.70	UL, TUV, CSA	.31	.125	.21	
SMD075	30	0.75	1.50	40	0.50	UL, TUV, CSA	.31	.125	.21	
SMD100	30	1.10	2.20	40	0.24	UL, TUV, CSA	.31	.118	.21	
SMD125	15	1.25	2.50	40	0.14	Pend UL & TUV	.31	.118	.21	
SMD150	15	1.50	3.00	40	0.12	UL, TUV, CSA	.37	.118	.26	

See Our Additional Data Pages In Sections A • 4800 - B • 5300 - D • 3900

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SCHURTER

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FUSES AND FUSEHOLDERS •

ISO 9001
Quality Certified

SURFACE MOUNT – SUBMINIATURE

OMF 63V

New

Fuse now available pre-inserted into fuseholder

- Super quick-acting (<1s @ 200%, <10ms @ 400%)
- UL, CSA approved 63mA-5A / 63V
- Measures 7.4 x 3.1 x 2.6 mm
- U.S. Patented
- Solderability: 235°C for 2 seconds (IEC 68-2-58,Td)
- Soldering heat resistance: 260°C for 10sec. (IEC 68-2-58,Td)
- UL 94 V-O material
- Available in bulk or tape & reel packaging
- Optional surface mount fuseholder

Order Numbers: OMF 63V fuse

3402.0003.XX	63mA
3402.0004.XX	100mA
3402.0005.XX	160mA
3402.0006.XX	250mA
3402.0043.XX	350mA
3402.0044.XX	375mA
3402.0007.XX	400mA
3402.0045.XX	500mA
3402.0008.XX	630mA
3402.0046.XX	750mA
3402.0009.XX	1A
3402.0010.XX	1.25A
3402.0047.XX	1.5A
3402.0011.XX	1.6A
3402.0012.XX	2A
3402.0013.XX	2.5A
3402.0014.XX	3A
3402.0048.XX	3.15A
3402.0015.XX	3.5A
3402.0016.XX	4A
3402.0017.XX	5A

3402.XXXX.11	Box of 100 pcs
3402.XXXX.22	750 pcs on tape & reel
3402.XXXX.24	3,000 pcs on tape & reel

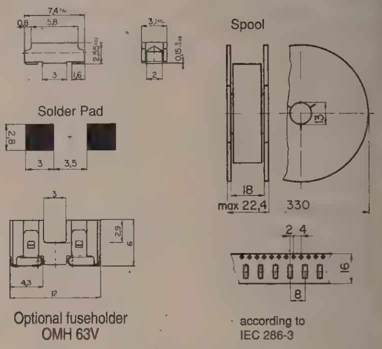
Order Numbers: OMH 63V fuseholder

031.7701.11	Box of 100 pcs
031.7701.22	750 pcs on tape & reel
031.7701.23	1500 pcs on tape & reel

Order Numbers: OMK 63V (OMF/OMH 63 combined. Fuse pre-inserted into fuseholder)

3422.0003.XX	63mA
3422.0004.XX	100mA
3422.0005.XX	160mA
3422.0006.XX	250mA
3422.0043.XX	350mA
3422.0044.XX	375mA
3422.0007.XX	400mA
3422.0045.XX	500mA
3422.0008.XX	630mA
3422.0046.XX	750mA
3422.0009.XX	1A
3422.0010.XX	1.25A
3422.0047.XX	1.5A
3422.0011.XX	1.6A
3422.0012.XX	2A
3422.0013.XX	2.5A
3422.0014.XX	3A
3422.0048.XX	3.15A
3422.0015.XX	3.5A

3422.XXXX.11	Box of 100 pcs
3422.XXXX.23	1,500 pcs on tape & reel


7,4
5,8
0,8
2,55
3,1
Solder Pad
2,8
3
3,5
Optional fuseholder OMH 63V
4,3
12
Spool
13
18
max 22,4
330
4
16
8
according to IEC 286-3

OMF 250V

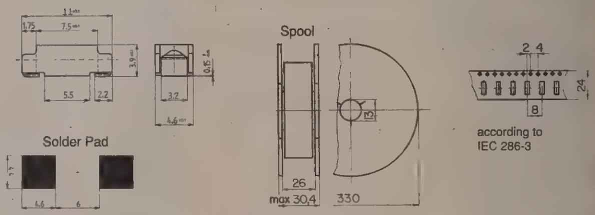
New

- Quick-acting (<1h @ 125%, <300s @ 170%, <0.01s @ 1000%)
- UL recognized 400mA-4A/250V VDE, SEMKO, SEV pending
- Measures 11 x 4.6 x 3.9 mm
- U.S. Patented
- Solderability: 235°C for 2 seconds (IEC 68-2-58,Td)
- Soldering heat resistance: 260°C for 10sec. (IEC 68-2-58,Td)
- UL 94 V-O material
- Available in bulk or tape & reel packaging
- Surface mount fuseholder in development

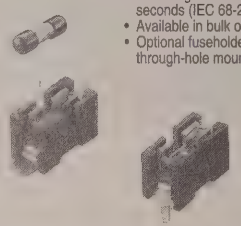
Order Numbers: OMF 250 fuse

3403.0012.XX	400mA
3403.0013.XX	500mA
3403.0014.XX	630mA
3403.0015.XX	800mA
3403.0016.XX	1A
3403.0017.XX	1.25A
3403.0018.XX	1.6A
3403.0019.XX	2A
3403.0020.XX	2.5A
3403.0021.XX	3.15A
3403.0022.XX	4A

3403.XXXX.11	Box of 100 pcs
3403.XXXX.24	2,000 pcs on tape & reel


11
1,75
7,5
3,9
5,5
2,2
0,5
3,7
4,6
Solder Pad
4,6
6
Spool
13
26
max 30,4
330
4
24
8
according to IEC 286-3

MELF 125V



- Quick-acting
- UL, CSA approved 125mA-7A/125V
- Measures 7.3 x 2 mm
- High breaking capacity: 300A
- Soldering heat resistance: 260°C for 10 seconds (IEC 68-2-20)
- Available in bulk or tape & reel packaging
- Optional fuseholders – surface mount or through-hole mount

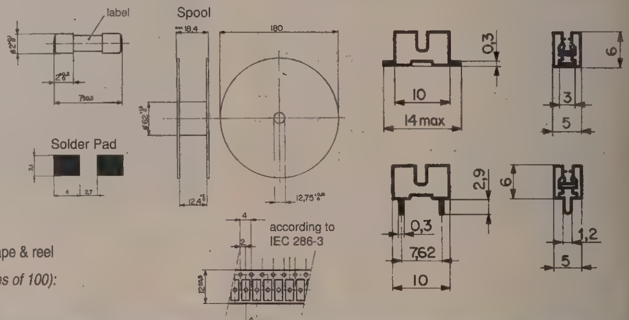
Order Numbers: fuse (in boxes of 100):

7010.9760.XX	125mA
7010.9770.XX	250mA
7010.9780.XX	375mA
7010.9790.XX	500mA
7010.9800.XX	750mA
7010.9810.XX	1A
7010.9820.XX	1.5A
7010.9830.XX	2A
7010.9840.XX	2.5A
7010.9850.XX	3A
7010.9860.XX	3.5A
7010.9870.XX	4A
7010.9880.XX	5A
7010.9890.XX	7A

7010.XXXX.63	Box of 100 pcs
7010.XXXX.57	1,500 pcs on tape & reel

Order numbers - fuseholder (boxes of 100):

7090.9010.03	SMD
7090.9020.03	through-hole


label
Spool
18,4
180
Solder Pad
12,4
12,75
according to IEC 286-3
4
0,3
6
10
14 max
3
5
2,9
6
0,3
7,62
10
1,2
5

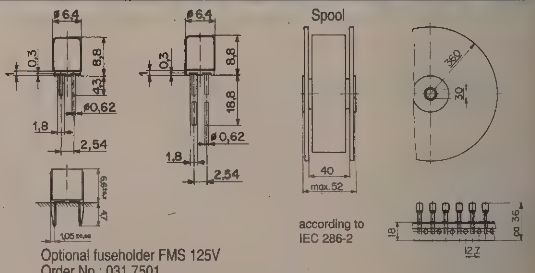
THROUGH-HOLE MOUNT – SUBMINIATURE

MSF 125V

- According to IEC 127-3/1, UL 198G, and CSA 59 2M
- Quick-acting (<10 min. @150%, <5s @ 200%, <300ms @275%, <30ms @400%)
- UL, CSA approved 100mA-5A/125V
- UL 94 V-O material
- Solderability: 235°C for 2 seconds (IEC 68-2-20,Ta)
- Soldering heat resistance: 260°C for 10 seconds (IEC 68-2-20,Tb)
- Options: Long or short leads; transparent or metal cap; bulk or tape and reel packaging

Order Numbers:

Short Leads	Long Leads	
034.4209	034.4239	100mA
034.4210	034.4240	125mA
034.4211	034.4241	160mA
034.4212	034.4242	200mA
034.4213	034.4243	250mA
034.4214	034.4244	315mA
034.4215	034.4245	400mA
034.4216	034.4246	500mA
034.4217	034.4247	630mA
034.4218	034.4248	710mA
034.4219	034.4249	750mA
034.4220	034.4250	800mA
034.4221	034.4251	1A
034.4222	034.4252	1.25A
034.4223	034.4253	1.6A
034.4224	034.4254	2A
034.4225	034.4255	2.5A
034.4226	034.4256	3.15A
034.4227	034.4257	4A
034.4228	034.4258	5A

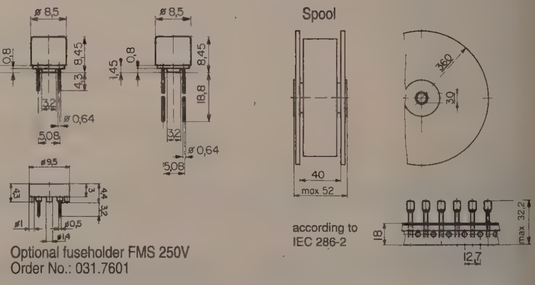

ø6,4
0,3
8,8
4,3
ø0,62
1,8
2,54
18,8
Optional fuseholder FMS 125V
Order No.: 031.7501
Spool
360
30
40
max.52
according to IEC 286-2
18
36
12,7

MSF 250V

- According to IEC 127-3/3
- Quick-acting (min. 60min. @150%, max. 30min. @210%, max. 3s @ 275%, max. 300ms @400%, max. 20ms @1000%)
- UL approved 40mA-5A/250V
- VDE, SEMKO, & SEV approved 50mA-3.15A/250V
- UL 94 V-O material
- Options: Long or short leads; bulk or tape and reel packaging

Order Numbers:

Short Leads	Long Leads	
034.6000	034.6030	40mA
034.6001	034.6031	50mA
034.6002	034.6032	63mA
034.6003	034.6033	80mA
034.6004	034.6034	100mA
034.6005	034.6035	125mA
034.6006	034.6036	160mA
034.6007	034.6037	200mA
034.6008	034.6038	250mA
034.6009	034.6039	315mA
034.6010	034.6040	400mA
034.6011	034.6041	500mA
034.6012	034.6042	630mA
034.6013	034.6043	800mA
034.6014	034.6044	1A
034.6015	034.6045	1.25A
034.6016	034.6046	1.6A
034.6017	034.6047	2A
034.6018	034.6048	2.5A
034.6019	034.6049	3.15A
034.6020	034.6050	4A
034.6021	034.6051	5A


ø8,5
1,45
0,8
8,45
4,3
3,2
ø0,64
5,08
18,8
ø9,5
Optional fuseholder FMS 250V
Order No.: 031.7601
Spool
360
30
40
max 52
according to IEC 286-2
18
32,2
12,7

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FUSES AND FUSEHOLDERS •

ISO 9001
Quality Certified

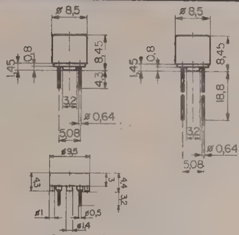
THROUGH-HOLE MOUNT – SUBMINIATURE, cont'd

MST 250V

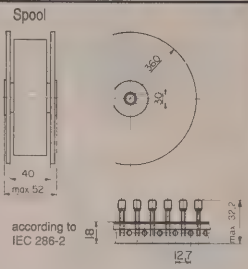
- According to IEC 127-3/4
- Time-lag (max. 2min. @ 210%, max. 10s @ 275%, max. 3s @ 400%, max. 150ms @ 1000%)
- UL recognition 63mA-6.3A/250V
- VDE, SEMKO, SEV approved 63mA-6.3A/250V
- UL 94 V-O material
- Options: Long or short leads; bulk or tape and reel packaging

Order Numbers:

Short Leads	Long Leads	
034.6603	034.6703	63mA
034.6604	034.6704	80mA
034.6605	034.6705	100mA
034.6606	034.6706	125mA
034.6607	034.6707	160mA
034.6608	034.6708	200mA
034.6609	034.6709	250mA
034.6610	034.6710	315mA
034.6611	034.6711	400mA
034.6612	034.6712	500mA
034.6613	034.6713	630mA
034.6614	034.6714	800mA
034.6615	034.6715	1A
034.6616	034.6716	1.25A
034.6617	034.6717	1.6A
034.6618	034.6718	2A
034.6619	034.6719	2.5A
034.6620	034.6720	3.15A
034.6621	034.6721	4A
034.6622	034.6722	5A
034.6623	034.6723	6.3A



Optional fuseholder FMS 250V
Order No.: 031.7601



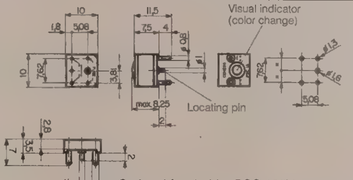
PSC 125V

- Indicating fuse with relay has two independent electrical circuits acting successively for local and remote alarm indication
- Quick-acting
- UL approved 1A-5A/125V
- Especially appropriate for telecommunications and medical equipment
- Measures 10 x 10 x 7 mm

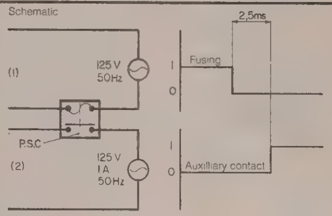
Order Numbers:*

7100.0160.71	1A
7100.0170.71	2A
7100.0180.71	3A
7100.0190.71	4A
7100.0200.71	5A

** 10-piece magazine holder per order number*



Optional fuseholder PSC 125V
Order No.: 7149.9017.01 (10-piece box)



MSA 125V

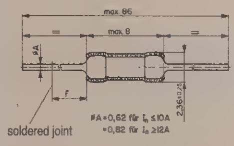
Ceramic cartridge with plastic insulating sleeve

- Quick-acting (≤10A=5s max. @ 200% and 30ms max. @ 400%)
- UL approved 63mA-10A/125V, CSA certified 63mA-7A/125V
- High breaking capacity: 300A/125V ac/dc
- Soldering heat resistance according to IEC 68-2-20
- Available in bulk or tape and reel packaging (IEC 286-1)

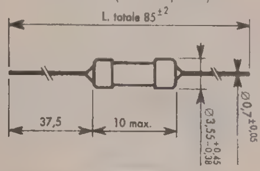
Order Numbers:

Loose	Taped	
034.4807	034.4857	63mA
034.4810	034.4860	125mA
034.4813	034.4863	250mA
034.4815	034.4865	375mA
034.4817	034.4867	500mA
034.4820	034.4870	750mA
034.4822	034.4872	1A
034.4824	034.4874	1.5A
034.4826	034.4876	2A
034.4827	034.4877	2.5A
034.4828	034.4878	3A
034.4830	034.4880	3.5A
034.4831	034.4881	4A
034.4832	034.4882	5A
034.4833	034.4883	7A

MSA 125V



MSA 250V (in development)



5 x 20 mm FUSES – According to IEC with UL Recognition

Series SP / SPT

- High-breaking capacity
- Sand filled, 5 x 20 mm

SP - Quick acting
UL rec. 500mA-10A
VDE app.500mA-6.3A
SEMKO app.500mA-6.3A
SEV app.500mA-6.3A

SPT - Time lag
UL rec.500mA-16A
VDE app. 1A-6.3A
SEMKO app.1A-6.3A
SEV app.1A-6.3A

Current	Series SP	Series SPT
500mA	SP 001.1001	SPT 001.2501
630mA	SP 001.1002	SPT 001.2502
800mA	SP 001.1003	SPT 001.2503
1A	SP 001.1004	SPT 001.2504
1.25A	SP 001.1005	SPT 001.2505
1.6A	SP 001.1006	SPT 001.2506
2A	SP 001.1007	SPT 001.2507
2.5A	SP 001.1008	SPT 001.2508
3.15A	SP 001.1009	SPT 001.2509
4A	SP 001.1010	SPT 001.2510
5A	SP 001.1011	SPT 001.2511
6.3A	SP 001.1012	SPT 001.2512
8A	SP 001.1013	SPT 001.2513
10A	SP 001.1014	SPT 001.2514
12.5A	SP 001.1015	SPT 001.2515
16A	SP 001.1016	SPT 001.2516

Series FSF / FST

- Low-breaking capacity
- 5 x 20 mm

FSF - Quick acting
UL rec.32mA-6.3A
VDE app.32mA-6.3A
SEMKO app.32mA-6.3A
SEV app.32mA-6.3A

FST - Time lag
UL rec.125mA-6.3A
VDE app.32mA-6.3A
SEMKO app.32mA-6.3A
SEV app.32mA-6.3A
BSI license 125mA-6.3A
BEAB app.32mA-6.3A

Current	Series FSF	Series FST
2mA	FSF 034.1501	---
4mA	FSF 034.1502	---
7mA	FSF 034.1503	---
10mA	FSF 034.1504	---
14mA	FSF 034.1505	---
20mA	---	FST 034.3101
32mA	FSF 034.1527	FST 034.3102
40mA	FSF 034.1528	FST 034.3103
50mA	FSF 034.1529	FST 034.3104
63mA	FSF 034.1530	FST 034.3105
80mA	FSF 034.1531	FST 034.3106
100mA	FSF 034.1506	FST 034.3107
125mA	FSF 034.1507	FST 034.3108
160mA	FSF 034.1508	FST 034.3109
200mA	FSF 034.1509	FST 034.3110
250mA	FSF 034.1510	FST 034.3111
315mA	FSF 034.1511	FST 034.3112
400mA	FSF 034.1512	FST 034.3113
500mA	FSF 034.1513	FST 034.3114
630mA	FSF 034.1514	FST 034.3115
800mA	FSF 034.1515	FST 034.3116
1A	FSF 034.1516	FST 034.3117
1.25A	FSF 034.1517	FST 034.3118
1.6A	FSF 034.1518	FST 034.3119
2A	FSF 034.1519	FST 034.3120
2.5A	FSF 034.1520	FST 034.3121
3.15A	FSF 034.1521	FST 034.3122
4A	FSF 034.1522	FST 034.3123
5A	FSF 034.1523	FST 034.3124
6.3A	FSF 034.1524	FST 034.3125
8A	FSF 034.1525	FST 034.3126
10A	FSF 034.1526	FST 034.3127
12.5A	---	FST 034.3128
16A	---	FST 034.3129
20A	---	FST 034.3130

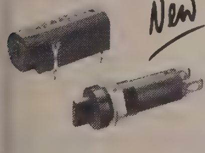
Fuses available with plug-on pigtail leads for through-hole mounting (for fuses with rated current up to 8 amps. Contact Schurter at 707-778-6311 for ordering information)

***Notice:** All CENELEC countries shall require a high-breaking capacity fuse, if the short circuit current through the fuse is more than 35A or 10 x I_n, whichever is greater, no later than January 1st, 1993.*

INTERNATIONAL SHOCK-SAFE FUSEHOLDERS – IEC 257 / VDE 0820, IEC 65 / VDE 0860, IEC 529

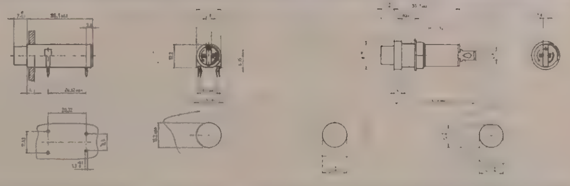
FBS (Medical)

New



UL, CSA, VDE, SEMKO, SEV, CS approved 10A/250V. Fuseholder and carrier complete in one unit. Solder/quick-connect terminals 4.8 x 0.5 mm. Super shock safe, for 5 x 20 mm fuses.

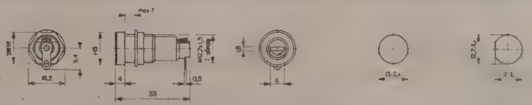
031.3901	Front panel mount (slotted carrier)
031.3911	Front panel mount (finger grip carrier)
031.3981	PCB mount (slotted carrier)
031.3991	PCB mount (finger grip carrier)



FEF

UL, CSA, VDE rated 10A/250V for 5 x 20 mm fuses.

031.1085	Fuseholder/slotted carrier, screw-on mount, solder terminals
031.1165	Fuseholder/slotted carrier, push-on mount, solder/fast-on terminals



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FUSES AND FUSEHOLDERS •

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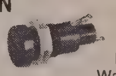
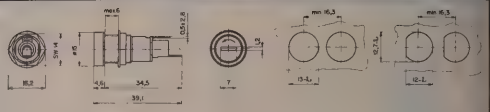
FIN



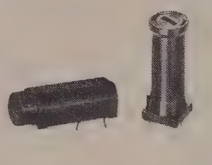
IP 67
Watertight

UL, CSA, rated 10A/250V, VDE rated 6.3A/250V. Watertight, for 5 x 20 mm fuses with solder/fast-on terminals .110" x .020"

031.1351	Complete fuseholder with carrier, axial terminals
031.1353	Complete fuseholder with carrier. End term. 90° off axis.

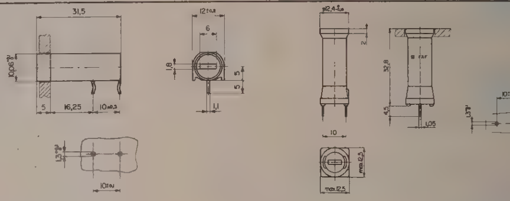


FAF



UL rated 12A/250V, CSA 10A/250V, VDE 6.3A/250V. For 5 x 20 mm fuses, pcb mount, flux proof. Unsealed or sealed (IP 54).

031.3558	Complete fuseholder with fuse carrier, IP 40, horizontal
031.3751	Complete fuseholder with fuse carrier, IP 40, vertical
031.3753	Complete fuseholder with fuse carrier, IP 54, vertical

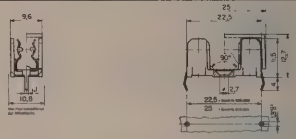


OGN

UL, CSA, VDE, SEMKO, SEV approved 10A/250V. Fuseblock for 5x20mm fuses. Kicked terminals for optimum wave soldering, with 2 different pin spacings available. UL 94V-O plastic.

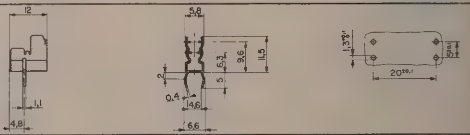
031.8201	22.5 mm pin spacing
031.8211	25.0 mm pin spacing
853.0551	transparent insulation cover

SMT version in development



OG

751.0099	Fuse clips for 1/4 x 1 1/4" or 5 x 20 mm fuses. Bronze, tin-plated. UL rec. 16A/500V (Fuses according to 250V standards only.)
751.0100	Fuse clips, brass, tin-plated



FEU

UL recognized 20A/250V, CSA certified 16A/250V, VDE approved 10A/250V.

Finger grip style

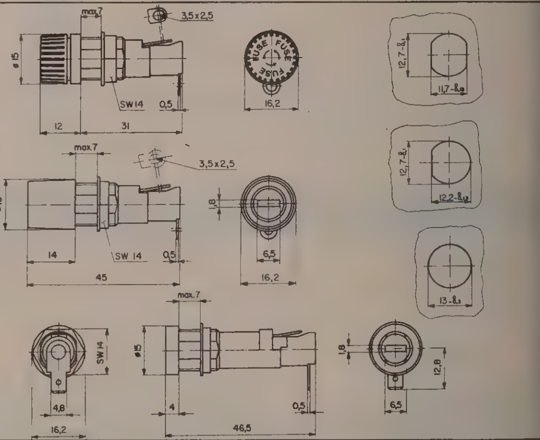
031.1803	Fuseholder complete with fuse carrier for 5 x 20 mm fuse
031.1804	Fuseholder complete with carrier for 1/4 x 1 1/4" fuse

Screwdriver slot style (part number for fuseholder and fuse carrier ordered separately)

031.1653	Fuseholder (high-profile) for 5 x 20mm or 1/4 x 1 1/4" fuse, solder terminals 3.5 x 2.5mm
031.1693	Fuseholder (low-profile) for 5 x 20mm or 1/4 x 1 1/4" fuse, quick-connect terminals 4.8 x 0.5mm
031.1666	Fuse carrier for 1/4 x 1 1/4" fuse
031.1663	Fuse carrier for 5 x 20mm fuse

Screwdriver slot style (part number for fuseholder and fuse carrier packaged together)

031.1659	Fuseholder 031.1653 / fuse carrier 031.1666
031.1751	Fuseholder 031.1653 / fuse carrier 031.1663
031.1699	Fuseholder 031.1693 / fuse carrier 031.1666
031.1706	Fuseholder 031.1693 / fuse carrier 031.1663



FAU

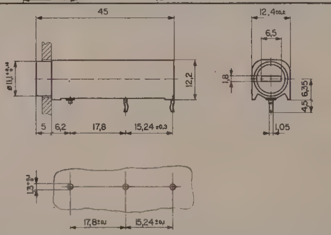
UL, CSA rated 16A/250V, VDE rated 10A/250V

Fuseholder and fuse carrier ordered separately:

031.3577	Fuseholder body
031.1666	Fuse carrier for 1/4 x 1 1/4" fuses (slotted)
031.1663	Fuse carrier for 5 x 20 mm fuses (slotted)

Fuseholder and fuse carrier packaged together:

031.3581	Fuseholder 031.3577 / fuse carrier 031.1666
031.3582	Fuseholder 031.3577 / fuse carrier 031.1663



FAC

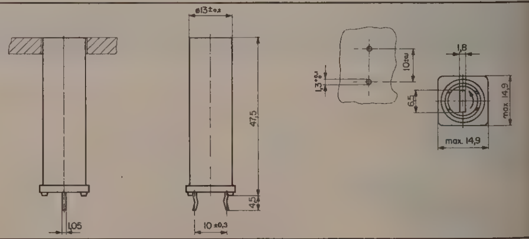
UL, CSA rated 16A/250V, VDE rated 10A/250V.

Fuseholder and fuse carrier ordered separately:

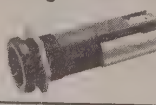
031.3804	Fuseholder body
031.1666	Fuse carrier for 1/4 x 1 1/4" fuses (slotted)
031.1663	Fuse carrier for 5 x 20 mm fuses (slotted)

Fuseholder and fuse carrier packaged together:

031.3822	Fuseholder 031.3804 / fuse carrier 031.1666
031.3821	Fuseholder 031.3804 / fuse carrier 031.1663

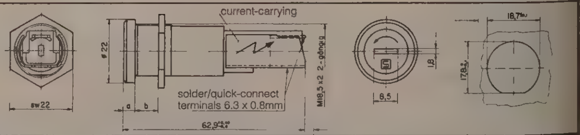


FUL-High Current



UL, CSA rated 30A/250V, VDE rated 16A/250V. For 1/4 x 1 1/4" or 5 x 20 mm fuses. 1/4" quick-connect terminals.

031.2308	Body only
031.2321	Fuse carrier for 1/4 x 1-1/4" fuses
031.2323	Fuse carrier for 5 x 20 mm fuses
859.0046	Insulator boot (optional)



MICROTEMP® Thermal Cutoffs

MICROTEMP® thermal cutoffs from Therm-O-Disc offer an accurate, reliable solution to upper limit temperature protection. Known as a "fuse" or TCO, the MICROTEMP® thermal cutoff provides low-cost protection against potentially hazardous over-heating by interrupting an electrical circuit when operating temperatures exceed the rated temperature of the cutoff.

Features and Benefits of the MICROTEMP®

MICROTEMP® TCO features include:

- One shot operation cuts off electrical current
- High current interrupt capacity for applications requiring up to 20 amps @ 250 VAC (25 amps @120 VAC)
- Low resistance
- Compact size facilitates mounting in confined spaces
- Special configurations and mounting packages are available

The Operating Principle of the MICROTEMP®

The active trigger mechanism of the thermal cutoff is an exclusively formulated, electrically non- conductive pellet. Under normal operating temperatures, the solid pellet holds spring loaded contacts closed.

When a predetermined temperature is reached, the pellet melts, allowing the barrel spring to relax. The trip spring then slides the contact away from the lead and the circuit is opened.

Once a MICROTEMP® thermal cutoff opens a circuit, the circuit will remain open until the TCO is replaced. This replacement procedure must include correction of the fault condition before the product can be operated again.

The MICROTEMP® Thermal Cutoff Series

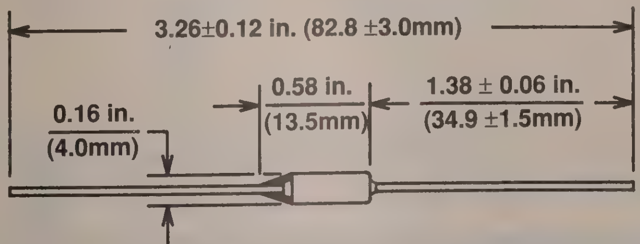
There are three primary types of MICROTEMP® thermal cutoffs recognized by all of the major approval agencies around the world. As shown in the chart at the right, MICROTEMP® TCOs are available in a range of temperatures from 72° C to 240° C with electrical ratings up to 20 Amps at 250 VAC (25 Amps at 120 VAC.)

Dimensions for the G4 and G5 Series thermal cutoffs are shown below. The G7 Series TCO is approximately 30% smaller than the G4 and G5 Series.

Please contact a Therm-O-Disc sales engineer at (419) 525-8500 for a free MICROTEMP® thermal cutoff sample and Technical Bulletin TCO-A which describes testing and installation procedures for thermal cutoffs.

MICROTEMP® TCO Temperature and Electrical Specifications

	G4 Series	G5 Series	G7 Series
Calibration Temperatures °C (Tolerance +0, -5 °C)	72	72	—
	77	77	77
	84	—	84
	91	91	93
	98	98	98
	104	104	—
	110	110	110
	117	117	117
	121	121	121
	128	128	128
	—	141	141
	152	152	152
	169	169	169
	184	184	184
	192	192	—
	216	216	—
	228	228	—
	240	240	—
Electrical Ratings	250 VAC 10.0A Res 8.0A Ind	250 VAC 20.0A Res —	250 VAC 5.0A Res 4.5A Ind
	120 VAC 15.0A Res 14.0 A Ind	120 VAC 25.0A Res —	120 VAC 5.0A Res 4.5A Ind



G4 and G5 Series Thermal Cutoff

For further information on MICROTEMP® thermal cutoffs, contact a Therm-O-Disc sales engineer at 419-525-8500

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- Pomona
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- Guardian
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- I/R
- ITT Takamisawa
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- Magnecraft
- Master Electronics
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- Theta-J
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- Arrowhart
- C & K
- Cherry Electric
- Eaton/Cutler-Hammer
- EECO
- Elect. Comp. Group
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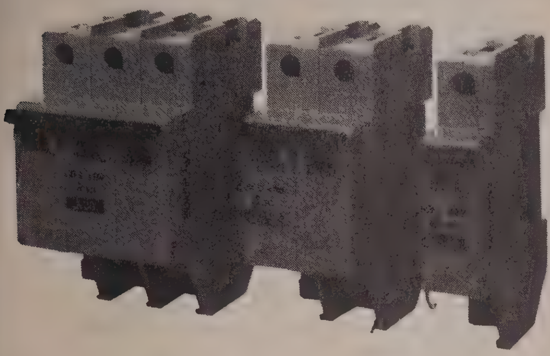
AS168 Thermal Magnetic Circuit Breaker



Description

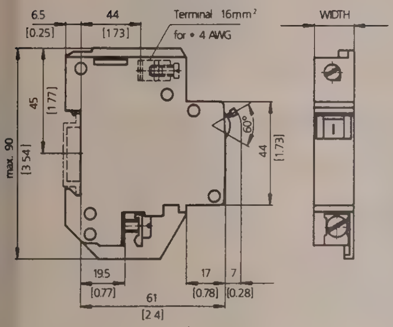
The AS168 is an energy limiting thermal magnetic circuit breaker. Bimetals are used to provide overload protection and initiate the thermal trip. A strong solenoid magnet provides instantaneous magnetic trip to achieve fast separation of contacts. The AS168 provides short-circuit interruption within less than a quarter of a full cycle, providing true current-limiting protection. Such performance limits the let through energy to less than 10% of that of a conventional breaker.

Comparison of AS168 versus conventional breakers

The AS168 features a unique ability to achieve short circuit interruptions far more effectively than conventional breakers. In conventional circuit breakers, short circuit interruption requires time of approximately one to two half cycles, because, when the contacts open, the resulting arc will continue to burn until the ac-current sine-wave passes through zero. It may reignite, due to the insufficient width of the contact gap. The current which flows until the arc is extinguished produces a heating effect, proportional to the I²t value (called the let through energy) of this current pulse.

The AS168 energy limiting breaker is designed to overcome the shortcomings of ordinary circuit breakers by limiting the let through current and the resulting "let through energy" drastically.

Dimensions



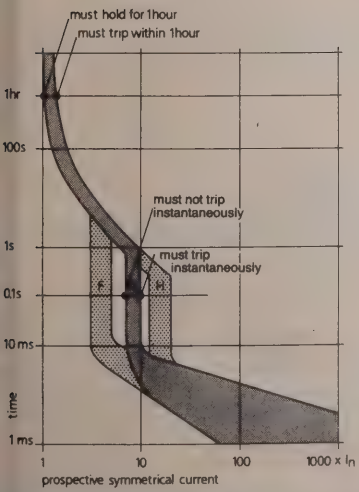
Superior short circuit protection

- less damage where the short occurs
- less wear of the breaker itself
- lower heating of all components downstream from the breaker

Selective disconnection

- wider range of selective action with upstream breakers or fuses than with a conventional breaker
- no nuisance shut-down of unfaulty lines in systems connected in parallel

Trip Curves



Technical Information

- Voltage Ratings: 480Vac
  DC-version = 360Vdc
- Current Ratings: 0.5-50A
- Short Circuit Capacity: 10,000A
- Contact life: For ratings up to 6 amps, the contact life in a circuit of 240Vac will be 50,000 operations.
  For ratings greater than 6 amps the contact life will exceed 10,000 operations.

(Note: IEC 898 requires 8,000 operations.)

Options

- Terminals: AS168B, Screw terminals
  AS168D, .25" Quick Connect ($I_n \leq 20A$)
- Module Options: Switched Neutral, Auxiliary contact, Signal Contact and Relay trip modules available
- Magnetic Trip Curves:
  F curve, 3 to 5 x I_n (optional)
  G curve, 6 to 10 x I_n (standard)
  H curve 12 to 20 x I_n (optional)

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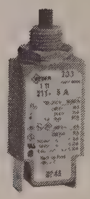
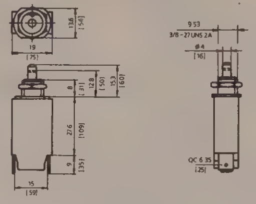
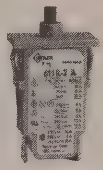
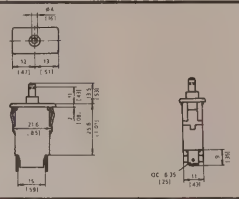




- Central mount M 10 x 1 thread with hex nut
- Central mount, 3/8-27" thread with hex nut (code 200)
- .25 inch/6.3 x 0.8 mm quick connect terminals
- Single pole - Push to reset
- Ratings: 0.05A to 12A (16A at 28 Vdc)
- .11 inch/2.8 x 0.8 mm quick connect terminals
- Trip band indicator
- Current rating printed on reset button
- Shunt terminal up to 6 A
- Dust cover
- Oversized knurled dress nut

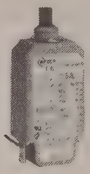
T11-611

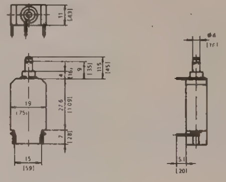




- Mounting style: Snap-in
- .25 inch/6.3 x 0.8 mm quick connect terminals
- Single pole - Push to reset
- Ratings: 0.05A to 12A (16A at 28 Vdc)
- .11 inch/2.8 x 0.8 mm quick connect terminals
- Trip band indicator
- Current rating printed on reset button
- Shunt terminal up to 6 A

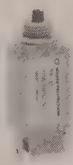
T11-818

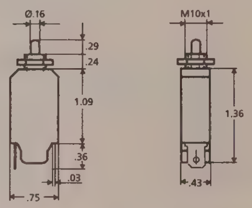




- Mounting style: Printed circuit board - vertical or horizontal
- Single pole - Push to reset
- Ratings: 0.05A to 12A
- Trip band indicator
- Current rating printed on reset button

T9

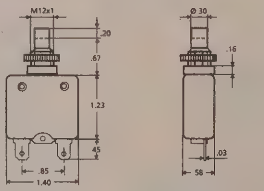




CBE with push to reset mechanism

- Three fitting possibilities: - central mounting
  - snap-in mounting
  - screw mounting
- Red re-set button
- Standard current range 4 - 16A
- Voltage range 120V AC / 240V AC, 32V DC
- Interrupting capacity 120V AC 1000A / 240V AC 200A
- Contact life 500 cycles at 200% I_n

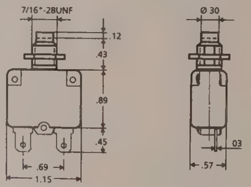
TS 701



Various arrangements and current ranges up to 40A

- Various fitting and connection possibilities
- Push to reset
- Standard current range 3 - 40A
- Voltage range 125V AC / 250V AC, 50V DC
- Interrupting capacity 125V AC 1000A / 250V AC 200A
- Contact life 500 cycles at 200% I_n

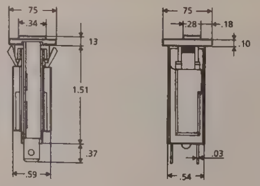
TS 709



Small low cost CBE

- Various fitting arrangements
- Standard current range 7 - 16A
- Voltage range 120V AC / 240V AC
- Interrupting capacity 120V AC 1000A / 240V AC 200A
- Contact life 500 cycles at 150% I_n

TS 710



Replaces fuse holders and fuses

- Arrangement with red push button
- Standard current range 4-15A
- Voltage range 120V AC / 240V AC, 32V DC
- Interrupting capacity 120V AC 150A / 240V AC 100A
- Contact life 500 cycles at 150% I_n

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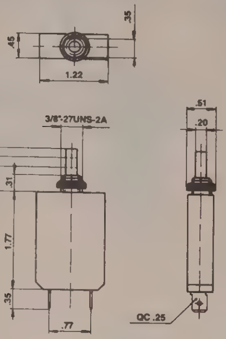
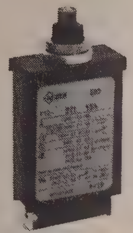
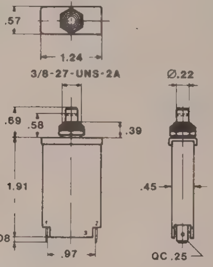


T13 Thermal Circuit Breaker

- Completely trip free
- Current ratings: .05-30A
- Voltage ratings: 277Vac, 28Vdc
- Interrupting capacity: UL 1077-5000A
- Breaking capacity: I_n<7A = 10 times rated current
  I_n ≥7A = 400 Amps max
- Trip indication by extended button

T12-221





T12 Thermal or Thermal Magnetic Circuit Breaker, Push On/Off, Push To Reset

- Completely trip free
- Current ratings: .05-16A
- Voltage ratings: 240Vac, 28Vdc
- Mounting styles: central and flange
- Trip indication by extended button
- Auxiliary contacts, shunt terminal
- Different magnetic trip curves, fast ($4xI_n$) or slow ($8xI_n$)

AMAZONAS

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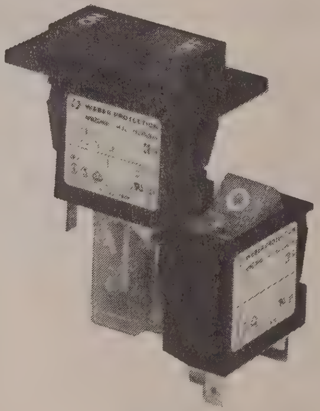
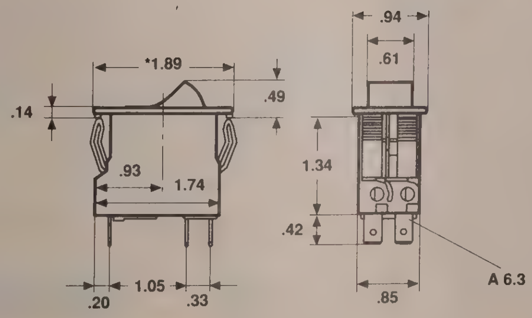


Amazonas Multi-Pole Circuit Breaker with Push-Button or Rocker Actuation

The AMAZONAS series combines power on/off switching with thermal overload protection in one compact unit. Push-button or rocker actuation with identical mounting dimensions offers design flexibility. This line of positively trip-free breakers carries all worldwide approvals and a variety of unique options.



- 2-pole or 3-pole versions with 1 or 2 thermally-protected poles
- Positively trip-free mechanism
- Snap-in or screw mounting
- Low-voltage release
- Remote trip release
- Mechanical safety release
- Auxiliary contacts
- Shunt connections
- Protective covers
- Rocker illumination
- Current ratings: 0.1-20A
- Voltage ratings: up to 240 Vac, 60 Vdc

ights of technical changes reserved

*Effective January 1994
New Area Code (610)

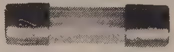
Weber Protection, Inc.

800 • WEBER PA

291 Great Valley Parkway, Malvern, PA 19355 • Tel: (215*) 651-0770 • Fax: (215*) 651-0775

Wickmann

Miniature Fuses



5 x 20 mm

250 Volt, Glass Tube
International IEC 127-2/II,III

VDE SEMKO BSI UL

NO. 19193 / QUICK ACTING

RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
32	35 Amps at 250VAC
40	
50	
63	
80	
100	
125	
160	
200	
250	
315	
400	
500	
630	
800	
1	
1.25	
1.6	
2	
2.5	
3.15	
4	40 Amps
5	50 Amps
6.3	63 Amps

NO. 19195 / TIME LAG

RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
32	35 Amps at 250VAC
40	
50	
63	
80	
100	
125	
160	
200	
250	
315	
400	
500	
630	
800	
1	
1.25	
1.6	
2	
2.5	
3.15	
4	40 Amps
5	50 Amps
6.3	63 Amps
8 *	63 Amps
10 *	63 Amps
12.5 *	63 Amps
16 *	63 Amps

*UL Recognized only
Not mentioned in the standards.

5 x 20 mm

250 Volt, Ceramic Tube
International IEC 127-2/I,V

VDE SEMKO UL

NO. 19194 / QUICK ACTING

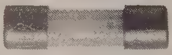
RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
50	10,000 Amps at 125VAC 1500 Amps at 250VAC
63	
80	
100	
125	
160	
200	
250	
315	
400	
500	
630	
800	
1	
1.25	
1.6	
2	
2.5	
3.15	
4	
5	
6.3	
8 *	
10 *	

*Not mentioned in the standards.

NO. 19181 / TIME LAG

RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
125 *	10,000 Amps at 125VAC 1500 Amps at 250VAC
160 *	
200 *	
250 *	
315 *	
400 *	
500 *	
630 *	
800 *	
1	
1.25	
1.6	
2	
2.5	
3.15	
4	
5	
6.3	
8 *	1000 Amps
10 *	1000 Amps

Contact Wickmann USA for alternative high breaking capacity fuses for use in CENELEC nations.



5 x 20 mm

250 Volt, Glass Tube
North American UL 198G

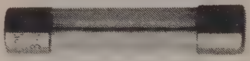
UL CSA

NO. 19197 / QUICK ACTING

RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
80	10,000 Amps at 125VAC 35 Amps at 250VAC
100	
125	
150	
175	
187	
200	
250	
300	
375	
400	
500	
600	
700	
750	
800	
1	
1.2	10,000 Amps at 125 VAC 100 Amps at 250VAC
1.25	
1.5	
1.6	
1.8	
2	
2.25	
2.5	
2.8	
3	
3.2	
3.5	

NO. 19198 / TIME LAG

RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
80	10,000 Amps at 125VAC 35 Amps at 250VAC
100	
125	
150	
175	
187	
200	
250	
300	
375	
400	
500	
600	
700	
750	
800	
1	
1.2	10,000 Amps at 125 VAC 100 Amps at 250VAC
1.25	
1.5	
1.6	
1.8	
2	
2.25	
2.5	
2.8	
3	
3.2	
3.5	



1/4" x 1 1/4"

500 Volt, Ceramic Tube
Special Construction

NO. 19354 / QUICK ACTING

RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
100	1000 Amps at 500VAC
125	
160	
200	
250	
315	
400	
500	
630	
800	
1	
1.25	
1.6	
2	
2.5	
3.15	
4	
5	
6.3	
8	
10	

NO. 19356 / TIME LAG

RATED CURRENT (mA/Amp)	BREAKING CAPACITY (Amp)
100	1000 Amps at 500VAC
125	
160	
200	
250	
315	
400	
500	
630	
800	
1	
1.25	
1.6	
2	
2.5	
3.15	
4	
5	
6.3	
8	
10	

A Mark of Safety

For complete catalog information, engineering support or sample requests, please call or write:

Wickmann USA, Inc.
ISO 9001 Quality Certified Products

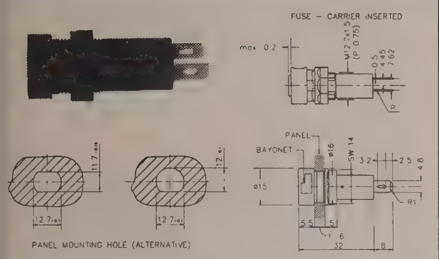
4100 Shirley Drive • Atlanta, Georgia 30336
Tel: (404) 699-7820 • Fax: (404) 699-9176

Wickmann

Shock-Safe Fuseholders

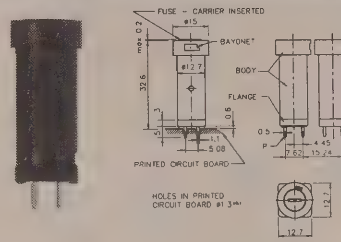
5 x 20mm

NO. 19820


FUSE – CARRIER INSERTED
max 0.2
PANEL
BAYONET
ø15
SW 14
R1
PANEL MOUNTING HOLE (ALTERNATIVE)

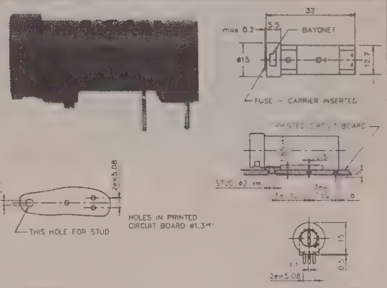
Fitting: Panel mounting
Terminals: Solder/Quick connect
Rated Voltage: 250V
Rated Current, approved:
10A/2.5W according to VDE/SEMKO
16A according to UL/CSA
Admissible Fuse Power Dissipation: 4W @40°C
Approvals:
SEMKO-approved No. 8916209
VDE-approved No. 53714
UL-recognized File No. E 70164
CSA-certified File No. 47574

NO. 19831


FUSE – CARRIER INSERTED
ø15
BAYONET
BODY
FLANGE
PRINTED CIRCUIT BOARD
HOLES IN PRINTED CIRCUIT BOARD ø1.3

Fitting: Vertical type, PC Board mount
Terminals: Solder pins
Rated Voltage: 250V
Rated Current, approved:
10A/2.5W according to VDE/SEMKO
16A according to UL/CSA
Admissible Fuse Power Dissipation: 2.5W @40°C
Approvals:
SEMKO-approved No. 8839041
VDE-approved No. 57938
UL-recognized File No. E 70164
CSA-certified File No. 47574

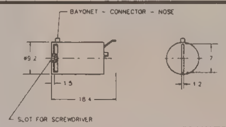
NO. 19830


BAYONET
FUSE – CARRIER INSERTED
PRINTED CIRCUIT BOARD
STUD
THIS HOLE FOR STUD
HOLES IN PRINTED CIRCUIT BOARD ø1.3

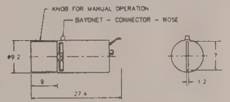
Fitting: Horizontal type, PC Board mount
Terminals: Solder pins
Rated Voltage: 250V
Rated Current, approved:
10A/2.5W according to VDE/SEMKO
16A according to UL/CSA
Admissible Fuse Power Dissipation: 2.5W @40°C
Approvals:
SEMKO-approved No. 8839041
VDE-approved No. 55787
UL-recognized File No. E 70164
CSA-certified File No. 47574

Fuse Carriers

NO. 19835

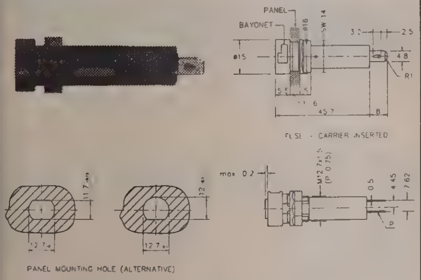

BAYONET – CONNECTOR – NOSE
SLOT FOR SCREWDRIVER

NO. 19837


KNOB FOR MANUAL OPERATION
BAYONET – CONNECTOR – NOSE

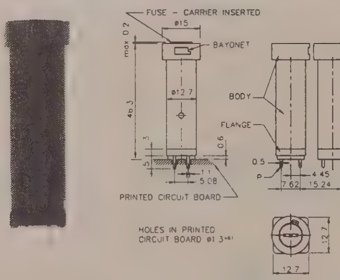
1/4" x 1 1/4" & 5 x 20mm

NO. 19800


PANEL
BAYONET
ø15
SW 14
R1
FUSE – CARRIER INSERTED
max 0.2
PANEL MOUNTING HOLE (ALTERNATIVE)

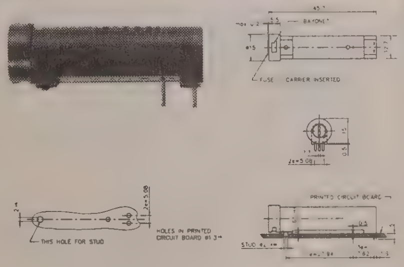
Fitting: Panel mounting
Terminals: Solder/Quick connect
Rated Voltage: 250V
Rated Current, approved:
10A/2.5W according to VDE/SEMKO
16A according to UL/CSA
Admissible Fuse Power Dissipation: 4W @40°C
Approvals:
SEMKO-approved No. 8727099
VDE-approved No. 49838
UL-recognized File No. E 70164
CSA-certified File No. 47574

NO. 19811


FUSE – CARRIER INSERTED
ø15
BAYONET
BODY
FLANGE
PRINTED CIRCUIT BOARD
HOLES IN PRINTED CIRCUIT BOARD ø1.3

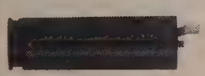
Fitting: Vertical type, PC Board mount
Terminals: Solder pins
Rated Voltage: 250V
Rated Current, approved:
10A/2.5W according to VDE/SEMKO
16A according to UL/CSA
Admissible Fuse Power Dissipation: 2.5W @40°C
Approvals:
SEMKO-approved No. 8903044
VDE-approved No. 55787
UL-recognized File No. E 70164
CSA-certified File No. 47574

NO. 19810

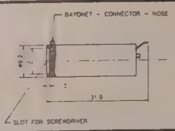

BAYONET
FUSE – CARRIER INSERTED
PRINTED CIRCUIT BOARD
THIS HOLE FOR STUD
HOLES IN PRINTED CIRCUIT BOARD ø1.3
STUD

Fitting: Horizontal type, PC Board mount
Terminals: Solder pins
Rated Voltage: 250V
Rated Current, approved:
10A/2.5W according to VDE/SEMKO
16A according to UL/CSA
Admissible Fuse Power Dissipation: 2.5W @40°C
Approvals:
SEMKO-approved No. 8815062
VDE-approved No. 55787
UL-recognized File No. E 70164
CSA-certified File No. 47574

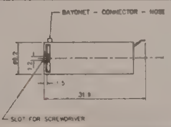
Fuse Carriers



NO. 19815
(5 x 20mm)


BAYONET – CONNECTOR – NOSE
31.9
SLOT FOR SCREWDRIVER

NO. 19816
(1/4" x 1 1/4")


BAYONET – CONNECTOR – NOSE
SLOT FOR SCREWDRIVER

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ISO 9001 Quality Certified Products

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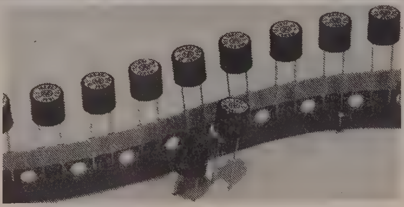
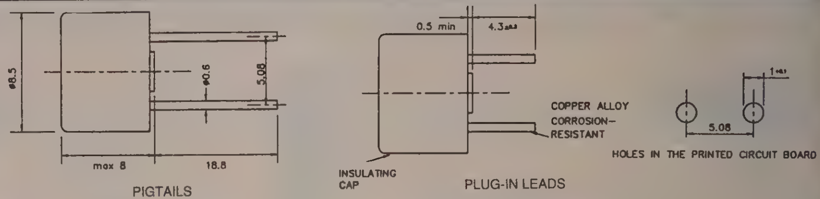
Wickmann

Subminiature Fuses

TR5 FUSE - 250 VOLT

Fast Acting & Time Lag





TR5/UL 198G, 250 Volt

Time/Current Characteristics				
Part No.	**Type**	**100%xI$_{rated}$**	**150%xI$_{rated}$**	**200%xI$_{rated}$**
19373	Fast Acting	> 4 hrs.	< 10 min.	< 5 sec.
19374	Time Lag	> 4 hrs.	< 10 min.	< 60 sec.

Fast Acting		Time Lag		
Pigtail Leads (Part No.)	**Plug-in Leads (Part No.)**	**Pigtail Leads (Part No.)**	**Plug-in Leads (Part No.)**	**Amp. Rating**
19373, 50mA	19373K, 50mA	19374, 50mA	19374K, 50mA	50mA
19373, 63mA	19373K, 63mA	19374, 63mA	19374K, 63mA	63mA
19373, 80mA	19373K, 80mA	19374, 80mA	19374K, 80mA	80mA
19373, 100mA	19373K, 100mA	19374, 100mA	19374K, 100mA	100mA
19373, 125mA	19373K, 125mA	19374, 125mA	19374K, 125mA	125mA
19373, 160mA	19373K, 160mA	19374, 160mA	19374K, 160mA	160mA
19373, 200mA	19373K, 200mA	19374, 200mA	19374K, 200mA	200mA
19373, 250mA	19373K, 250mA	19374, 250mA	19374K, 250mA	250mA
19373, 315mA	19373K, 315mA	19374, 315mA	19374K, 315mA	315mA
19373, 400mA	19373K, 400mA	19374, 400mA	19374K, 400mA	400mA
19373, 500mA	19373K, 500mA	19374, 500mA	19374K, 500mA	500mA
19373, 630mA	19373K, 630mA	19374, 630mA	19374K, 630mA	630mA
19373, 800mA	19373K, 800mA	19374, 800mA	19374K, 800mA	800mA
19373, 1A	19373K, 1A	19374, 1A	19374K, 1A	1A
19373, 1.25A	19373K, 1.25A	19374, 1.25A	19374K, 1.25A	1.25A
19373, 1.6A	19373K, 1.6A	19374, 1.6A	19374K, 1.6A	1.6A
19373, 2A	19373K, 2A	19374, 2A	19374K, 2A	2A
19373, 2.5A	19373K, 2.5A	19374, 2.5A	19374K, 2.5A	2.5A
19373, 3.15A	19373K, 3.15A	19374, 3.15A	19374K, 3.15A	3.15A
19373, 4A	19373K, 4A	19374, 4A	19374K, 4A	4A
19373, 5A	19373K, 5A	19374, 5A	19374K, 5A	5A
19373, 6.3A	19373K, 6.3A	19374, 6.3A	19374K, 6.3A	6.3A

UL CSA VDE SEMKO UL

TR5 Specifications

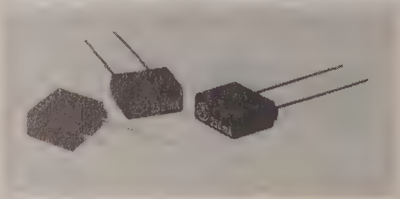
Rated Voltage: 250 Volts
Rated Current Range: 50mA - 6.3 Amps
Breaking Capacity: 50 Amps at 250 Volts
Pin Distance: 5.08mm (0.200 inches)
Board Solderable or Plug-in Leads
Soldering Heat Resistance: 260°C, 10 Sec.
Material: Thermoplastic Base & Cap meeting UL-94V0
Tinned, copper alloy, round pins
Vibration Resistance: 10-2kHz @ 0.75mm
amplitude, 6 hrs.
Acceleration Tolerance: Up to 50g for 11 msec.
Packaging: Boxes of 100, 500, or 1000 pcs.
850 pcs. per Reel for Taped style
Approvals: UL Listed/CSA Certified to UL 198G
VDE/SEMKO Approved,
UL Recognized to IEC 127

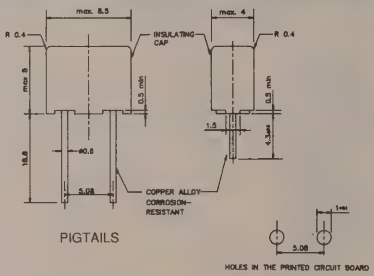
TR5/IEC 127, 250 Volt

Time/Current Characteristics (xI$_{rated}$)					
Part No.	**Type**	**150%**	**210%**	**275%**	**400%**
19370	Fast Acting	>1 hr.	<30 min.	10ms-3s	3ms-300ms
19372	Time Lag	>1 hr.	<2 min.	400ms-10s	150ms-3s

Fast Acting		Time Lag		
Pigtail Leads (Part No.)	**Plug-in Leads (Part No.)**	**Pigtail Leads (Part No.)**	**Plug-in Leads (Part No.)**	**Amp. Rating**
19370, 50mA	19370K, 50mA	19372, 50mA	19372K, 50mA	50mA
19370, 63mA	19370K, 63mA	19372, 63mA	19372K, 63mA	63mA
19370, 80mA	19370K, 80mA	19372, 80mA	19372K, 80mA	80mA
19370, 100mA	19370K, 100mA	19372, 100mA	19372K, 100mA	100mA
19370, 125mA	19370K, 125mA	19372, 125mA	19372K, 125mA	125mA
19370, 160mA	19370K, 160mA	19372, 160mA	19372K, 160mA	160mA
19370, 200mA	19370K, 200mA	19372, 200mA	19372K, 200mA	200mA
19370, 250mA	19370K, 250mA	19372, 250mA	19372K, 250mA	250mA
19370, 315mA	19370K, 315mA	19372, 315mA	19372K, 315mA	315mA
19370, 400mA	19370K, 400mA	19372, 400mA	19372K, 400mA	400mA
19370, 500mA	19370K, 500mA	19372, 500mA	19372K, 500mA	500mA
19370, 630mA	19370K, 630mA	19372, 630mA	19372K, 630mA	630mA
19370, 800mA	19370K, 800mA	19372, 800mA	19372K, 800mA	800mA
19370, 1A	19370K, 1A	19372, 1A	19372K, 1A	1A
19370, 1.25A	19370K, 1.25A	19372, 1.25A	19372K, 1.25A	1.25A
19370, 1.6A	19370K, 1.6A	19372, 1.6A	19372K, 1.6A	1.6A
19370, 2A	19370K, 2A	19372, 2A	19372K, 2A	2A •
19370, 2.5A	19370K, 2.5A	19372, 2.5A	19372K, 2.5A	2.5A
19370, 3.15A	19370K, 3.15A	19372, 3.15A	19372K, 3.15A	3.15A
19370, 4A	19370K, 4A	19372, 4A	19372K, 4A	4A
19370, 5A	19370K, 5A	19372, 5A	19372K, 5A	5A

TE5 FUSE - 125 VOLT





TE5/UL 198G, 125 Volt

Time/Current Characteristics				
Part No.	**Type**	**100%xI$_{rated}$**	**150%xI$_{rated}$**	**200%xI$_{rated}$**
19393	Fast Acting	> 4 hrs.	< 10 min.	< 5 sec.
19394	Time Lag	> 4 hrs.	< 10 min.	< 60 sec.

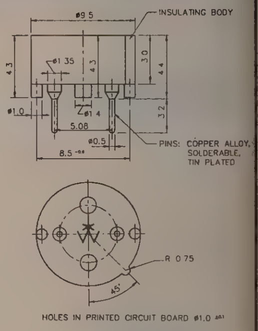
Fast Acting		Time Lag		
Pigtail Leads (Part No.)	**Plug-in Leads (Part No.)**	**Pigtail Leads (Part No.)**	**Plug-in Leads (Part No.)**	**Amp. Rating**
19393, 50mA	19393K, 50mA	19394, 50mA	19394K, 50mA	50mA
19393, 63mA	19393K, 63mA	19394, 63mA	19394K, 63mA	63mA
19393, 80mA	19393K, 80mA	19394, 80mA	19394K, 80mA	80mA
19393, 100mA	19393K, 100mA	19394, 100mA	19394K, 100mA	100mA
19393, 125mA	19393K, 125mA	19394, 125mA	19394K, 125mA	125mA
19393, 160mA	19393K, 160mA	19394, 160mA	19394K, 160mA	160mA
19393, 200mA	19393K, 200mA	19394, 200mA	19394K, 200mA	200mA
19393, 250mA	19393K, 250mA	19394, 250mA	19394K, 250mA	250mA
19393, 315mA	19393K, 315mA	19394, 315mA	19394K, 315mA	315mA
19393, 400mA	19393K, 400mA	19394, 400mA	19394K, 400mA	400mA
19393, 500mA	19393K, 500mA	19394, 500mA	19394K, 500mA	500mA
19393, 630mA	19393K, 630mA	19394, 630mA	19394K, 630mA	630mA
19393, 800mA	19393K, 800mA	19394, 800mA	19394K, 800mA	800mA
19393, 1A	19393K, 1A	19394, 1A	19394K, 1A	1A
19393, 1.25A	19393K, 1.25A	19394, 1.25A	19394K, 1.25A	1.25A
19393, 1.6A	19393K, 1.6A	19394, 1.6A	19394K, 1.6A	1.6A
19393, 2A	19393K, 2A	19394, 2A	19394K, 2A	2A
19393, 2.5A	19393K, 2.5A	19394, 2.5A	19394K, 2.5A	2.5A
19393, 3.15A	19393K, 3.15A	19394, 3.15A	19394K, 3.15A	3.15A
19393, 4A	19393K, 4A	19394, 4A	19394K, 4A	4A
19393, 5A	19393K, 5A	19394, 5A	19394K, 5A	5A
19393, 6.3A	19393K, 6.3A	19394, 6.3A	19394K, 6.3A	6.3A

TE5 Specifications

Rated Voltage: 125 Volts
Rated Current Range: 50mA - 6.3 Amps
Breaking Capacity: 50 Amps at 125 Volts
Pin Distance: 5.08mm (0.200 inches)
Board Solderable or Plug-in Leads
Soldering Heat Resistance: 260°C, 10 Sec.
Material: Thermoplastic Base & Cap meeting UL-94V0
Tinned, copper alloy, round pins
Vibration Resistance: 10-2kHz @ 0.75mm
amplitude, 6 hrs.
Acceleration Tolerance: Up to 50g for 11 msec.
Packaging: Boxes of 100, 500, or 1000 pcs.
1250 pcs. taped in concertina
arrangement
Approvals: UL Listed/CSA Certified to UL 198G

PC-MOUNT HOLDERS

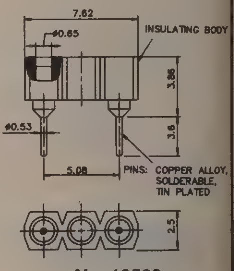
TR5 Holder


ø9.5
INSULATING BODY
4.3
ø1.35
4.3
3.0
4.4
ø1.0
ø1.4
3.2
5.08
ø0.5
8.5
PINS: COPPER ALLOY, SOLDERABLE, TIN PLATED
R 0.75
45°
HOLES IN PRINTED CIRCUIT BOARD ø1.0 ±0.1

- Rated to: 250V, 6.3A, 1.6W
- UL94-V0
- Also available in Panel Mount Shock-Safe design

No. 19560

TE5 Holder



- Rated to: 250V, 6.3A, 1.6W
- UL94-V0

No. 19562

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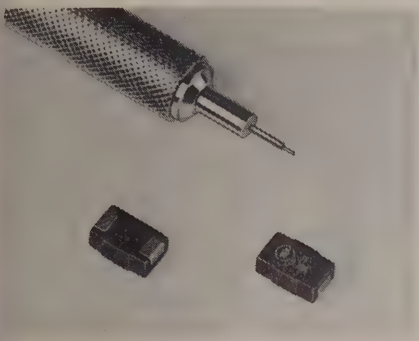
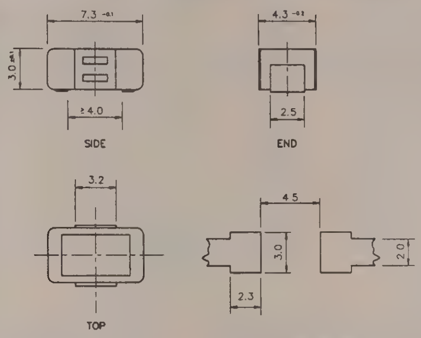
Wickmann

Subminiature Fuses

SM-3 SURFACE MOUNT FUSE



UL
E 67006



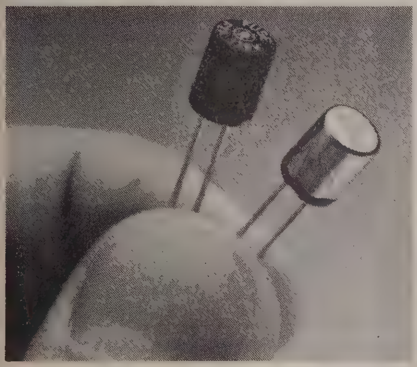
RECOMMENDED SOLDER PADS

THE NOMINAL THICKNESS OF THE COPPER LAYER SHALL BE ≥ 0.035mm

- **Rated Voltage:** 125 Volts
- **Rated Current Range:** 500mA - 4.0 Amps, Fast Acting
- **Suitable for all Surface Mount soldering processes**
- **Breaking Capacity:** 50 Amps at 125 VAC
- **Packaging:** Bulk and Blister Tape
- **Approvals:** UL Listed - File No. E67006

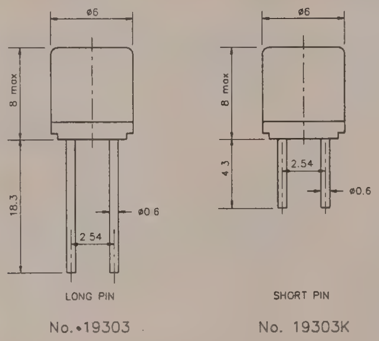
Catalog #	Description	Range
19413	SM3-F (Fast Acting)	500mA-4A

TR3 MICROFUSE - 125 VOLT



UL
E 67006

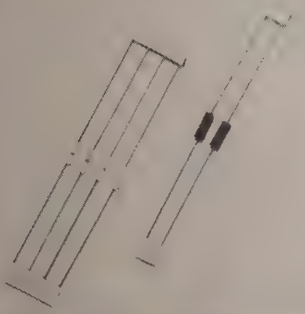
CSA
51378



- **Rated Voltage:** 125 Volts
- **Rated Current Range:** 50mA - 5.0 Amps, Fast Acting
- **Breaking Capacity:** 50 Amps at 125 VAC
- **Diameter:** 0.236" (6.0mm)
- **Height:** 0.315" (8.0mm) max.
- **Board solderable or Plug-in leads:** 0.1" (2.54mm) pin spacing
- **Board washable, shock and vibration resistant**
- **Metal or Thermoplastic cap**
- **Packaging:** Bulk (long or short pins) and Tape & Reel
- **Approvals:** UL Listed/CSA Certified (Metal cap only)

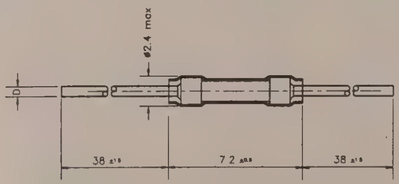
Catalog #	Description	Range	Approvals
19303	TR3-F (Fast Acting)	50mA-5.0A	UL/CSA (metal cap)
19300	TR3-F (Fast Acting)	50mA-5.0A	- (plastic cap)

PICOFUSE/NANOFUSE



UL-recognized
E 67006

CSA
51378



- **Rated Voltage:** 125 Volts
- **Rated Current Range:** 63mA - 10 Amps, Fast Acting (Also 15 Amps at 32 Volts)
- **Material:** Picofuse—Ceramic tube with clear shrink tube cover
  Nanofuse—Ceramic tube with black Thermoplastic molding
- **Board washable, shock and vibration resistant**
- **Packaging:** Taped
- **Approvals:**

	Picofuse	Nanofuse
UL Recognized:	63mA..10A	63mA..7A
CSA Certified:	63mA..10A	63mA..7A

Catalog #	Description	Range
19275	Picofuse	63mA-15A
19274	Nanofuse	63mA-7A

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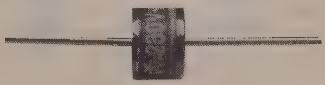
Wickmann

Gas Tube Surge Arresters

Light Duty (Mini-type)

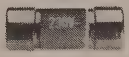
Dimensions	Part Number with leads	Part Number without leads	Nominal DC Sparkover Voltage (100 V/S)	Impulse Sparkover Voltage (1 KV/μS)	AC (RMS) Discharge Current (10 Impulses)	Surge Current 8x20μS Wave (10 Impulses)	Insulation Resistance (ohms)	Maximum Capacitance (pF)	Typical Applications
Figure 1	13501-N90	13500-N90	90+25%/-20%	600	2.5	2500	$>10^{10}$	<1	Data Lines
Figure 1	13501-N230	13500-N230	230 ± 20%	600	2.5	2500	$>10^{10}$	<1	Control Circuits
Figure 1	13501-N350	13500-N350	350 ± 20%	700	2.5	2500	$>10^{10}$	<1	

Medium Duty



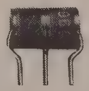
Dimensions	Part Number with leads	Part Number without leads	Nominal DC Sparkover Voltage (100 V/S)	Impulse Sparkover Voltage (1 KV/μS)	AC (RMS) Discharge Current (10 Impulses)	Surge Current 8x20μS Wave (10 Impulses)	Insulation Resistance (ohms)	Maximum Capacitance (pF)	Typical Applications
Figure 2	13832-N90	13831-N90	90+25%/-20%	600	5	5000	$>10^{10}$	<1	Data Lines CATV Telephone Lines Power Supplies
Figure 2	13832-N230	13831-N230	230 ± 20%	600	5	5000	$>10^{10}$	<1	
Figure 2	13832-N350	13831-N350	350 ± 20%	700	5	5000	$>10^{10}$	<1	
Figure 3	13931-N90	13930-N90	90+25%/-20%	600	20	10,000	$>10^{10}$	<1	
Figure 3	13931-N230	13930-N230	230 ± 20%	600	20	10,000	$>10^{10}$	<1	
Figure 3	13931-N350	13930-N350	350 ± 20%	700	20	10,000	$>10^{10}$	<1	
Figure 4	13935-N600S	13934-N600S	600+35%/-20%	1200	20	10,000	$>10^{10}$	<1	

Heavy Duty



Dimensions	Part Number with leads	Part Number without leads	Nominal DC Sparkover Voltage (100 V/S)	Impulse Sparkover Voltage (1 KV/μS)	AC (RMS) Discharge Current (10 Impulses)	Surge Current 8x20μS Wave (10 Impulses)	Insulation Resistance (ohms)	Maximum Capacitance (pF)	Typical Applications
Figure 5	N/A	13820-N90	90+25%/-20%	600	20	20,000	$>10^{10}$	<1	Telephone Lines
Figure 5	N/A	13820-N230	230 ± 20%	600	20	20,000	$>10^{10}$	<1	
Figure 5	N/A	13820-N350	350 ± 20%	700	20	20,000	$>10^{10}$	<1	

Heavy Duty (3-Electrode)



Dimensions	Part Number with leads	Part Number without leads	Nominal DC Sparkover Voltage (100 V/S)	Impulse Sparkover Voltage (1 KV/μS)	AC (RMS) Discharge Current (10 Impulses)	Surge Current 8x20μS Wave (10 Impulses)	Insulation Resistance (ohms)	Maximum Capacitance (pF)	Typical Applications
Figure 6	13942-N90	13940-N90	90+25%/-20%	600	10	10,000	$>10^{10}$	<1	Line Cards
Figure 6	13942-N230	13940-N230	230 ± 20%	600	10	10,000	$>10^{10}$	<1	Repeaters
Figure 6	13942-N350	13940-N350	350 ± 20%	700	10	10,000	$>10^{10}$	<1	Modems

Dimensional Data

Built in accordance with Standards CCITT, K.12 and VDE 0845.
UL Recognition Pending on No. 13935-N600S.

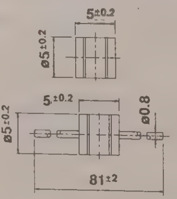


Fig. 1

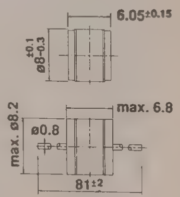


Fig. 2

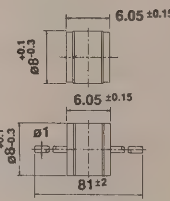


Fig. 3

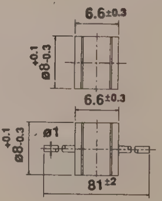


Fig. 4

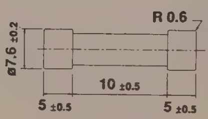


Fig. 5

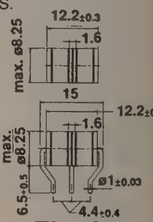


Fig. 6

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SANKOSHA CORP. GAS TUBES

U SERIES ELECTRICAL CHARACTERISTICS @ 25°C (UL Recognized)

Part Number w/o Lead	Part Number w/Lead	DC Breakdown Voltage 100 v/s volts	Impulse Breakdown Voltage Volts Max. 100V/µs	10KV/µs	DC Holdover Voltage* Volts Min.	AC Follow Current 60 Hz 1/2 Cycle AMP Peak	Impluse Life 10/1000µs 500A Times	AC Discharge Current 60Hz AMP RMS Repeat 10 Times	Single 11 Cycle
U-1A	U-1B	75±20%	500	900	52	10	300	10/5 Times	65
U-2A	U-2B	90±20%	500	900	52	10	300	10/5 Times	65
U-3A	U-3B	145±20%	500	900	80	40	300	10/5 Times	65
U-4A	U-4B	230±15%	600	900	135	80	300	10/5 Times	65
U-5A	U-5B	250±15%	600	1000	135	80	300	10	65
U-6A	U-6B	300±15%	700	1000	150	80	500	10	65
U-7A	U-7B	350±15%	700	1000	150	80	500	10	65
U-8A	U-8B	400±15%	700	1000	150	80	500	10	65
U-9A	U-9B	470±15%	700	1000	150	80	500	10	65
U-10A	U-10B	600±15%	800	1200	150	80	500	10	65
U-11A	U-11B	800±15%	1000	1500	150	80	500	10	65

3YW SERIES ELECTRICAL CHARACTERISTICS @ 25°C

3YW-230A	Not Applicable	230±20%	600	1000	150	40 x 2	1000	10 x 2	200 x 2
3YW-350A		350±20%	650	1100	150	40 x 2	1000	10 x 2	200 x 2
3YW-400A		400±25%	700	1200	150	40 x 2	1000	10 x 2	200 x 2

3J SERIES ELECTRICAL CHARACTERISTICS @ 25°C (UL Recognized)

3J-1A	See Dimension Drawings For Lead Suffixes	90±20%	700	1000	52	10 x 2	300/200A	5 x 2	65 x 2
3J-2A		145±20%	700	1000	52	10 x 2	300/200A	5 x 2	65 x 2
3J-3A		230±20%	500	800	135	40 x 2	300/200A	5 x 2	65 x 2
3J-4A		250±20%	500	800	135	40 x 2	300/200A	5 x 2	65 x 2
3J-5A		300±20%	600	900	135	40 x 2	300/200A	5 x 2	65 x 2
3J-6A		350±20%	600	900	150	40 x 2	300/200A	5 x 2	65 x 2
3J-7A**		400±20%	700	1000	150	40 x 2	4000	5 x 2	65 x 2

3P SERIES ELECTRICAL CHARACTERISTICS @ 25°C (UL Recognized)

3P-1A	See Dimension Drawings For Lead Suffixes	90±20%	600	1050	60	10 x 2	500	12 x 2	90 x 2
3P-2A		145±20%	600	1050	60	40 x 2	500	12 x 2	90 x 2
3P-3A		230±20%	650	1100	150	40 x 2	500	12 x 2	90 x 2
3P-4A		250±20%	700	1100	150	40 x 2	500	12 x 2	90 x 2
3P-5A		300±20%	700	1100	150	40 x 2	500	12 x 2	90 x 2
3P-6A		350±20%	700	1200	150	40 x 2	500	12 x 2	90 x 2
3P-7A**		400±25%	750	1200	150	40 x 2	500	12 x 2	90 x 2

Y08 SERIES ELECTRICAL CHARACTERISTICS @ 25°C

Y08Z-102A	Y08Z-102B	1000±20%	1500	2000	150	80	200	1	5
Y08-152A	Y08-152B	1500±15%	2200	2800	200	80	10	1	5
Y08-212A	Y08-212B	2100±20%	2700	3200	200	80	10	1	5
Y08-242A	Y08-242B	2400±20%	3000	3500	200	80	10	1	5
Y08-302A	Y08-302B	3000±20%	4000	5000	200	80	10	1	5
Y08-402A	Y08-402B	4000±20%	5000	6000	200	80	10	1	5
Y08-602A	Y08-602B	6000±20%	8000	10000	200	80	10	1	5
Y08-802A	Y08-802B	8000±20%	10000	12000	200	80	10	1	5
Y08-103A	Y08-103B	10K±20%							
Y08-123A	Y08-123B	12K±20%							
Y08-143A	Y08-143B	14K±20%							
Y08-163A	Y08-163B	16K±20%							

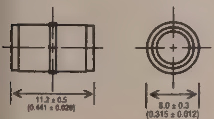
**Approved by REA (PE-80 Heavy Duty.)

3P SERIES OTHER RATINGS

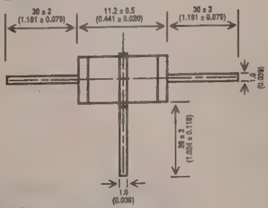
- Insulation Resistance: 10,000 Megohm Min.
- Capacitance (1MHz): 2.0pF Max.
- Impulse Discharge Current 8/20µs: 10 impulses at 5KA. Single impulse each side 10KA.

	A	B	C(max)	D(max)
L1	4.4±0.3	7.0±0.5	20.0	15.0
L2	4.7±0.3	7.0±0.5	20.0	15.0
L3	5.5±0.3	7.0±0.5	20.0	15.0
L4	6.6±0.3	7.0±0.5	20.0	19.0

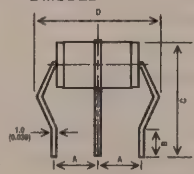
A TYPE


11.2 ± 0.5
(0.441 ± 0.020)
8.0 ± 0.3
(0.315 ± 0.012)

B TYPE


30 ± 2
(1.181 ± 0.079)
11.2 ± 0.5
(0.441 ± 0.020)
30 ± 2
(1.181 ± 0.079)
26 ± 3
(1.024 ± 0.118)
1.0
(0.039)

L MODEL

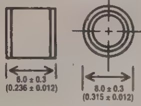

D
C
B
A
A
1.0
(0.039)

SEE OUR OTHER DATA PAGES IN SECTIONS 1500, 2450, 4700 AND 4800.

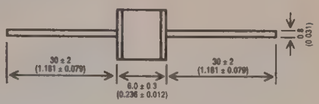
U SERIES OTHER RATINGS

- Insulation Resistance: 10,000 Megohm Min.
- Capacitance (1MHz): 1.0pF Max.
- Impulse Discharge Current 8/20µs: 10 impulses at 5KA. Single impulse at 10KA.

A TYPE

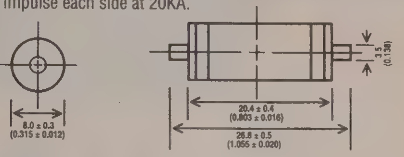

6.0 ± 0.3
(0.236 ± 0.012)
8.0 ± 0.3
(0.315 ± 0.012)

B TYPE


30 ± 2
(1.181 ± 0.079)
6.0 ± 0.3
(0.236 ± 0.012)
30 ± 2
(1.181 ± 0.079)
0.8
(0.031)

3YW SERIES OTHER RATINGS

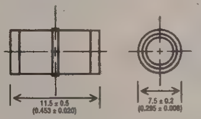
- Insulation Resistance: 10,000 Megohm Min.
- Capacitance (1MHz): 3.0pF Max.
- Impulse Discharge Current 8/20µs: 10 impulses each side at 10KA. Single impulse each side at 20KA.


8.0 ± 0.3
(0.315 ± 0.012)
20.4 ± 0.4
(0.803 ± 0.016)
26.8 ± 0.5
(1.055 ± 0.020)
3.5
(0.138)

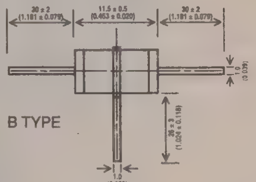
3J SERIES OTHER RATINGS

- Insulation Resistance: 10,000 Megohm Min.
- Capacitance (1MHz): 3.0pF Max.
- Impulse Discharge Current 8/20µs: 10 impulses at 5KA. Single impulse each side 10KA.

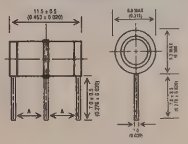
A TYPE


11.5 ± 0.5
(0.453 ± 0.020)
7.5 ± 0.2
(0.295 ± 0.008)

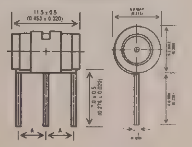
B TYPE

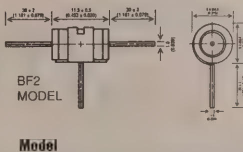

30 ± 2
(1.181 ± 0.079)
11.5 ± 0.5
(0.453 ± 0.020)
30 ± 2
(1.181 ± 0.079)
26 ± 3
(1.024 ± 0.118)
1.0
(0.039)

J0 MODEL

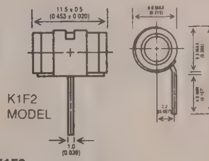

11.5 ± 0.5
(0.453 ± 0.020)
A
A

J0F2 MODEL


11.5 ± 0.5
(0.453 ± 0.020)
A
A


30 ± 2
11.5 ± 0.5
30 ± 2

BF2 MODEL


11.5 ± 0.5
(0.453 ± 0.020)
1.0
(0.039)

K1F2 MODEL

Model J0, J0F2

A Dimension

J1 = 4.4 ± 0.3

J2 = 4.7 ± 0.3

J3 = 5.0 ± 0.3

Model J0F2, BF2, K1F2

1A x 2: ≤15 sec.

3A x 2: ≤10 sec.

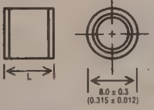
5A x 2: ≤ 7 sec.

10A x 2: ≤5 sec.

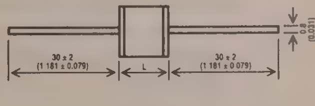
Y08 SERIES OTHER RATINGS

- Insulation Resistance: 10,000 Megohm Min.
- Capacitance (1MHz): 1.0pF Max.
- Impulse Discharge Current 8/20µs: 10 impulses at 3KA thru Y08-242, Y08-302 thru Y08-802 1KA. Single impulse at 10KA thru Y08-242, Y08- 302 thru Y08-802 5KA.

A TYPE


L
8.0 ± 0.3
(0.315 ± 0.012)

B TYPE


30 ± 2
(1.181 ± 0.079)
L
30 ± 2
(1.181 ± 0.079)
0.8
(0.031)

L Dimension

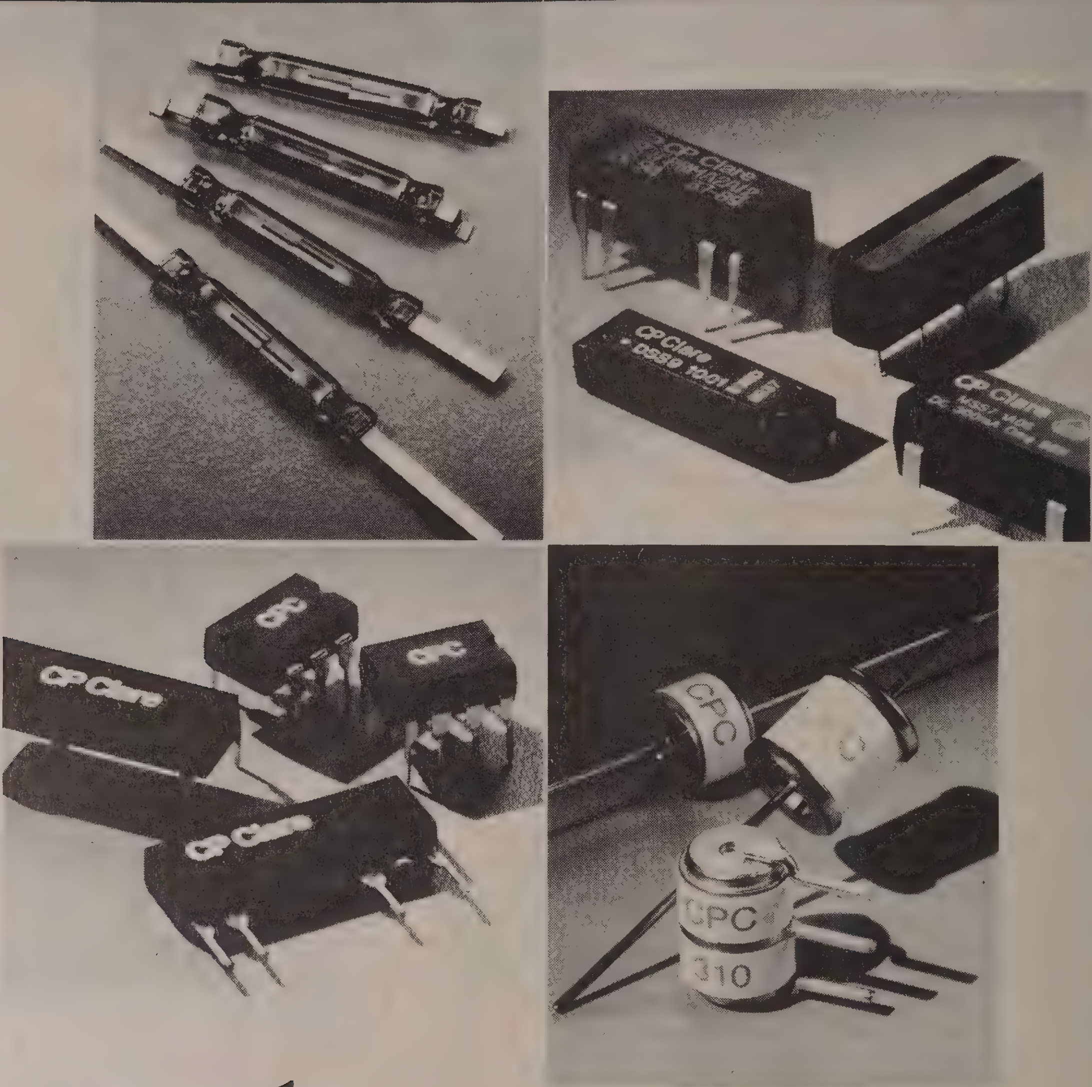
Y08Z-102:8.0 ± 0.3 • Y08-152 to 402:8.5 ± 0.3

Y08-602 to 103:13.0 ± 0.5 • Y08-123 to 163:17.0 ± 0.5

All dimensions are nominals except where mentioned.

WORLD PRODUCTS INC.

19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380



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A Commitment to Quality

At Clare, quality is integral to our approach of maximizing total value for our customers. We have earned the position of being the world's largest supplier of relays, reed switches and surge arrestor products. The Clare Relay Family covers the spectrum of relay technologies for low-power switching: solid-state relays; dry reed relays; mercury-wetted reed relays; and electro-mechanical relays.

Couple this with high-volume manufacturing capabilities, and you get superior quality products at competitive prices with fast off-the-shelf delivery and full product support.

Call your local Clare representative or authorized Clare distributor for more information about our full family of: ■ Relays ■ Reed Switches ■ Surge Arrestors

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Chicago, IL 60645
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FAX: 312-262-7819

CP Clare
CORPORATION

RELAYS

		Reed																		
Manufacturer	**Starting EEM Page No.**	**Mercury Wetted Contacts**	**Dry Contacts**	**Solid State**	**Hybrid**	**Thermal**	**Time Delay**	**I/O Module**	**General Purpose**	**Latching**	**Current Sensing**	**Sensitive**	**High Power**	**High Voltage**	**RF**	**Plug-in**	**PC Mount**	**DIP/SIP**	**Low Profile**	**Approvals/ Ratings**
Advanced Components Industries	**B**•1403								√	√			√				√			
Aleph International	**B**•1404	√§	√	√					√§		√	√		√	√		√§	√	√§	UL
American Relays	**B**•1407	√	√							√	√	√	√	√			√	√	√	
American Zettler	**B**•1412			√					√	√		√	√			√	√	√	√	UL, CSA, VDE
Amperite	**B**•1417			√§		√§	√§									√§				
Aromat Corp.	**B**•1418		√	√§				√	√	√§		√§	√	√	√	√	√§	√§	√§	UL, CSA, TUV, VDE, TV
Robert Bosch Inc.	**B**•1435						√		√				√			√	√			
CP Clare & Co.	**B**•1436	√§	√§	√§				√§		√	√§	√§			√	√	√§	√§	√§	UL, CSA, BSI, PTB, VDE, FCC68
Communications Instruments Inc.	**B**•1438	√					√		√	√§*	√§*	√§*	√§*		√§*	√*	√§*	√*	√§*	M5757, M61016 M39016, UL, CSA
Comus International	**B**•1449												√	√		√				
Cornell Dubilier	**B**•1450								√	√		√	√			√	√		√	
Coto Wabash	**B**•1451	√	√			√			√	√				√			√	√		
CR Magnetics	**B**•1455			√	√		√		√		√									
Crouzet Corp.	**B**•1456			√			√		√		√					√			√	UL, CSA
Crydom Co.	**B**•1464			√	√		√	√					√	√			√	√	√	UL, CSA, VDE
Deltrol Controls	**B**•1480								√	√			√			√				UL, CSA
Douglas Randall	**B**•1473		√	√	√	√	√			√	√	√	√	√		√	√	√§	√	
El & S Corp.	**B**•1482	√	√	√						√	√	√					√	√	√	
Electronic Applications Corp.	**B**•1483	√§	√§*		√	√	√	√	√	√§	√	√	√	√§	√	√§	√§	√§	√§	
Electronic Specialty Corp.	**B**•1484						√		√	√*		√	√		√	√	√			M39016/45, MS27401
Fifth Dimension	**B**•1486	√								√					√		√	√		
Fujitsu Microelectronics	**B**•1489								√§	√		√	√§			√	√	√	√	
Genicom	**B**•1500								√§*	√§*	√§*	√§*			√§*	√*	√§*	√§*	√§*	MIL-R-39016
Gentron Corp.	**B**•1504			√	√				√				√	√						UL, CSA
Grayhil	**B**•1507			√				√												UL, CSA
Guardian Electric Manufacturing Co.	**B**•1509								√			√				√	√			
Hamlin	**B**•1513	√*	√§*			√*				√•	√•	√•	√•	√•			√•	√§*	√§*	HE3300 Series UL File # E47258 (N)

* MIL Spec. § Surface Mount.

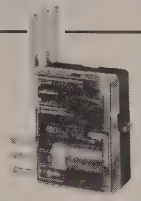
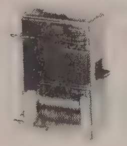
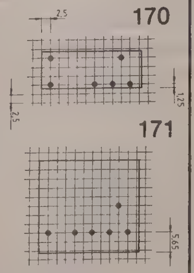
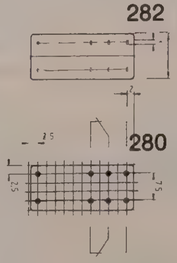
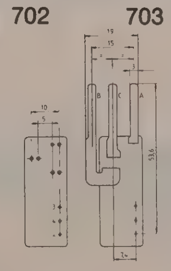
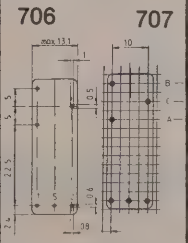
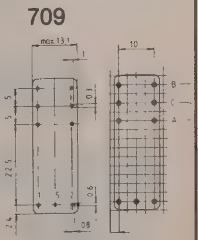
RELAYS (cont'd)

Manufacturer	Starting EEM Page No.	Reed: Mercury Wetted Contacts	Reed: Dry Contacts	Solid State	Hybrid	Thermal	Time Delay	I/O Module	General Purpose	Latching	Current Sensing	Sensitive	High Power	High Voltage	RF	Plug-in	PC Mount	DIP/SIP	Low Profile	Approvals/ Ratings
Hasco Components International Co.	B•1514		√§						√	√		√	√			√	√	√	√	UL, CSA
IDEC	B•1522			√			√		√							√	√	√		
Instrumentation and Control Systems	B•1524			√			√									√				
International Rectifier	B•1526			√§		√						√					√	√§	√	UL, CSA, VDE
ITT Components	B•1527			√					√	√§		√§	√		√	√	√	√§	√§	UL, CSA, VDE
Joslyn Jennings Corp.	B•1536													√*	√*					
Kilovac Corp.	B•1540									√*	√*		√*	√*	√*		√			
Leach Corp.	B•1547			√			√*	√*	√*	√*			√*			√*	√*			MIL-R-6106, MIL-R-83726
Logitek Inc.	B•1556						√*									√*				
Master Electronic Controls	B•1558		√	√			√	√	√	√			√	√		√	√	√	√	
Matrix Systems	B•1562	√	√	√						√					√					
NEC Electronics Inc.	B•1566		√						√§	√§			√§				√§	√	√§	UL, CSA
NTE Electronics Inc	B•1572		√	√		√		√	√	√	√					√	√		√	UL, CSA
Potter & Brumfield	B•1577	√	√	√			√	√	√	√	√	√	√	√		√	√	√	√	
Ross Engineering Corp.	B•1592									√*			√*	√*	√*					
Scientific Technologies	B•1595						√*													
Signal Switch Co.	B•1479	√	√	√						√					√					
Solid State Optronics	B•1597			√§				√§												
Stancor, White Rodgers	B•1602					√			√				√			√	√			UL
Standex Electronics	B•1605		√																	MIL-Q-9858, MIL-STD-790, MIL-I-45208
Struthers-Dunn/ Hi-G	B•1606	√*		√§*	√		√§*		√§*	√*	√*	√§*	√*	√	√§*	√*	√*			
Teledyne Relays	B•1616				√§				√§	√§		√§					√			
TH Electronics	B•1624			√§	√§				√				√	√				√§		
Triridge Corp.	B•1625	√	√							√	√	√	√	√			√	√	√	

* MIL Spec. § Surface Mount.

PC MOUNTABLE RELAYS by GRUNER

NEW

	POWER RELAYS		POLARIZED LATCHING RELAYS FOR COIL SENSITIVITY		
					
SERIES	170 / 171	280 / 282 / 286	702 / 703	706 / 707	709
DIMENSIONS (L x W x H)	170 1.13x0.41x1.03 171 1.11x1.01x0.41	1.14x0.49x1.02	1.53x0.59x1.15	1.47x0.52x0.98	1.47x0.52x0.98
FEATURES	*DC Coil *Both Slim and flat version	*DC Coil *AC Coil	*Polarized Latching *Permanent Memory *Pulse Operation	*Polarized Latching *Permanent Memory *Pulse Operation	*Polarized Latching *Permanent Memory *Pulse Operation
SEALED OPTION	*	*	N/A	N/A	N/A
LATCHING OPTION	*	*			
CONTACT DATA					
Form:	SPDT / SPST	280: DPDT / DPST 282: SPDT / SPST 286: SPDT / SPST	SPDT / SPST	SPDT / SPST	SPDT / SPST
Material:	AgCdO, AgNi	AgCdo, AgNi	AgCdo - AgNi	AgCdo - AgNi	AgCdo - AgNi
Ratings:					
250 Vac	**8 Amp.**	**280: 8 Amp.** **282: 10 Amp.** **286: 16 Amp.**	**702 25 Amp.** **703 35 Amp.**	**706 16 Amp.** **707 20 Amp.**	**10 Amp.**
Power VA:	2000	1500 / 2500 / 4000	5750 / 8000	4000	2500
Mechanical Life Expectancy	10^7	10^7	$5x10^6$	10^7	10^7
Test Voltage Contact-Coil VAC	4000	4000	4000	4000	4000
Contact Ground VAC	1000	1000	2000	2000	2000
COIL DATA					
Vdc	6 ... 60	6 ... 60	6 ... 48	6 ... 48	6 ... 48
Vac	N/A	6 ... 220	N/A	N/A	N/A
Operating Power					
VA (DC)	0.45 ... 0.6	0.5 ... 0.8			
VA (AC)		2.2 ... 2.6			
VA (Latching)	0.9 ...1.2	0.9 ...1.2	0.6 ... 2.0	0.4 ...1.5	0.4 ...1.5
Operating Time	7-10 ms	7-10 ms	20 ms	20 ms	20 ms
Release Time	2-4 ms	2-4 ms	20 ms	20 ms	20 ms
Abmient Temperature	-25 ... 70°C	-25 ... 70°C	-25 ... 70°C	-25 ... 70°C	25 ... 70°C
Conform to	VDE, UL, CSA SEV, SEMCO	VDE, UL, CSA SEV, SEMCO	VDE. UL, CSA SEV, SEMCO	VDE, UL, CSA SEV, SEMCO	VDE, UL, CSA SEV, SEMCO
BOTTOM VIEW (mm)					

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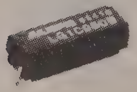
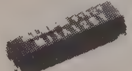
REED RELAYS

SURFACE MOUNT REED RELAYS

L series • M series
.71 x .24 x .23 in. .71 x 20 x .17 in.
18 x 6 x 6 mm 18 x 5 x 4 mm





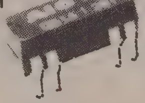
L J 1 A $\boxed{0}$ $\boxed{5}$ B W

- SMT process compatibility
- Ultra miniature size

Power–B: 10W C: 3W (1C)
Nominal coil voltage–5V, 12V
Contact form–1A, 1B, 1C
Termination –J: J-lead G: Gull wing
L: Sensitive coil M: Electrostatic shield

DIP REED RELAYS

8PIN DIP / DA • DB series
.75 x .28 x .26 in.
19 x 7 x 6 mm



4PIN DIP / DF series
.75 x .28 x .26 in.
19 x 7 x 6 mm

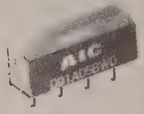
D B 1 A $\boxed{0}$ $\boxed{5}$ B W (D)

- DIP transfer molded package
- Miniature size
- Standard DIP footprint
- Various contact configurations
- UL Models Available

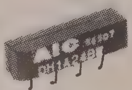
D: Diode (optional)
X: Magnetic shield (optional on DA1A, DB1A, DB1C, DF1A) W: Standard
Y: Electrostatic shield (optional on DB1A, DB1C)
Z: Magnetic & Electrostatic shield (optional on DB1A, DB1C)
Power–B: 10W C: 3W (1C) D: 50W (Mercury)
N: 50W (Mercury high speed)
Nominal Coil voltage–5V, 12V, 24V
Contact form–1A, 2A, 1B, 1C
A: 8-pin DIP with pin #13 not connected
B: 8-pin DIP F: 4-pin DIP

SIP REED RELAYS

SIP / DG series
.76 x .28 x .28 in.
19 x 7 x 7 mm



SIP / DH series
.75 x .20 x .21 in.
19 x 5 x 5 mm



D G 1 A $\boxed{0}$ $\boxed{5}$ B W (D)

- Ultra miniature size
- UL Models Available
- Industry standard footprint

D: Diode (optional)
W: Standard
X: Magnetic shield (optional on DG1A,DE1A)
Power–B: 10W D: 50W (Mercury)
N: 50W (Mercury high speed)
Nominal coil voltage–5V, 12V, 24V
Contact form–1A, 1B
H: Ultra miniature G & E: Standard size

SIP / SG series
.91 x .28 x .30 in.
23 x 7 x 7 mm

S G 1 A $\boxed{0}$ $\boxed{5}$ A W J (D)

- Various contact configurations
- UL Models Available
- Up to 4000VAC isolation

D: Diode (optional)
W: Standard X: Magnetic shield (optional on SG series, standard on SE series)
Power–A: 10W F: 3W (1C) E: 50W (Mercury)
Nominal coil voltage–5V, 12V, 24V
Contact form–1A, 1B, 1C

SIP / SD series
1.00 x .35 x .37 / 1.20 x .40 x .42 in.
25 x 9 x 9 / 30 x 10 x 10 mm

S D 1 A $\boxed{0}$ $\boxed{5}$ A W J

- Industry standard footprint
- High power contacts
- UL Models Available

W: Standard X: Magnetic shield (optional)
Y: Electrostatic shield (optional on SD1A)
Z: Magnetic & Electrostatic shield (optional on SD1A)
Power–A: 10W C: 50W D: 25W (high voltage)
C: 3W (1C)
Nominal coil voltage–5V, 12V, 24V
Contact form–1A, 1C

CURRENT SENSING RELAYS

Current Sensing / PCS series
1.1 x .59 x .60 in.
29 x 15 x 15 mm

P C S $\boxed{2}$ $\boxed{0}$ 7 2-1

-1:6 Ω coil
-2:8 Ω coil
-3:10 Ω coil

- For telephone line sensing
- High Coil-to-Contact insulation 4000 VAC
- Choice of coil resistances
- Dual coil models available
- Optional magnetic shielding
- 300 mA max coil current
- 14 mA nominal current

Free evaluation samples and design assistance to qualified OEM Designers

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REED RELAYS

ULTRA COMPACT REED RELAYS

ZA, ZC, ZH series
.78 x.20 x.23 in. /.20 x 5 x 6 mm
ZM series
.78 x .24 x .26 in. /.20 x 6 x 7 mm

ZF series
.98 x .30 x .30 in./25 x 7 x 7 mm

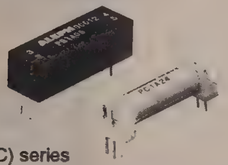
ZA1A05NZ

- Ultra compact package
- G H z Models Available
- Metal can for interference immunity
- Coaxial shields

X: Magnetic shield (standard on ZF series)
Z: Magnetic & Electrostatic shield (standard on ZA,ZC, ZH, ZM series)
Power–A: 10W C: 3W (1C) N: 50W (Mercury)
Nominal coil voltage–5V, 12V
Contact form–1A, 1C
ZA: General applications ZC: Contact form–1C
ZF: Magnetic shield only ZH: RF applications
ZM: Stable high speed operation between 0 to 200Hz

ECONO-OPEN REED RELAYS

PB (PC) 1A,1C series
1.18 x .37 x .39 in./30 x 9 x 10 mm



PB(PC) series
1.18 x .47 x .39 in./30 x 12 x 10 mm

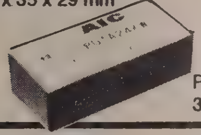
PB1A05AWE

- Industry standard package
- Various contact configurations
- .10" & .15" Grids Available
- Open frame and encased package
- UL Models Available

E: Side coil termination G: End coil termination
W: Standard X: Magnetic shield (optional)
Y: Electrostatic shield (optional)
Z: Magnetic & Electrostatic shield (optional)
Power–A: 10W C: 50W D: 25W (high voltage)
F: 3W (1C) E: 50W (Mercury)
Nominal coil voltage–5V, 12V, 24V
Contact form–1A 2A,1B,1C, 2B, 2C, 3A Types are available
PB: ECONO type (with plastic case) PC: OPEN frame

HIGH VOLTAGE REED RELAYS

PG 1A, 1B series
3.0 x 1.37 x 1.14 in.
76 x 35 x 29 mm



PG 2A, 2B, 1D series
3.0 x 2.36 x 1.14 in./76 x 60 x 29 mm

PG1A05HW

- High voltage contacts (2K~6KVDC)
- High Coil-to-Contact breakdown (10K~15KVDC)

Breakdown voltage (open contact)–H: 5KV J: 10KV K: 15KV M: 10KV (high power–300W)
Nominal coil voltage–5V, 12V, 24V
Contact form–1A, 1B, 2A, 2B, 1D (1A & 1B type)

PM series
2.5 x .79 x .90 in.
65 x 20 x 23 mm

PM1A05HW

Breakdown voltage (open contact)–
H: 5KV J: 10KV K: 15KV
Nominal coil voltage–5V, 12V, 24V
Contact form–1A

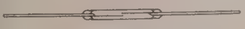
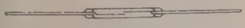
REED SWITCHES

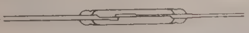
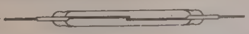
HYR 9004-9-3540

Model #
Minimum pull-in [AT]
Max pull-in [AT]
9: high I.R. / 7: high speed
90: Mercury switch / 50: 50 mm glass length
40: 40 mm glass length
20: 20 mm glass length / 10: 10 mm glass length

General application switches
Switching power rating of 10-15 watt.
***UL** Listed

HYR 1532* >

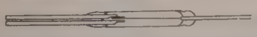
HYR 2001* >

HYR 2031* >

HYR 2034 >

HYR 4001 >

HYR 5051 >


Form "C" switches
Feature break-before-make, single pole double throw (SPDT)

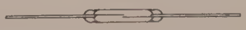
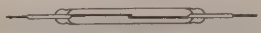
HYR 1554 >

HYR 1555 >

HYR 4003 >


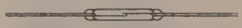
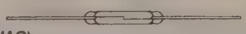
High Voltage breakdown switches
Breakdown voltage rated from 1,000 up to 15 KV.
Vacuum internal atmosphere for high dielectric withstand voltages.

HYR 1559* >

HYR 2016* >

HYR 5006 >
HYR 5007 >
HYR 5008 >


High power switches
Switching power rating between 20 and 70 watt

HYR 1531* >
(for 110VAC)

HYR 2003-1 >
(for 220 VAC)

HYR 2016* >
(for more than 220VAC)


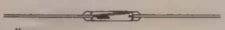
Mercury Wetted Switches

HYR 9001
(General purpose)
HYR 9001-1 >

(High voltage breakdown)
HYR 9001-9
(High insulation resistance)

HYR 9003 >

(All position)

HYR 9005-1 >

(High operating speed)
HYR 9005-9
(High insulation resistance)

HYR 8001
Precision Hg Tilt Switch. For acceleration, tilt and vibration sensing

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- National Controls
- Omron
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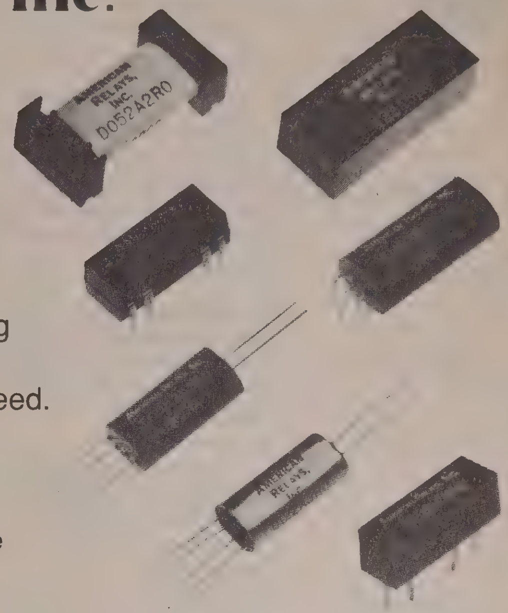
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PACKAGE STYLES

- **Encapsulated**
- **Open Frame**
- **Axial Leads**
- **DIP** • **SIP**

SWITCHING TYPE

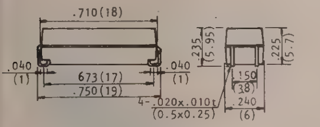
- **General Purpose Dry Reed**
- **Low Level Switching**
- **High Power** • **High Voltage**
- **Mercury Wetted Contacts**

- **UL Recognized Relays Available**

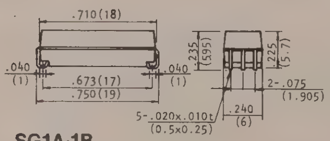
SURFACE MOUNT SERIES

OUTLINE DIMENSIONS

SJ1A·1B


.710(18)
.040 (1)
.673(17)
.750(19)
.040 (1)
.235 (5.95)
.225 (5.7)
.150 (3.8)
4-.020x.010t (0.5x0.25)
.240 (6)

SJ1C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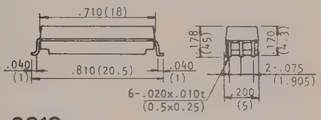
.235 (5.95)
.225 (5.7)
2-.075 (1.905)
5-.020x.010t (0.5x0.25)
.240 (6)

SG1A (with coaxial shield)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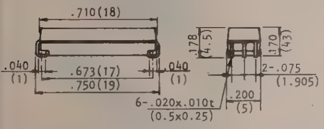
6-.020x.010t (0.5x0.25)
.200 (5)

SJ1A (with coaxial shield)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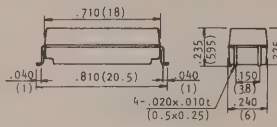
.170 (4.3)
2-.075 (1.905)
6-.020x.010t (0.5x0.25)
.200 (5)

SG1A·1B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.810(20.5)
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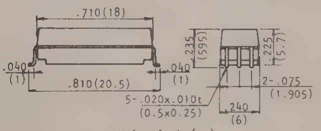
.150 (3.8)
4-.020x.010t (0.5x0.25)
.240 (6)

SG1C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.810(20.5)
.040 (1)
.235 (5.95)
.225 (5.7)
2-.075 (1.905)
5-.020x.010t (0.5x0.25)
.240 (6)

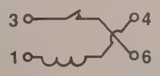
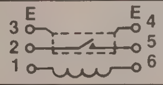
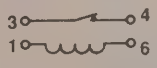
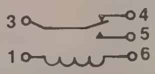
Unit: Inch (mm)

GENRAL SPECIFICATIONS

Specifications	Form A/B	Form C
Operate time max. (incl. bounce)	1.0 ms	2.0 ms
Release time max.	0.5 ms	0.5 ms
Contact resistance max. (initial)	0.2 Ohms	0.2 Ohms
Breakdown voltage min. (cont-coil)	500 VDC	500 VDC
Insulation resistance min.	10^{10} Ohms	10^{9} Ohms
Life (low level) (rated load)	3×10^{8} Oper. 8×10^{5} Oper.	10^{8} Oper. 2×10^{6} Oper.

- Miniature surface mount package
- True SMT process compatible
- Sensitive coil
- Coaxial shield for RF Switching

PART NUMBERS AND OPERATING CHARACTERISTICS (@ 25°C)

Contact Form	Part Number		Coil Voltage VDC	Coil Resistance OHMS	Must Operate VDC	Must Release VDC	Contact Ratings	Breakdown Voltage VDC	Schematics
	J-Lead	Gull Wing							
1A	SJ051A00 SJ121A00	SG051A00 SG121A00	5 12	500 1000	3.8 9.0	0.5 1.0	10 Watts 150 VDC 0.5 Amps	200	
1A (with coaxial shield)	SJ051A0B SJ121A0B	SG051A0B SG121A0B	5 12	150 600	3.8 9.0	0.5 1.0	10 Watts 150 VDC 0.5 Amps	200	
1B	SJ051B00 SJ121B00	SG051B00 SG121B00	5 12	500 500	3.8 9.0	0.5 1.0	10 Watts 150 VDC 0.5 Amps	200	
1C	SJ051C00 SJ121C00	SG051C00 SG121C00	5 12	200 500	3.8 9.0	0.5 1.0	3 Watts 100 VDC 0.5 Amps	200	

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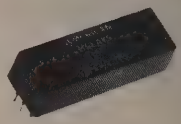
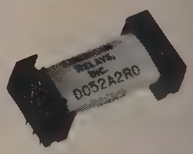
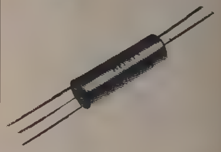
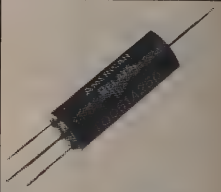
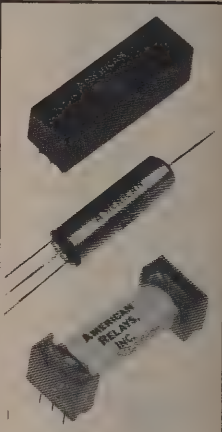
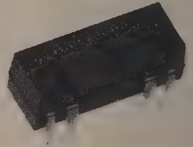
REED RELAY INDEX

RELAY TYPE	DESCRIPTION	TERMINAL GRID	CONTACT FORMS AVAILABLE POLES	PACKAGE
ENCAPSULATED	Epoxy encapsulated. Total Environmental protection. Wide range of contact forms and coil voltages are available.	1.000 × .100 1.000 × .150	Form A (1 to 6) Form B (1 & 2) Form A/B (1 & 2) Form C (1 to 4) Form A Latching (1 & 2)	
OPEN FRAME	Durable glass filled polyester bobbin construction. Switch and coil leads are securely held with epoxy potting. Cost efficient plug-in type reed relay.	1.000 × .100 1.000 × .150	Form A (1 to 4) Form B (1 & 2) Form C (1, 2, 3) Form A Latching (1)	
AXIAL	Rugged axial lead tubular relay. Nickel plated metal jacket provides magnetic shield. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1) Form C (1 & 2) Form A Latching (1)	
T SERIES	Most economical, high performance tubular relay. Completely sealed in a flame retardant plastic tube. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1) Form C (1)	
HIGH POWER	50W contact rating. Available with encapsulated, open frame and axial lead packages.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
HIGH VOLTAGE	25W, 1000 VDC switching. 2500 VDC breakdown voltage. Miniature size. Available with encapsulated, open frame and axial lead package.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
MERCURY WETTED	Mercury wetted contact relay. 50W contact rating. Extremely long life expectancy. No contact bounce. Stable low contact resistance.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2) Form C (1 & 2)	
DIP RELAYS	Epoxy molded DIP reed relay. Logic compatible. Stable contact resistance. Fits all standard DIP sockets and is automatic insertion compatible.	DIP .300 × .100	Form A (1 & 2) Form B (1) Form C (1)	
SIP RELAYS	High quality economical Single-In-Line package reed relays. Epoxy encapsulated package. Various contact ratings are available. UL recognized series available.	SIP .2 × .4 × .2 .2 × .2 × .2	Form A (1) Form B (1) Form C (1)	
SPECIAL RELAYS	Let us design reed relays for your specific application. Special relays are cost competitive with standard relays in most cases. Consult the factory or your local representative with your specific requirements.			

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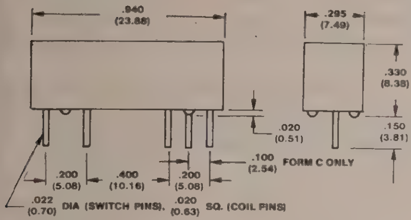
REED RELAYS

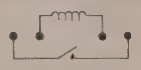
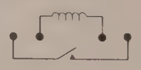
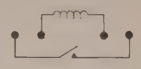
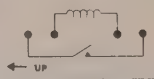
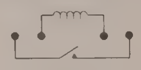
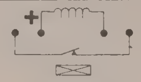
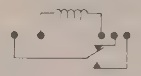
SINGLE-IN-LINE SERIES (S SERIES)


.940
(23.88)
.295
(7.49)
.330
(8.38)
.020
(0.51)
.150
(3.81)
.100
(2.54)
FORM C ONLY
.200
(5.08)
.400
(10.16)
.200
(5.08)
.022
(0.70)
DIA (SWITCH PINS).
.020
(0.63)
SQ. (COIL PINS)

- High Quality Low Cost Single-In-Line
- Sturdy Bobbin and Encapsulated in a Polyester Case
- UL Recognized (File #E104383)

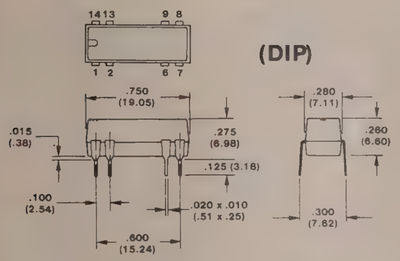
GENERAL SPECIFICATIONS

Contact resistance: .150 ohms max.
Operate time: 0.5 ms typ.
Release time: 0.2 ms typ.
Bounce time: (Form A & B) 0.25 ms typ. (form C, NO/NC) 0.5/1.5 ms typ.
Insulation resistance: 10^{10} ohms min. (form A), 10^9 ohms min. (form C)
Operating temperature: −40° to +85°C
Vibration: 20G (10 — 2000 Hz)
Shock: 50G @ 11 ms duration

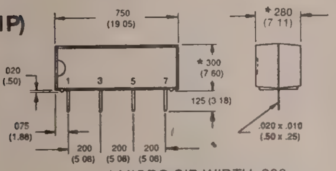
Contact Form	Part Number	Coil VDC	Coil Res. (Ohms)	Must Oper-ate VDC	Must Re-lease VDC	Contact Ratings	Break Down Voltage	Schematic
1A Standard ®ЯU	SE051A00 SE061A00 SE121A00 SE241A00	5-6 5-6 12 24	500 125 500 2000	3.8 3.8 8.0 16.0	0.5 0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	250	
1A High Power ®ЯU	SE051A10 SE061A10 SE121A10 SE241A10	5-6 5-6 12 24	300 125 500 2000	3.8 3.8 8.0 16.0	0.5 0.5 1.0 2.0	50 Watts 200 VDC 1.0 Amps	500	
1A High Voltage	SE051A20 SE061A20 SE121A20 SE241A20	5-6 5-6 12 24	300 125 500 2000	3.8 3.8 8.0 16.0	0.5 0.5 1.0 2.0	25 Watts 1000 VDC 1.0 Amps	2500	
1A Mercury	SE051A30 SE061A30 SE121A30 SE241A30	5-6 5-6 12 24	200 125 500 2000	4.0 4.0 9.0 18.0	0.5 0.5 1.0 2.0	50 Watts 500 VDC 1.0 Amps	1500	
1A Low Level Ruthenium Contact	SE051A40 SE061A40 SE121A40 SE241A40	5-6 5-6 12 24	500 125 500 2000	3.8 3.8 8.0 16.0	0.5 0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	300	
1B ®ЯU	SE051B00 SE061B00 SE121B00 SE241B00	5-6 5-6 12 24	300 125 500 2000	3.8 3.8 8.0 16.0	0.5 0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	250	
1C	SE051C00 SE061C00 SE121C00 SE241C00	5-6 5-6 12 24	200 125 500 2000	3.8 3.8 8.0 16.0	0.5 0.5 1.0 2.0	3 Watts 100 VDC 0.25 Amps	200	

DIP AND SIP REED RELAYS

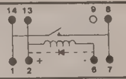
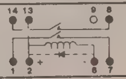
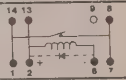
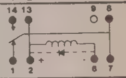
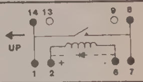
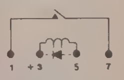
(DIP)

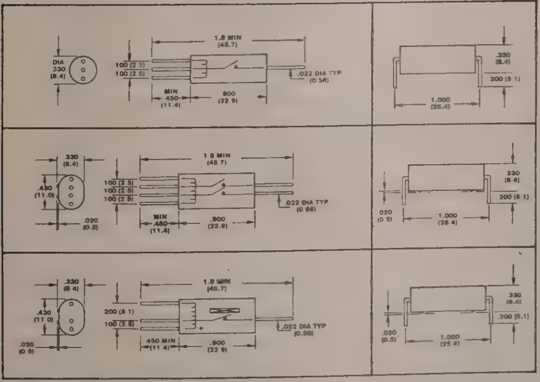

14 13
9 8
1 2
6 7
.750
(19.05)
.280
(7.11)
.015
(.38)
.275
(6.98)
.260
(6.60)
.125 (3.18)
.100
(2.54)
.020 x .010
(.51 x .25)
.300
(7.62)
.600
(15.24)

(SIP)


750
(19 05)
* 280
(7 11)
020
(.50)
1
3
5
7
* 300
(7 60)
125 (3 18)
075
(1.88)
.020 x .010
(.50 x .25)
200
(5 08)
200
(5 08)
200
(5 08)

* MICRO SIP WIDTH .200
* MICRO SIP HEIGHT .225
* MICRO SIP W/DIODE HEIGHT .300

Contact Form	Part Number		Coil VDC	Coil Res. (Ohms)	Must Oper-ate VDC	Must Re-lease VDC	Contact Ratings	Break Down Voltage	Schematic
	No Diode	With Diode							
1A	AD1A05 AD1A12 AD1A24	AD1A05D AD1A12D AD1A24D	5 12 24	500 850 2200	3.8 8.0 16.0	0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	250	
2A	AD2A05 AD2A12 AD2A24	AD2A05D AD2A12D AD2A24D	5 12 24	200 500 1750	3.8 8.0 16.0	0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	250	
1B	AD1B05 AD1B12 AD1B24	AD1B05D AD1B12D AD1B24D	5 12 24	500 500 1750	3.8 8.0 16.0	0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	250	
1C	AD1C05 AD1C12 AD1C24	AD1C05D AD1C12D AD1C24D	5 12 24	200 500 1750	3.8 8.0 16.0	0.5 1.0 2.0	3 Watts 100 VDC 0.25 Amps	200	
1A Hg Wet	AD1A05HG AD1A12HG AD1A24HG	AD1A05HGD AD1A12HGD AD1A24HGD	5 12 24	160 500 1440	4.0 9.0 18.0	0.5 1.0 2.0	50 Watts 500 VDC 2.0 Amps	1000	
1A Mini SIP	SD1A05 SD1A12 SD1A24	SD1A05D SD1A12D SD1A24D	5 12 24	500 850 2200	3.8 8.0 16.0	0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	250	
1A Micro SIP	SH1A05 SH1A12 SH1A24	SH1A05D SH1A12D SH1A24D	5 12 24	500 1500 1500	3.8 8.0 16.0	0.5 1.0 2.0	10 Watts 200 VDC 0.5 Amps	200	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(45.7)
DIA
330
(8.4)
100 (2 5)
100 (2 5)
.022 DIA TYP
(0 56)
MIN
450
(11.4)
900
(22 9)
.330
(8.4)
200 (5 1)
1.000
(25.4)
.430
(11.0)
.020
(0.5)

"T" SERIES

- Most Economical High Quality Relay
- Axial Leads for Flexible Mounting
- Formed Leads for P.C. Board Mounting

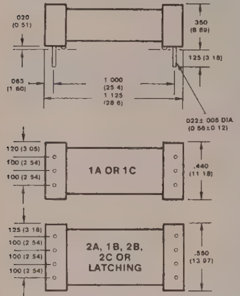
Contact Form	Part Number		Coil VDC	Coil Res.	Must Operate	Must Release	Contact Ratings	Break Down Voltage
	Axial	Formed (1.00″ Center)						
1A	T0051A500 T0121A500 T0241A2K0	TU051A500 TU121A500 TU241A2K0	5 12 24	500 500 2000	4.0 9.0 18.0	0.5 1.2 2.4	10 Watts 200 VDC 0.5 Amps	300
2A	T0052A250 T0122A1K0 T0242A2K0	TU052A250 TU122A1K0 TU242A2K0	5 12 24	250 1000 2000	4.0 9.0 18.0	0.5 1.2 2.4	10 Watts 200 VDC 0.5 Amps	300
1B	T0051B250 T0121B1K0 T0241B2K0	TU051B250 TU121B1K0 TU241B2K0	5 12 24	250 1000 2000	4.0 9.0 18.0	0.5 1.2 2.4	10 Watts 200 VDC 0.5 Amps	300

American Relays, Inc.

10306 Norwalk Blvd., Santa Fe Springs, CA 90670 • (310) 944-0447 • FAX (310) 944-0590

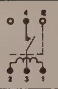
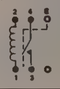
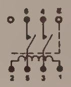
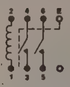
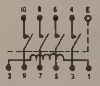
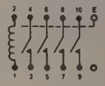
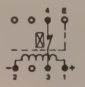
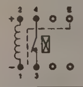
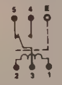
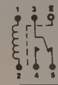
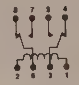
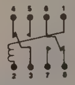
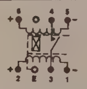
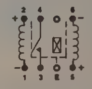
REED RELAYS

OPEN FRAME REED RELAYS (SERIES C AND D)



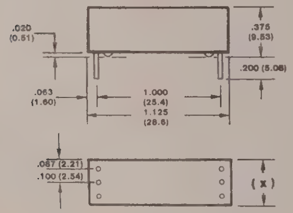
- High Performance, Low Cost Open Frame, PC Mount Dry Reed Relays
- Popular 1.000″ x .100″ or 1.000″ x .150″ Pin Spacing
- Rigid Polyester Relay Body with Epoxy Filled Ends

Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	100 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf.
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^9 Ohms
Life (Low Level)	100 x 10^6 Oper.	50 x 10^6 Oper.
Life (Rated Load)	10 x 10^6 Oper.	5 x 10^6 Oper.
Temperature Vibration Shock	−40°C to +85°C 20G to 2000 Hz 50G @ 11 MS Duration	

Contact Form	Part Number		Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width	Schematic Top View C End Coil	Schematic Top View D Side Coil
	C End Coil	D Side Coil							
1A	C051A2R0	D051A2R0	5	500	3.8	0.5	.440		
	C121A2R0	D121A2R0	12	1000	9.0	1.2			
	C241A2R0	D241A2R0	24	2000	18.0	2.4			
2A	C052A2R0	D052A2R0	5	300	3.8	0.5	.550		
	C122A2R0	D122A2R0	12	750	9.0	1.2			
	C242A2R0	D242A2R0	24	1500	18.0	2.4			
4A	C054A2R0	D054A2R0	5	150	3.8	0.5	.640		
	C124A2R0	D124A2R0	12	375	9.0	1.2			
	C244A2R0	D244A2R0	24	1000	18.0	2.4			
1B	C051B2R0	D051B2R0	5	500	3.8	0.5	.550		
	C121B2R0	D121B2R0	12	1000	9.0	1.2			
	C241B2R0	D241B2R0	24	2000	18.0	2.4			
1C	C051C2R0	D051C2R0	5	500	3.8	0.5	.440		
	C121C2R0	D121C2R0	12	1000	9.0	1.2			
	C241C2R0	D241C2R0	24	2000	18.0	2.4			
2C	C052C2R0	D052C2R0	5	300	3.8	0.5	.550		
	C122C2R0	D122C2R0	12	750	9.0	1.2			
	C242C2R0	D242C2R0	24	1500	18.0	2.4			
1A Latching	C051K3R0	D051K3R0	5	375	3.8	0.5	.550		
	C121K2R0	D121K2R0	12	500	9.0	1.2			
	C241K3R0	D241K3R0	24	2000	18.0	2.4			

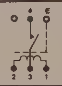
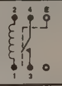
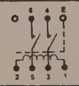
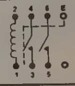
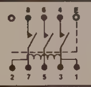
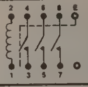
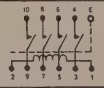
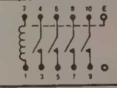
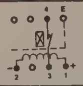
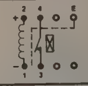
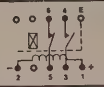
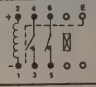
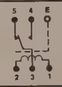
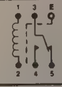
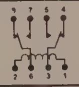
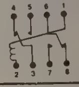
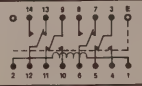
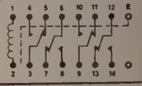
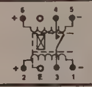
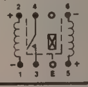
ENCAPSULATED REED RELAYS (SERIES I AND J)

- Total Environmental Protection
- A Wide Variety of Coil and Contact Arrangement Available



Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	100 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^9 Ohms
Life (Low Level)	100 x 10^6 Oper.	50 x 10^6 Oper.
Life (Rated Load)	10 x 10^6 Oper.	5 x 10^6 Oper.
Temperature Vibration Shock	−40°C to +85°C 20G to 2000 Hz 50G @ 11 MS Duration	

NOTE:
1. Electro-static shielding (E) is optional.
2. On latching relays, (+) indicates set positive.

Contact Form	Part Number		Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width (X)	Schematic Top View I End Coil	Schematic Top View J Side Coil
	I End Coil	J Side Coil							
1A	I051A2R0	J051A2R0	5	500	3.8	0.5	.375		
	I121A2R0	J121A2R0	12	1000	9.0	1.2			
	I241A2R0	J241A2R0	24	2000	18.0	2.4			
2A	I052A2R0	J052A2R0	5	300	3.8	0.5	.475		
	I122A2R0	J122A2R0	12	750	9.0	1.2			
	I242A2R0	J242A2R0	24	1500	18.0	2.4			
3A	I053A2R0	J053A2R0	5	250	3.8	0.5	.575		
	I123A2R0	J123A2R0	12	500	9.0	1.2			
	I243A3R0	J243A3R0	24	2000	18.0	2.4			
4A	I054A2R0	J054A2R0	5	150	3.8	0.5	.700		
	I124A2R0	J124A2R0	12	375	9.0	1.2			
	I244A2R0	J244A2R0	24	1000	18.0	2.4			
1B	I051B2R0	J051B2R0	5	500	3.8	0.5	.475		
	I121B2R0	J121B2R0	12	1000	9.0	1.2			
	I241B2R0	J241B2R0	24	2000	18.0	2.4			
1A1B	I052F2R0	J052F2R0	5	250	3.8	0.5	.575		
	I122F2R0	J122F2R0	12	500	9.0	1.2			
	I242F3R0	J242F3R0	24	2000	18.0	2.4			
1C	I051C2R0	J051C2R0	5	500	3.8	0.5	.375		
	I121C2R0	J121C2R0	12	1000	9.0	1.2			
	I241C2R0	J241C2R0	24	2000	18.0	2.4			
2C	I052C2R0	J052C2R0	5	300	3.8	0.5	.500		
	I122C2R0	J122C2R0	12	750	9.0	1.2			
	I242C2R0	J242C2R0	24	1500	18.0	2.4			
4C	I054C2R0	J054C2R0	5	50	3.8	0.5	.875		
	I124C2R0	J124C2R0	12	300	9.0	1.2			
	I244C2R0	J244C2R0	24	800	18.0	2.4			
1A Latching	I051K3R0	J051K3R0	5	375	3.8	0.5	.475		
	I121K2R0	J121K2R0	12	500	9.0	1.2			
	I241K3R0	J241K3R0	24	2000	18.0	2.4			

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REED RELAYS

HIGH POWER SERIES

- Miniature High Power Reed Relays. 50W Contact Rating.
- Capable of Handling High Inrush, Inductive and Capacitive Loads
- Open Frame, Encapsulated and Axial Lead Packages are Available

HIGH VOLTAGE SERIES

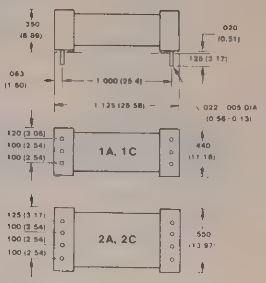
- Miniature High Voltage Reed Relays
- Meets FCC Part 68 Voltage Breakdown Requirement
- Open Frame, Encapsulated and Axial Lead Packages are Available

MERCURY WETTED SERIES

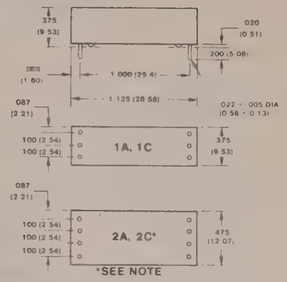
- Miniature Reed Relay with Mercury Wetted Contacts
- No Contact Bounce
- 50 Watts Contact Rating
- Open Frame, Encapsulated and Axial Lead Packages are Available

Specifications	High Power	High Voltage	Mercury Wetted	
			Form A	Form C
Power (Resistive Load)	50 Watts	25 Watts	50 Watts	50 Watts
Voltage (Max. Switching)	200 VDC	1000 VDC	500 VDC	500 VDC
Voltage (Min. Breakdown)	300 VDC	2500 VDC	1500 VDC	1500 VDC
Current (Max. Switching)	1 Amp	1 Amp	2 Amps	1 Amp
Current (Max. Carry)	2 Amps	2 Amps	3 Amps	2 Amps
Capacitance (Typical)	0.2 Pf	0.2 Pf	0.3 Pf	0.7 Pf
Contact Resistance (Max. Initial Typ.)	0.5 Ohms	0.2 Ohms	0.07 Ohms	0.07 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms	1.5 ms	2.0 ms
Release Time (Typical)	0.5 ms	0.2 ms	1.0 ms	2.0 ms
Insulation Resistance (Min. Typ)	10^{10} Ohms	10^{10} Ohms	10^{10} Ohms	10^9 Ohms
Life (Medium Load)	10 x 10^6 Oper	100 x 10^6 Oper.	10^9 Oper.	10^9 Oper.
Life (Rated Load)	1 x 10^6 Oper	10 x 10^6 Oper	5 x 10^7 Oper.	5 x 10^7 Oper.

OPEN FRAME

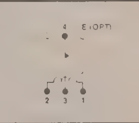
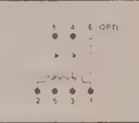
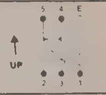
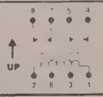


ENCAPSULATED



Note: Dimension for 2 Form C Mercury Encapsulated Relays. Length: 1.175, Width: .600, Height: .375.

PART NUMBERS AND OPERATING CHARACTERISTICS (@ 25°C)

Contact Form	Nom. Coil VDC	Max. Pick-up VDC	Min. Drop-out VDC	High Power			High Voltage			Mercury Wetted*			Schematic Top View
				Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		
					Open Frame	Encapsulated		Open Frame	Encapsulated		Open Frame	Encapsulated	
1A	5	3.8	0.5	500	C051A2TO	I051A2TO	500	C051A2HO	I051A2HO	125	C051A1MO	I051A1MO	
	6	4.5	0.6	125	C061A1TO	I061A1T0	125	C061A1HO	I061A1HO	125	C061A1MO	I061A1MO	
	12	9.0	1.2	750	C121A1TO	I121A1TO	1000	C121A2HO	I121A2HO	750	C121A1MO	I121A1MO	
	24	18.0	2.4	2000	C241A2TO	I241A2TO	2000	C241A2HO	I241A2HO	2000	C241A2MO	I241A2MO	
2A	5	3.8	0.5	100	C052A1TO	I052A1TO	100	C052A1HO	I052A1HO	100	C052A1MO	I052A1MO	
	6	4.5	0.6	100	C062A1TO	I062A1TO	100	C062A1HO	I062A1HO	100	C062A1MO	I062A1MO	
	12	9.0	1.2	300	C122A1TO	I122A1TO	750	C122A2HO	I122A2HO	300	C122A1MO	I122A1MO	
	24	18.0	2.4	1500	C242A2TO	I242A2TO	1500	C242A2HO	I242A2HO	1500	C242A2MO	I242A2MO	
1C	5	4.0	0.5	—	NA	—	—	—	—	100	C051C1MO	I051C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	350	C121C1MO	I121C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1500	C241C1MO	I241C1MO	
2C	5	4.0	0.5	—	NA	—	—	—	—	75	C052C1MO	I052C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	300	C122C1MO	I122C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1200	C242C1MO	I242C1MO	

* Mercury wetted relays should be mounted within ±30° from vertical position.

AXIAL LEAD SERIES

- Encapsulated Axial Lead Reed Relays
- Axial Leads Allows Various Mounting Configurations.
- Total Environmental Protection
- Nickel Plated Metal Tube Provides Magnetic Shielding
- Formed Leads are Also Available
- 1 Form A, 2 Form A, 1 Form B, 1 Form C and 2 Form C Types are Available
- Various Contact Ratings Available
- Contact American Relays, Inc. for Specific Part Numbers and Additional Options

SPECIAL RELAY DESIGN

American Relays, Inc. is a custom relay specialist. Our major objective is to design and build parts that fulfill special requirements for the reed relay user.

Our facility is designed and equipped for prompt, systematic processing of samples, prototype and production orders.

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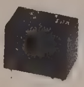

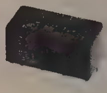

Low Profile Relays

SERIES		AZ5	AZ7	AZ820	AZ830	AZ830P
FEATURES		• High Sensitivity • Subminiature Size • Low Cost • Meets FCC Part 68.302 and 68.304	• Meets FCC 1500V Surge Requirement • Low Profile • High Sensitivity • Pd-Ag Contacts Available	• Meets FCC Part 68.302 and 68.304 • Bifurcated Pd-Ag Contacts • Low Profile • Dip Package	• Meets FCC Part 68.302 and 68.304 • Polarized Coil • Dip Package • Bifurcated Contacts • Pd-Ag Contacts Available	• Polarized Magnetic Bistable (Latching) Relay • Meets FCC Part 68.302 and 68.304 • Dip Package • Bifurcated Contacts • Pd-Ag Contacts Available
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes
CONTACTS	Form	1 Form C	2 and 4 Form C Form D Available	2 Form C	2 and 4 Form C	2 and 4 Form C
	Rating (Resistive)	Standard Duty: 1A @ 30 VDC or 120 VAC Heavy Duty: 2A @ 30 VDC 1A @ 120 VAC	2A @ 30 VDC or 50 VAC 0.5A @ 125 VAC	2A @ 15 VDC or 30 VAC 1A @ 30 VDC or 60 VAC 0.5A @ 60 VDC or 125 VAC	2 Pole: 2A @ 30 VDC or 60 VAC 1A @ 60 VDC or 125 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole: 2A @ 30 VDC or 30 VAC	2 Pole: 2A @ 30 VDC or 60 VAC 1A @ 60 VDC or 120 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole: 2A @ 30 VDC or 30 VAC
COIL VOLTAGE		5, 6, 9, 12, 24V (DC)	5, 6, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)
COIL POWER AT PICK UP VOLTAGE		Standard Coils: 220 mW Sensitive Coils: 100 mW	2 Pole: 190 mW 4 Pole: 310 mW	250 mW	Standard Coils: 200 mW Sensitive Coils: 100 mW	Standard Coils Monostable: 200 mW Bistable (Latching) Two: 180 mW Sensitive Coils Monostable: 100 mW Bistable (Latching) Two: 90 mW
DIELECTRIC STRENGTH		Coil to Contact: 1000 Vrms Between Open Contacts: 500 Vrms	Between All Points: 1500 Vrms Between Open Contacts: 750 Vrms	Between All Points: 1500 Vrms Between Open Contacts: 1000 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms
TYPICAL LIFE OPERATIONS	Electrical	(Std. Duty) 5 x 10^5 – 1A/30 VDC or 4 x 10^5 – 0.5A/120 VAC (Hvy Duty) 2 x 10^5 – 2A/30 VDC or 2 x 10^5 – 1A/120 VAC	5 x 10^6 – 1A/26 VDC 10^6 – 2A/30 VDC	5 x 10^5 – 1A/30 VDC	5 x 10^5 – 2A/30 VDC or 1A/125 VAC 2 x 10^6 – 1A/30 VDC or 0.5A/125 VAC	5 x 10^5 – 2A/30 VDC or 1A/125 VAC 2 x 10^6 – 1A/30 VDC or 0.5A/125 VAC
	Mechanical	10^7	10^8	10^7	10^8	10^8
MAXIMUM SIZE INCHES L x W x H		0.610 x 0.420 x 0.450	2 Pole: 1.200 x 0.826 x 0.458 4 Pole: 1.200 x 0.965 x 0.458	0.795 x 0.394 x 0.453	2 Pole: 0.788 x 0.390 x 0.371 4 Pole: 1.09 x 0.390 x 0.390	2 Pole: 0.788 x 0.390 x 0.366 4 Pole: 1.39 x 0.390 x 0.390
Terminals	PC	X	X	X	X	X
	Solder/Plug-in	—	—	—	—	—
UL/CSA/VDE		UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

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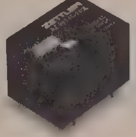

Low Profile (Cont.)

AZ845	AZ846
• Micro Miniature Size • High Sensitivity • Meets FCC Part 68.302 • Bistable (Latching) Versions Available	• Meets Bellcore 2.5 kV Surge • Meets FCC 1500 V Surge Requirements • Micro Miniature Size • High Sensitivity • Latching Version Available
Yes	Yes
2 Form C	2 Form C
1A @ 30 VDC or 60 VAC 0.5A @ 125 VAC	Max. Switched Current: 1A Max. Carry Current: 1A Max. Switched Voltage: 150 VDC, 125 VAC Max. Switched Power: 30 W, 60 VAC
3, 5, 6, 9, 12, 24V (DC)	3 thru 24V (DC)
Monostable Coil: 79 mW (3-12 VDC) 113 mW (24 VDC) Bistable (Latching) Two Coil: 113 mW (3-12 VDC) 169 mW (24 VDC)	18 mW
Between Open Contacts: 750 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1000 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms 2500V peak per Bellcore
2×10^5 – 1A/30 VDC 10^5 – 0.5A/125 VAC	2×10^6 – 0.5 A resistive
5×10^7	10^8
0.551 x 0.354 x 0.158	0.591 x 0.245 x 0.343
X	X
—	—
UL/CSA	UL/CSA

General Purpose Relays

SERIES		AZ941	AZ8	AZ420
FEATURES		• Subminiature Size • Extremely Low Cost • Rugged Construction • Meets FCC Part 68.302 and 68.304 • Wide Switching Range	• High Sensitivity • Subminiature Size • Low Cost • Wide Switching Range • Class F (155°C) Version Available	• Versatile Contact Configurations • Wide Switching Range • High Sensitivity • Long Life
EPOXY SEALED		Yes	Yes	Yes
CONTACTS	Form	1 Form C (1 Form A Avail.)	1 Form A and C	1-6 Form C Forms A, B, D Avail.
	Rating (Resistive)	3A @ 30 VDC or 125 VAC 5A @ 30 VDC or 125 VAC 10A @ 125 VAC	Form A: 10A @ 30 VDC or 120 VAC Form C: 3A @ 30 VDC or 200 VAC 6A @ 30 VDC or 300 VAC	2A @ 28 VDC or 115 VAC 3A @ 30 VDC or 115 VAC 7.5A @ 30 VDC or 115 VAC
COIL VOLTAGE		5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	3 thru 115V (DC)
COIL POWER AT PICK UP VOLTAGE		230 mW	110 to 210 mW Standard Coil: 210 mW Sensitive Coil: 110 mW to 140 mW	Standard Coils: 450 to 850 mW Sensitive Coils: 40 mW per pole, 25 mW per pole Available
DIELECTRIC STRENGTH		Contact to Contact: 750 Vrms Contact to Coil: 1500 Vrms	Contact to Contact: 750 Vrms Contact to Coil: 2000 Vrms	Between All Points: 1000 Vrms 1500 Vrms Versions Available
TYPICAL LIFE OPERATIONS	Electrical	10^5 (at rated load)	(LD) 3×10^5 – 3A/120 VAC (MD) 1.8×10^5 – 6A/120 VAC (HD) 10^5 – 10A/120 VAC	1×10^8 – 10 mA/6 VDC 1.5×10^6 – 2A/28 VDC or 115 VAC 2×10^5 – 5A/28 VDC or 115 VAC 1×10^5 – 7.5A/28 VDC or 115 VAC
	Mechanical	10^7	10^8	5×10^8
MAXIMUM SIZE INCHES L x W x H		0.89 x 0.65 x 0.65	0.840 x 0.637 x 0.565	2 Pole: 0.940 x 0.735 x 1.230 6 Pole: 1.395 x 0.735 x 1.230
Terminals	PC	X	X	X
	Solder/Plug-in	—	—	X
UL/CSA/VDE		UL/CSA	UL/CSA	UL/CSA

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ZETTLER
AZ 696 1A-5DE
DC5V
AC 250V 8A

Power Relays

SERIES		AZ 690	AZ 695	AZ 696	AZ 730	AZ 745	AZ 2100
FEATURES		• High Dielectric Strength, 4000 Vrms • Complete List of International Approvals • 10 Amp Switching Capability in Compact Size	• Utilizes only 0.18 Sq. In. of PCB Area • 5 Amp Switching in Miniature Size • High Dielectric Strength, 3000 Vrms • High Sensitivity	• Subminiature Size • 10 Amp, Low Profile • High Sensitivity • Complete List of Approvals • Dielectric Strength 4000 Vrms	• High Dielectric Strength, 4000 Vrms • Complete List of International Approvals • 8 Amp Switching Capability in Compact Size	• High Dielectric Strength, 5000 Vrms • Complete List of International Approvals • 16 Amp Switching Capability in Compact Size	• Oversize Contact Switching Up to 30 Amps • Versatility of Both PC & .250" Fast-On Tabs for Contacts • Complete UL and CSA Approvals • Class F (155°C) Version Available
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes	Yes
CONTACTS	Form	1 Form A, B, or C	1 Form A	1 Form A	2 Form A, B, or C	1 Form A or C	1 Form A, B, or C
	Rating (Resistive)	10A @ 30 VDC or 200 VAC 1/4 HP 120 VAC Motor Load	5A @ 30 VDC or 250 VAC	10A @ 30 VDC or 250 VAC	8A @ 30 VDC or 120 VAC 1/8 HP 120 VAC Motor Load	Unsealed: 15A @ 250 VAC 1/2 HP @ 250 VAC Sealed: 7A @ 250 VAC General Use	Form A: 30A @ 30 VDC or 240 VAC Form B: 15A @ 30 VDC or 300 VAC Form C (NO): 20A @ 30 VDC or 300 VAC
COIL VOLTAGE		5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 18, 24V (DC)	5, 6, 12, 24, 48V (DC)	5, 6, 12, 24, 48V (DC)	4.5, 6, 12, 24, 48V (DC) 6, 12, 24, 48, 125V (AC)	5, 6, 9, 12, 15, 18, 24, 48, 70, 110V (DC)
COIL POWER AT PICK UP VOLTAGE		Standard Coils: 350 mW Sensitive Coils: 250 mW	100 mW	100 mW	Standard Coils: 350 mW Sensitive Coils: 250 mW	350 mW	500 mW
DIELECTRIC STRENGTH		Coil to Contact: 4000 Vrms Between Open Contact: 1000 Vrms	Contact to Contact: 750 Vrms Coil to Contact: 3000 Vrms	Coil to Contact: 4000 Vrms	Coil to Contact: 4000 Vrms Contact to Contact: 2500 Vrms Between Open Contacts: 1000 Vrms	Coil to Contact: 5000 Vrms Between Open Contacts: 1000 Vrms 10,000 V Surge, Max, 40 Micro Seconds, Contact to Coil	Coil to Contact: 2500 Vrms Between Open Contacts: 1500 Vrms
TYPICAL LIFE OPERATIONS	Electrical	5×10^4 – 10A/30 VDC or 115 VAC 2×10^5 – 8A/250 VAC	10^5 – 5A/30 VDC or 250 VAC	10^5 (at rated load)	10^5 – 8A/30 VDC 2×10^5 – 8A/115 VAC or 6A/250 VAC	10^5 – 16A/30 VDC 2×10^5 – 16A/120 VAC 10^5 – 14A/250 VAC	10^5 (at rated load)
	Mechanical	3×10^7	2×10^7	10^7	3×10^7	10^7	10^7
MAXIMUM SIZE INCHES L x W x H		SLIMPAK – 1.110 x 0.467 x 1.030 THINPAK – 1.110 x 1.030 x 0.441	0.690 x 0.256 x 0.492	1.180 x 0.394 x .638	1.110 x 0.496 x 1.030	1.140 x 0.488 x 0.984	OPEN 1.20 x 0.970 x 0.618 ENCASED 1.270 x 1.080 x 1.100
Terminals	PC	X	X	X	X	X	X
	Solder/Plug-in	—	—	—	—	—	Quick Connect
UL/CSA/VDE		UL/CSA/VDE	UL/CSA	UL/CSA/VDE	UL/CSA/VDE	UL/CSA/VDE	UL/CSA

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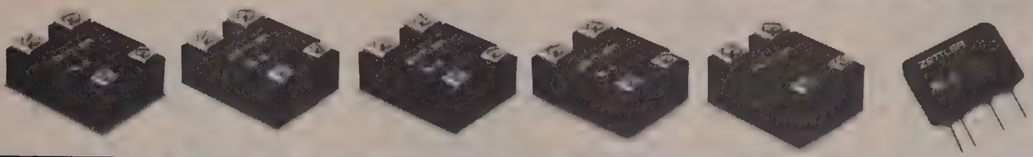

Solid State Relays

	SERIES	SA/SD	SH	ST	SDC	SM	PD
	FEATURES	• Solid State Relays for AC (SA) or DC (SD) Activation • Inverse-Parallel Output Thyristors • Suitable for Inductive Loads Due to Integrated RC Component • Available with or without Zero Voltage Switching	• High-Blocking Solid State Relay with Integrated Control Circuit for AC or DC Activation • Suitable for Three Phase Current Loads • Inverse-Parallel Output Thyristors • Optimum Heat Dissipation	• Low Cost SST Relay with Triac Output for AC or DC Activation • Particularly Suited for Inductive Loads • Suitable for Inductive Loads Due to Integrated RC Components	• Low Cost SST Relay with Integrated RC Components • High Immunity to Interference Due to Active Filters • High Blocking Output with Inverse Parallel Output Thyristors	• Solid State DC Relay with Power MOSFET Output • DC Loads Up to 4 kW • Low Power Dissipation • Logic-Compatible Input	• Solid State AC Relay • Used for Installation in PCB's • TTL-Compatible • Suitable for Inductive Loads Due to Integrated RC Components • Low Cost and Good Heat Dissipation
OUTPUT	Operating Voltage Range	With Zero Voltage Switching 48-530 VAC Without Zero Voltage Switching 90-530 VAC	48-530 VAC	48-280 VAC	48-530 VAC	0-500 VDC	60-280 VAC
	Max. Load Current	10-90 A	50-90 A	10-25 A	25-90 A	7-40 A	2-3.5 A
	Leakage Current at Rated Voltage	10 mA	< 1 - < 12 mA	10 mA	10 mA	Max. 0.3 mA	Max. 8 mA
INPUT	Control Voltage Range						
	AC Input (SA)	90-280 VAC	90-140 VAC	90-280 VAC			
	DC Input (SD)	3-32 VDC	4-32 VDC	3-32 VDC	4-32 VDC	3.5 - 32 VDC	3-28VDC
	Input Impedence						
	AC Input (SA)	60,000 Ohms	> 10,000 Ohms	60,000 Ohms			
	DC Input (SD)	1,000-1,500 Ohms	> 1,000 Ohms	1,500 Ohms	1,000 Ohms @ 32 VDC	1,000 Ohms	1,500 Ohms
Insulation Test Voltage		4,000 Vrms	4,000 Vrms	4,000 Vrms	4,000 Vrms	2,500 Vrms	5,000 Vrms
Coupling Capacitance Input/Output		8 pF	< 16 pF	8 pF	16 pF	50 pF	10 pF
Ambient Temperature (Operating)		–30°C to 80°C (–22°F to 176°F)	–30°C to 80°C (–22°F to 176°F)	–30°C to 80°C (–22°F to 176°F)	–30°C to 80°C (–22°F to 176°F)	0°C to 80°C (32°F to 176°F)	–20°C to 80°C (4°F to 176°F)
Maximum Size Inches L" x W" x H"		Up to 50 A 2.25 x 1.75 x .87 Up to 75A 2.25 x 1.75 x 1.10	Up to 50A 2.25 x 1.75 x .87 Up to 90A 2.25 x 1.75 x 1.10	2.25 x 1.75 x .87	2.25 x 1.75 x .87	2.25 x 1.75 x 1.10	1.69 x .47 x 1.10
UL/CSA/VDE		UL/CSA/VDE	UL/CSA/VDE	UL/CSA/VDE	UL/CSA	UL/CSA Pending	UL/CSA

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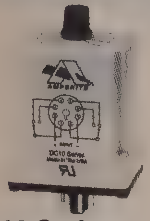
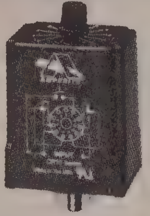
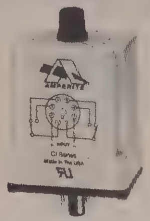


DC10 Series
- Solid state CMOS digital circuitry
- Delay on Operate timing mode
- 10A relay output with DPDT contacts

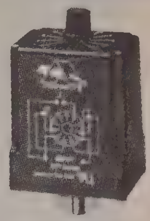
C10 Series
- Solid state analog circuitry
- Delay on Operate timing mode
- 10A relay output with DPDT contacts



CR10 Series
- Solid state analog circuitry
- Triggered Delay on Release timing mode
- 10A relay output with DPDT contacts

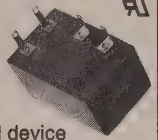


CI Series
- Solid state analog circuitry
- One-shot timing mode (interval on)
- 10A relay output with DPDT contacts

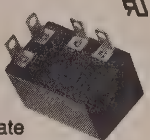


CIR Series
- Solid state analog circuitry
- Triggered 1-shot timing mode (triggered interval on)
- 10A relay output with DPDT contacts

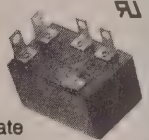
B Series
- Thermal device
- Delay on Make or Break timing modes
- 3 AMP rating



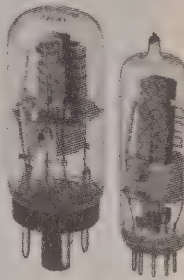
BR Series
- Thermal device
- Delay on Release timing modes
- 3 AMP rating



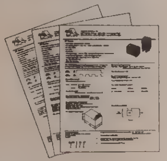
C Series
- Solid state analog circuitry
- Delay on Operate timing mode
- Low current relay output with SPDT contacts



CR Series
- Solid state analog circuitry
- Triggered Delay on Release timing mode
- Low current relay output with SPDT contacts



G Series
- Hermetically sealed
- Thermal device
- 3A rating



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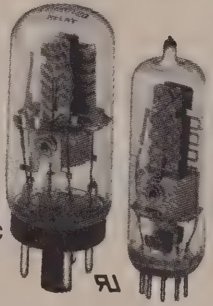
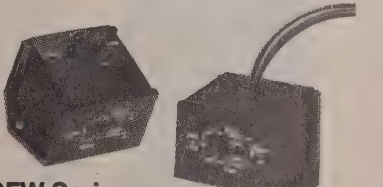
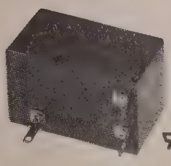
DF10 Series
- 10A relay with DPDT contacts
- 12V – 120V input voltage available
- Flash rates available from 10-240 FPM



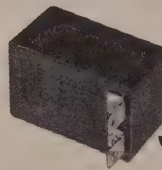
GF Series
- Hermetically sealed
- Thermal flasher circuitry
- Octal & 9-pin glass tube configuration
- All units work on AC & DC input voltage



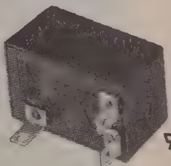
DFW Series
- Ideal for emergency or police vehicular use
- Small, compact, reliable & easy to install with 1/4" Q.C. or #14 gauge wire termination
- 20A relay contacts
- Flash rate fixed at 110 FPM



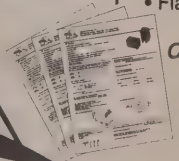
D Series
- No moving parts to wear out
- 2A load rating
- AC or DC units available
- Flash rates available from 10-1000 FPM
- No current leakage to load



DF Series
- Universal input – 24V-120V AC or DC
- 2A load rating
- 2 terminal configuration – easy connection to load
- Flash rates available from 10-1000 FPM



BF Series
- Thermal flasher circuitry
- 2A load rating @ 115V AC
- All units work on AC & DC input voltage
- 3 terminal configuration



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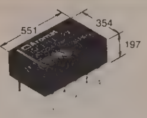
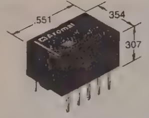
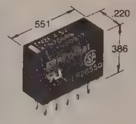
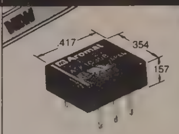
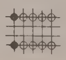
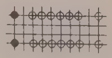
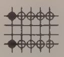
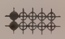
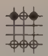
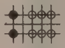
Relay Selector Chart

	NEW T-SERIES				
	TQ-RELAY	TF-RELAY	TN-RELAY	TK-RELAY	TW-RELAY
• Type of relay inch					NEW .579 .289 .427
• Features	• Ultra-small size • High sensitivity • 1,500V FCC • 4 pole model available	• Highest sensitivity • Ultra-small size • 1,500V FCC • Surface-mount type available • 48V coil type available	• Ultra-slim size • High sensitivity • 1,500V FCC	• Low profile 4 mm .157 inch • High contact capacity: 2 A • Surge withstand voltage between contact and coil: 2,500 V	• Surge withstand: 2,500 V • High contact capacity: 2 A 30 V DC • Current surge capacity: 4.2 A 700 V AC
• Sealed types availability	●	●	●	●	●
• Latching types availability	●	●	●	●	●
• Contact material (Optional material)	Gold-clad silver	Gold-clad silver	Gold-clad silver	Gold-clad silver nickel	Gold-clad silver nickel
• Contact rating chart Maximum (cos $\varphi = 1$) 15 A 10 A 8 A 5 A 3 A 2 A 1 A	1 A 30 V DC	1 A 30 V DC	1 A 30 V DC	2 A 30 V DC	2 A 30 V DC
Minimum 1 mA 100 μA 10 μA	10 μA 10 mV DC	10 μA 10 mV DC	10 μA 10 mV DC	10 μA 10 mV DC	10 μA 10 mV DC
• Contact arrangement	2c, 4c	2c	2c	1c	2c
• Life (Min. operation) Electrical	2×10^5	2×10^5	2×10^5	10^5	10^5
• Life (Min. operation) Mechanical	10^8	10^8	10^8	10^8	10^8
• Breakdown voltage Between open contacts	750Vrms	750Vrms	750Vrms	750Vrms	1,000Vrms
• Breakdown voltage Between contact sets	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms
• Breakdown voltage Between contacts and coil	1,000Vrms	1,000Vrms	1,000Vrms	1,500Vrms	1,800Vrms
• Breakdown voltage Between live parts and ground	—	—	—	—	—
• Surge withstand voltage	1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC
• Coil voltage	(DC) 3, 4.5, 5, 6, 9, 12, 24 V	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48V	(DC) 3, 4.5, 5, 6, 9, 12, 24V	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24 V	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48 V
• Nominal operating power	(Single) (2C) 140mW (4C) 280mW (−L2) 200mW	80mW (DC 3 to 12V) 140mW (DC 24V) 260mW (DC48V)	(Single) 140mW (Up to 12VDC) 200mW (24VDC)	140mW	(Single) 140 mW (Up to 12V DC) 200 mW (24VDC) 260mW (48VDC)
• Terminal layout (Bottom View) ◆: coil terminal (.100 inch grid)	 2c  4c				
• Standards	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)
• Mounting method	┳	┳ ⊓	┳	┳	┳

Note: Meaning of symbol marks ┳ : PC board terminal; ┳ : Plug-in; ▲ : Top-mounting; ▲ : Top-mounting with PC board terminals; ⊓ : Surface-mounting

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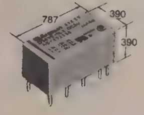
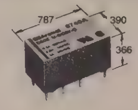
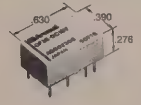
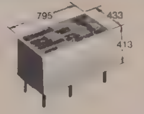
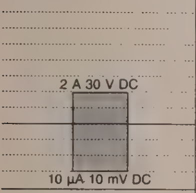
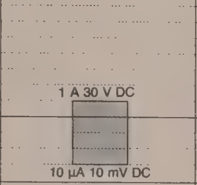
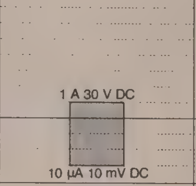
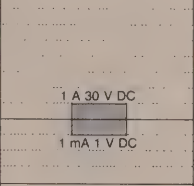
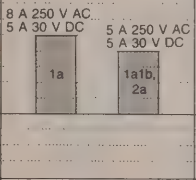
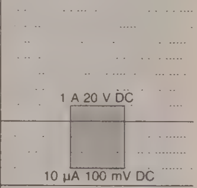
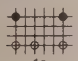
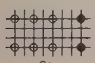
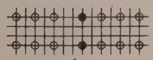
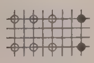
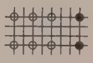
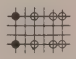
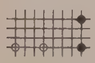
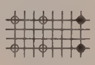
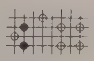
 IC Relay option					 IC Relay option
• 1,500V FCC surge satisfied • High sensitivity • High switching power	• High sensitivity • 2 Form C contact • 1,500V FCC • Sealed construction	• High breakdown voltage: 1,500V FCC • 2c type matching 16 pin IC socket	• Smaller than most 2 form C relays • High sensitivity • DIL	• High switching capacity • High sensitivity • High contact welding resistance • High breakdown voltage	• Magnetically shielded • High sensitivity • High speed operation
●	●	●	●	●	●
●	●	●	●	●	●
Gold-clad silver (Silver palladium)	Gold-clad silver	Gold-clad silver	Gold-clad silver	Gold-flash over silver alloy	Gold cobalt
					
1c, 2c, 4c	2c	2c	2c	1a, 1a1b, 2a	1c
5×10^5	5×10^5	5×10^5	10^5	10^5	10^6
10^8	10^8	10^8	(Single) 5×10^6 (Latching) 10^6	5×10^7	10^9
1,000Vrms (500 Vrms for DS1-S)	750Vrms	750Vrms	500Vrms	1,000Vrms	350Vrms or 500VDC
1,000Vrms	1,000Vrms	—	500Vrms	2,000Vrms	—
1,500Vrms (1,000 Vrms for DS1-S)	1,000Vrms	1,000Vrms	1,000Vrms	3,000Vrms	1,000Vrms
—	—	—	—	—	1,000Vrms
1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC	5,000V surge	—
(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 12, 24, 48V
M type (Single) 400mW (–L2) 360mW S type (Single) 200mW (–SL2) 180 mW	(Single) 200mW (300mW: 48V) (–L2) 180mW (360mW: 48V)	(Single) 400mW (–L2) 360mW	(Single) 200mW (–L) 100mW (–L2) 200mW	(Single) 300mW (–L) 150mW (–L2) 300mW	(Single) 150 to 280mW (–L) 70 to 100mW (–L2) 150 to 230mW
 1c  2c  4c				 1a  1a1b, 2a	
UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57521), CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550)	UL (E57521), CSA (LR26550)
┳	┳	┳	┳	┳	┳

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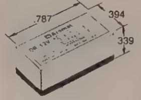
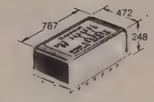
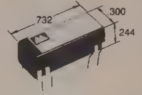
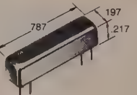
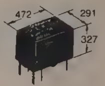
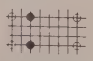
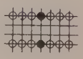
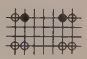
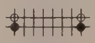
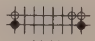
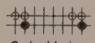
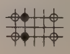
Relay Selector Chart

		Highly Reliable DIL **DR-RELAY**	Hermetically Sealed **DX-RELAY**	Economical Reed **DA-RELAY**	High Quality Reed **DB-RELAY**	Ultra-Miniature Single Pole **HD-RELAY**
• Type of relay	inch					
• Features		• High sensitivity • High contact force • High breakdown voltage • High speed operation	• High radio frequency characteristics • High shock and vibration resistance	• DIL terminal • Glass encapsulated reed switch	• High insulation resistance • High sensitivity • High speed operation	• Ultra-small type • High sensitivity • Sealed construction
• Sealed types availability		●	●	●	●	●
• Latching types availability		●	●			
• Contact material (Optional material)		Gold cobalt	Gold-clad silver alloy	Rh-plated nickel-iron alloy	Rhodium	Gold-clad silver
• Contact rating chart Maximum (cos $\varphi = 1$)	15 A 10 A 8 A 5 A 3 A 2 A 1 A	1 A 20 V DC	1 A 30 V DC	0.2 A 48 V DC	0.4 A 24 V DC	1 A 30 V DC
Minimum	1 mA 100 μA 10 μA	10 μA 100 mV DC	10 μA 30 mV DC	1 mA 100 mV DC	100 μA 5 V DC	1 mA 1 V DC
• Contact arrangement		1c	2c	1a, 2a	1a	1c
• Life (Min. operation)	**Electrical**	10^6	2×10^5	10^6	10^6	10^5
	Mechanical	10^9	3×10^7	10^8	2×10^8 (2 shield pin)	5×10^6
• Breakdown voltage	**Between open contacts**	750Vrms	500Vrms	200VDC (1 min.)	200VDC (1 min.)	500Vrms
	Between contact sets	—	500Vrms	—	—	—
	Between contacts and coil	1,500Vrms	500Vrms	500VDC (1 min.)	500VDC (1 min.)	500Vrms
	Between live parts and ground	1,000Vrms	500Vrms	—	500VDC (1 min.)	—
• Surge withstand voltage		1,500V FCC	—	—	—	—
• Coil voltage		(DC) 3, 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24V	(DC) 5, 6, 12, 24V	(DC)1.5, 3, 5, 6, 9, 12, 15, 18, 24V	(DC) 1.5, 3, 5, 6, 9, 12, 24V
• Nominal operating power		(Single) 96 to 209mW (–L) 56 to 109mW (–L2) 111 to 290mW	(Single) 125 to 144mW (–L) 125 to 144mW (–L2) 250 to 288mW	(1a) 230mW (2a) 325mW	(Standard) 130mW (High sensitivity for 5V type) 80mW	280 to 300mW
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid)					 No shield pin  1 shield pin  2 shield pins	
• Standards		UL (E57521), CSA (LR26550)	—	—	—	UL (E57521), CSA (LR26550)
• Mounting method		┳	┳	┳	┳	┳

Note: Meaning of symbol marks ┳ : PC board terminal; ┰ : Plug-in; ▲ : Top-mounting; ▲ : Top-mounting with PC board terminals; ☐ : Surface-mounting

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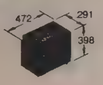
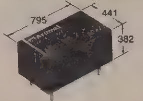
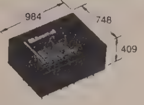
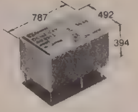
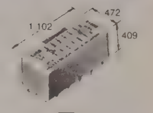
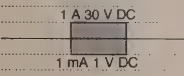
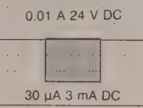
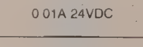
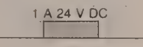
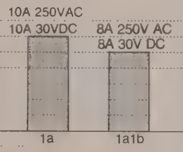
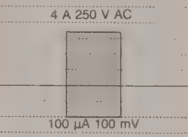
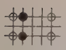
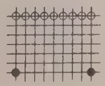
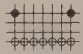
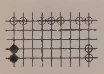
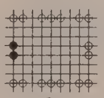
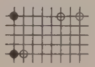
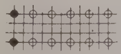
High Sensitivity 1 Form C Relay **HY-RELAY**	High Frequency **RF-RELAY**	High Frequency **RK-RELAY**	1C and 2C High Frequency **RG-RELAY**	Miniature Power **DK-RELAY**	High Density **SEB-RELAY**
 472 291 398	984 827 366	 795 441 382	 984 748 409	 787 492 394	 1 102 472 409 IC Relay option
• High sensitivity: 150mW/200mW • A wide range of ambient temperature: −40°C to +70°C −40°F to +158°F	• Excellent high frequency • High reliability and long life • Flux-resistant molded construction	• Excellent high frequency characteristics • High sensitivity in small size	• Excellent high frequency • Wide selection • 1A 24VDC	• Large capacity in small size • High sensitivity • High breakdown voltage	• High sensitivity • High vibration and shock resistance • Low thermal electromotive force
●	●	●	●	●	●
		●	●	●	●
Gold-clad silver	(Stationary contact) Gold-plated nickel silver (Movable contact) Gold-clad phosphorus bronze	Gold-clad silver	Gold-clad silver	Gold-flash over silver alloy	Gold-clad silver alloy
 1 A 30 V DC 1 mA 1 V DC	 0.01 A 24 V DC 30 μA 3 mA DC	 0 01A 24VDC	 1 A 24 V DC	 10A 250VAC 10A 30VDC 8A 250V AC 8A 30V DC 1a 1a1b	 4 A 250 V AC 100 μA 100 mV
1c	1c	1c	1c, 2c	1a, 1a1b	2a2b, 4a
10^5	10^5	3×10^5	10^5	10^5	10^5
10^7	5×10^6	5×10^6	5×10^6	5×10^7	10^8
500Vrms	1,000Vrms	500Vrms	1,000Vrms	1,000Vrms	750Vrms
—	—	—	—	4,000Vrms	1,000Vrms
1,000Vrms	2,000Vrms	1,000Vrms	2,000Vrms	4,000Vrms	1,500Vrms
—	Between contacts and ground: 500Vrms; Between ground and coil: 2,000Vrms	500Vrms	500Vrms	—	—
—	—	—	—	—	—
(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 12, 24, 48V
Standard: 200mW High sensitivity: 150mW	450mW	(Single) 200mW (−L) 200mW (−L2) 400mW	(Single) 350 to 400mW (−L) 180 to 200mW (−L2) 350 to 400mW	200mW	192 to 355mW
			 1c  2c		
UL (E57521), CSA (LR26550)	—	—	—	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)

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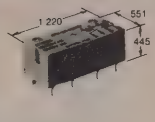
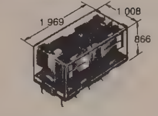
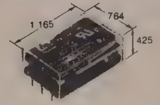
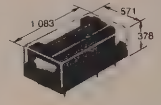
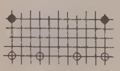
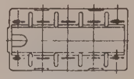
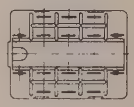
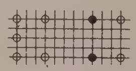
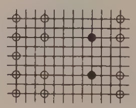
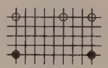
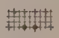
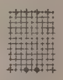
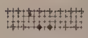
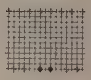
Relay Selector Chart

	Field Switching Power **STE-RELAY**	Compact Power Sensitive **SP-RELAY**	Flatpack **NF-RELAY**	Thin 1 Form C **NB-RELAY**	Flatpack/Vertical type 5 AMP **NC-RELAY**
• Type of relay inch					1 000 1 000 429
• Features	• Large capacity in small size • High inrush capability	• High sensitivity • High vibration and shock resistance • Wide switching range	• 1,500V FCC surge satisfied • Low profile • High sensitivity • MBB contact available	• 1500V FCC surge satisfied • Low profile • 5A contact rating	• Flatpack and vertical type • DIL terminal • Bifurcated contacts
• Sealed types availability	●		●	●	●
• Latching types availability	●	●		●	●
• Contact material (Optional material)	Gold-flash over silver alloy	Silver alloy/gold-plated silver alloy	Gold-clad silver (Silver palladium)	(Single) Silver nickel (Bifurcated) Gold-clad silver nickel	Gold-clad Silver nickel
• Contact rating chart Maximum (cos $\varphi = 1$) 15 A 10 A 8 A 5 A 3 A 2 A 1 A	8 A 250 V AC	15 A 250 V AC 2c 10 A 250 V AC 4c	2 A 30 V DC	(Single contact) 5 A 250 V AC, 30 V DC (Bifurcated contact) 3 A 250 V AC, 30 V DC	5 A max. 250 V AC
Minimum 1 mA 100 µA 10 µA	1 mA 1 V	1 mA 10 V 1 mA 10 V	100 µA 100 mV DC	1 mA 1 V 1 mA 1 V	100 µA 1 V
• Contact arrangement	1a1b, 2a	2c, 4c	2c, 4c, 2D, 4D	1c	2c, 4c
• Life (Min. operation) Electrical	10^5	10^5	10^6	2×10^5	(2c) 10^5 (4c) 10^5
• Life (Min. operation) Mechanical	10^7	5×10^7	(2c) 3×10^8 (4c) 10^8	10^7	2×10^7
• Breakdown voltage: Between open contacts	1,200Vrms	1,500Vrms	750Vrms	1,000Vrms	1,000Vrms
• Breakdown voltage: Between contact sets	2,000Vrms	3,000Vrms	1,000Vrms	—	1,000Vrms
• Breakdown voltage: Between contacts and coil	3,750Vrms	3,000Vrms	1,000Vrms	2,000Vrms	2,000Vrms
• Breakdown voltage: Between live parts and ground	—	—	1,000Vrms	—	—
• Surge withstand voltage	6,000V surge	—	1,500V FCC	1,500V FCC	—
• Coil voltage	(DC) 3, 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48, 110V
• Nominal operating power	240mW	300mW	(2c) 300mW (4c) 480mW	400mW	(Single) (2c) 360mW (4c) 720mW (−L2) (2c) 800mW (4c) 1,600mW
• Terminal layout (Bottom View) • coil terminal (.100 inch grid) mm inch		 SP2  SP4	 2c  4c		 2c (Slim)  2c (Flat)  4c (Slim)  4c (Flat)
• Standards	UL (E57520), VDE, CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57521), VDE, CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), VDE, CSA (LR26550)
• Mounting method	┳	⊍	┳	┳	┳ ⊍

Note: Meaning of symbol marks ┳ : PC board terminal; ⊍ : Plug-in; ▲ : Top-mounting; ▲┳ : Top-mounting with PC board terminals; ☐ : Surface-mounting

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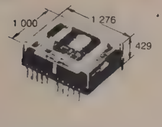
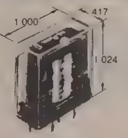
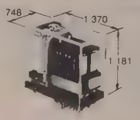
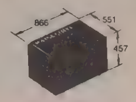
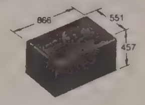
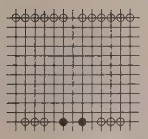
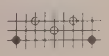
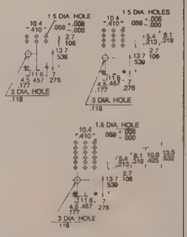
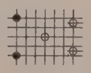
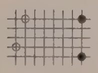
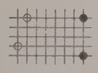
6PDT Flatpack DIL **NL-RELAY**	Vertical type **NT-RELAY**	High Sensitivity **K-RELAY**	Compact Economical Power **JE-X-RELAY**	Small Sized Power Relay **JZ-RELAY**	8A Power Relay **JG-RELAY**
					
• 6PDT Flat-pack • Low operating power • MBB contact available	• Large capacity 8A • Compact size • AC coils	• Sealed types available • Long life • Bifurcated contact	• Compact size • High contact capacity • Safety-oriented between coil and contact • Flux-resistant type available	• Small sized flat type • High dielectric withstanding • High noise resistance	• Compact & flat design • High capacity 8A • High surge resistance
●		●			
●					
Gold-clad silver	Gold-clad silver nickel	Gold-clad silver/ silver	Silver alloy	Silver alloy	Silver alloy
2 A 30 V DC 100 µA 100 mV DC	8 A 250 V AC 1 mA 1 V	5 A 125 V AC (K2F) 1 A 50 V AC, 2 A 250 V DC 100 µA 100 mV	3 A 277 V AC 5 A 125 V AC 5 A 30 V DC	5 A 125 V AC, 3 A 125 V AC	8 A 125 V AC
6c, 6D	1c	2c, 4c, 6c	1a, 1c	1a	1a
5×10⁵	10⁵	10⁶	10⁵	2×10⁵	2×10⁵
5×10⁷	10⁷	10⁸	5×10⁶	5×10⁶	5×10⁶
1,000Vrms	1,000Vrms	750Vrms	750Vrms	750Vrms	750Vrms
1,000Vrms	—	750Vrms	—	—	—
2,000Vrms	2,000Vrms	1,500Vrms	1,500Vrms	2,000Vrms	2,000Vrms
—	—	1,250Vrms	—	—	—
—	—	—	5,000V surge	10,000V surge	10,000V surge
(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 3, 6, 12, 24, 48, 60, 110V (AC) 6, 12, 24, 28, 48, 60, 110, 220V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 5, 6, 9, 12, 18, 24V	(DC) 5, 6, 9, 12, 18, 24V
(single) 720mW (–L2) 1,600mW	(DC) 290mW (AC) 0.75VA	(2c) 200 to 400mW (4c) 500 to 700mW (6c) 1,300mW	400mW	(Standard) 400mW (High sensitivity) 200mW	200mW
					
UL (E57521), CSA (LR26550)	UL (E57521), VDE, CSA (LR26550)	UL (E57521), VDE, CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550), TV rating	UL (E57520), TÜV, CSA (LR26550)
⊤	⊤	⊤ ⊤	⊤	⊤	⊤

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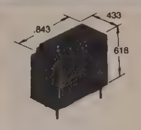
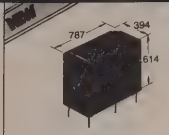
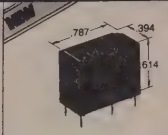
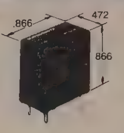
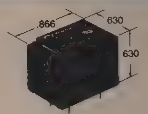
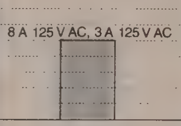
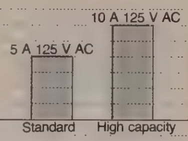
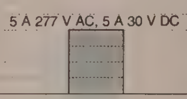
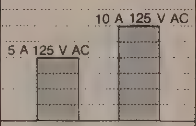
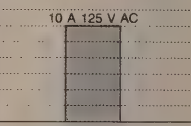
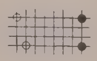
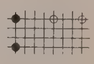
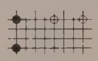
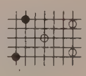
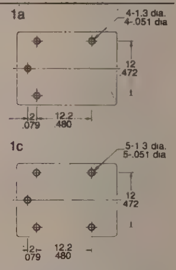
Relay Selector Chart

	Slim Type Power Relay	High Electrical & Mechanical Noise Immunity Relay	High Electrical & Mechanical Noise Immunity Relay	Compact Power	Ultra-Miniature PC Board Type Power Relay
	JK-RELAY	**JQ-RELAY**	**PQ-RELAY**	**JY-RELAY**	**JS-RELAY**
• Type of relay inch					
• Features	• Compact & slim design • High capacity type (8A) available • Sealed type available	• High electrical noise immunity • High switching capacity • High surge voltage: 8,000V	• High electrical noise immunity • High sensitivity: 200mW • High surge voltage: 8,000V	• 5A, 10A types • Class B coil type available • High dielectric withstanding: 5,000V surge	• Ultra-miniature size with universal terminal footprint • High switching capacity 10A
• Sealed types availability	●	●	●	●	●
• Latching types availability					
• Contact material	Silver alloy	Silver alloy	Silver alloy (Bifurcated)	Silver alloy	Silver alloy
• Contact rating chart Maximum (cos φ = 1) 15 A 10 A 8 A 5 A 3 A 2 A 1 A					
Minimum 1 mA 100 μA 10 μA					
• Contact arrangement	1a	1a, 1c	1a	1a, 1c	1a, 1c
• Life (Min. operation) Electrical	10^5	5×10^4	10^5	10^5	10^5
• Life (Min. operation) Mechanical	5×10^6	10^7	10^7	5×10^6	10^7
• Breakdown voltage Between open contacts	750Vrms	1a: 1,000Vrms 1c: 750Vrms	1,000Vrms	800Vrms	750Vrms
• Breakdown voltage Between contact sets	—	—	—	—	—
• Breakdown voltage Between contacts and coil	2,000Vrms	4,000Vrms	4,000Vrms	2,000Vrms	1,500Vrms
• Breakdown voltage Between live parts and ground	—	—	—	—	—
• Surge withstand voltage	8,000V surge	8,000V surge	8,000V surge	5,000V surge	—
• Coil voltage	(DC) 3, 5, 6, 9, 12, 18, 24V	(DC) 3, 5, 6, 9, 12, 18, 24, 48 V	(DC) 3, 5, 6, 9, 12, 18, 24 V	(DC) 5, 6, 9, 12, 24, 48 V	(DC) 5, 6, 9, 12, 24, 48V
• Nominal operating power	200mW	1a: 200mW 1c: 400mW	200mW	400mW	360mW
• Terminal layout (Bottom View) ⊕ coil terminal (.100 inch grid) mm inch		 1a		 1c	 1a 4-1.3 dia. 4-.051 dia 12 .472 2 .079 12.2 .480 1c 5-1.3 dia. 5-.051 dia 12 .472 2 .079 12.2 .480
• Standards	UL (E57520), TÜV, CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550), TV rating
• Mounting method	┳	┳	┳	┳	┳

Note: Meaning of symbol marks ┳ : PC board terminal; ┳ : Plug-in; ▲ : Top-mounting; ▲ : Top-mounting with PC board terminals; ☐ : Surface-mounting

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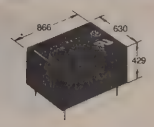
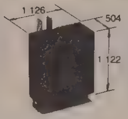
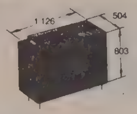
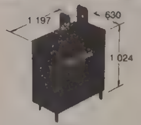
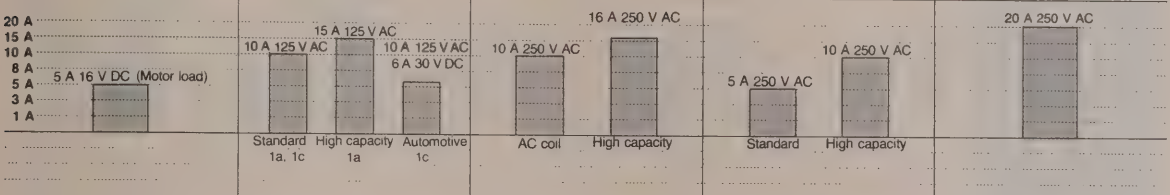
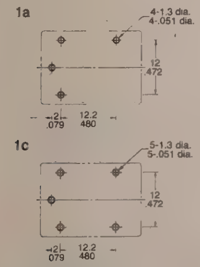
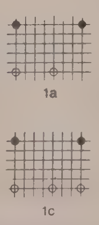
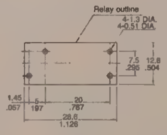
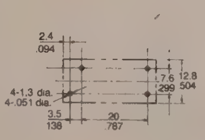
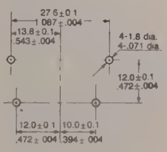
Automotive Ultra-Miniature Power Relay **JSM-RELAY**	Compact Flat Power **JV-RELAY**	Slim Type Power **JR-RELAY**	Compact PC Board Power Relay **JW-RELAY**	Compact Power Relay for inductive Load **JM-RELAY**
NEW 866 630 630		 1 126 504 1 122	 1 126 504 803	 1 197 630 1 024
• Dedicated for automotive applications • Contact capacity: 5A 16VDC, Inrush 25A (Motor load)	• High capacity in a compact body • High sensitivity	• 16A type available • Wide insulation distance • High inrush current capability	• High dielectric withstanding for transient protection • Class B coil insulation types available	• Super welding resistance • High surge resistance • Compact high capacity relay for inductive load
●	●		●	
Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy



JSM-RELAY	JV-RELAY	JR-RELAY	JW-RELAY	JM-RELAY
1a, 1c	1a, 1c	1a	Standard: 1a, 1c, 2a, 2c High capacity: 1a, 1c	1a
10^5	(Sealed) 10^5 (Flux-resistant) 10^5 to 3×10^5 (Automotive) 4×10^4	10^5	10^5	10^5
10^7	(Standard, High capacity) 10^7 (Automotive) 5×10^6	5×10^6	5×10^6	10^6
750Vrms	(Standard, High capacity) 1,000Vrms (Automotive) 750Vrms	1,000Vrms	1,000Vrms	1,000Vrms
—	—	3,000Vrms	—	—
1,500Vrms	1,500Vrms	5,000Vrms	5,000Vrms	5,000Vrms
—	—	—	—	—
—	—	10,000V surge	10,000V	—
(DC) 9, 12, 24V	(DC) 5, 6, 9, 12, 18, 24, 48*, 100V* *Only for Standard, High Capacity type.	(DC) 6, 12, 24, 48 V (AC) 115V	(DC) 5, 6, 9, 12, 24, 48 V	(DC) 5, 6, 9, 12, 24, 48V
640mW	(Standard, High capacity) 1a: 200mW 1c: 400mW (Automotive) 450mW	530mW	530mW	0.9W
 1a 4-1.3 dia. 4-.051 dia. 12 .472 2 .079 12.2 480 1c 5-1.3 dia. 5-.051 dia. 12 .472 2 079 12.2 480	DIL 	 Relay outline 4-1.3 DIA. 4-0.51 DIA. 7.5 .295 12.8 .504 1.45 .057 5 197 20 .787 28.6 1.126 (TMP)	 2.4 .094 4-1.3 dia. 4-.051 dia. 7.6 299 12.8 504 3.5 138 20 .787 1a	 27.6±0.1 1.087±.004 13.8±0.1 .543±.004 4-1.8 dia. 4-.071 dia. 12.0±0.1 .472±.004 12.0±0.1 .472±.004 10.0±0.1 .394±.004
—	UL (E57520), CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550), TV rating	UL (E57520), TÜV, VDE CSA (LR26550), TV rating	UL (E57520), CSA (LR26550)
┳	┳	┳ ■ ■	┳	■

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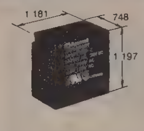
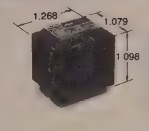
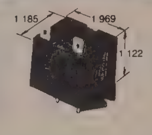
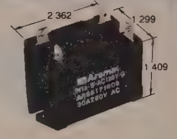
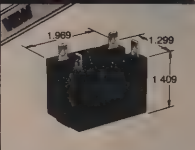
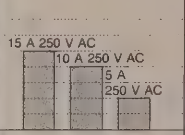
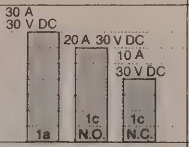
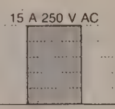
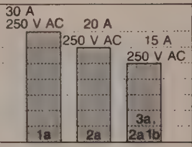
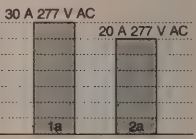
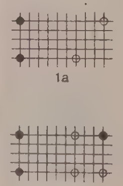
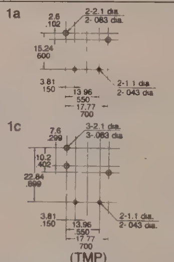
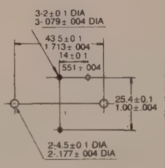
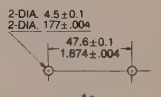
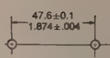
Relay Selector Chart

		Compact High Power **JC-RELAY**	30 A, DC Coil PC Board Relay **JT-RELAY**	1 HP Compact Power **JA-RELAY**	Compact High Power **JH-RELAY**	TV-15, 30 Amp (1 Form A) Power **HE-RELAY**
● **Type of relay**	inch	 1 181 748 1 197	 1.268 1.079 1 098	 1 185 1 969 1 122	 2 362 1 299 1 409	 NEW 1.969 1.299 1 409
● **Features**		● Class B coil type available ● TV-rated type available ● High dielectric withstanding: 10,000V surge	● High switching capacity ● Open, Dust cover, Sealed types available ● Class B coil type available	● High switching capacity 55A inrush, 15A steady ● TV-rated type available	● High dielectric withstanding: 10,000V surge ● High inrush resistance	● High dielectric withstanding: 10,000V surge ● High inrush resistance (TV-15: 1 Form A) (TV-10: 2 Form A)
● **Sealed types availability**			●			
● **Latching types availability**					●	
● **Contact material** (Optional material)		Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy
● **Contact rating chart** Maximum (cos $\varphi = 1$)	30 A 20 A 15 A 10 A 8 A 5 A 3 A					
Minimum	1 mA 100 µA 10 µA					
● **Contact arrangement**		1a 2a 1a1b	1a, 1c	1a, 1b, 1c	1a 2a 3a, 2a 1b	1a 2a
● **Life** (Min. operation)	**Electrical**	10^5	10^5	10^5	10^5	2×10^5
	Mechanical	5×10^6	10^7	5×10^6	5×10^6	10^7
● **Breakdown voltage**	Between open contacts	2,000Vrms	1,500Vrms	1,000Vrms	2,000Vrms	2,000Vrms
	Between contact sets	2,000Vrms	—	—	2,000Vrms	4,000Vrms
	Between contacts and coil	4,000Vrms	1,500Vrms	2,000Vrms	5,000Vrms	5,000Vrms
	Between live parts and ground	—	—	—	—	—
● **Surge withstand voltage**		10,000V surge	—	5,000V surge	10,000V surge	10,000V surge
● **Coil voltage**		(DC) 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 15, 18, 24V	(DC) 6, 12, 24V (AC) 6, 12, 24, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220, 240V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 240V
● **Nominal operating power**		(1a) 0.9W (2a, 1a1b) 1W	890mW	(DC) 1.2W (AC) 1.3VA	(DC) 1.9W (AC) 3.2VA	(DC) 1.9W (AC) 1.65 to 2.59VA
● **Terminal layout** (Bottom View) ●: coil terminal (.100 inch grid)	mm inch	 1a 2a, 1a1b	 1a 2.6 .102 2-2.1 dia. 2-.083 dia. 15.24 600 3.81 150 13 96 550 17.77 700 2-1 1 dia. 2-.043 dia 1c 7.6 .299 3-2.1 dia. 3-.083 dia 10.2 .402 22.84 .899 3.81 .150 13.96 .550 17 77 700 2-1.1 dia. 2-.043 dia. (TMP)	 3-2±0 1 DIA 3-.079±.004 DIA 43 5±0 1 1 713±.004 14±0 1 551±.004 25.4±0.1 1.00±.004 2-4.5±0 1 DIA 2-.177±.004 DIA (TMP)	 2-DIA. 4.5±0.1 2-DIA. .177±.004 47.6±0.1 1.874±.004 1a	 47.6±0.1 1.874±.004 (NEMA terminal)
● **Standards**		UL (E57520), VDE, CSA (LR26550), TV rating	UL (E57520), CSA (LR26550)	UL (E57520), TÜV, CSA (LR26550), TV rating	UL (E57520), VDE, TÜV, CSA (LR26550), TV rating	UL (E57520), CSA (LR26550)
● **Mounting method**		┳ ⊔ ▆	┳ ╬	▆ ╬	▆	▆

Note: Meaning of symbol marks ┳ : PC board terminal; ⊔ : Plug-in; ▆ : Top-mounting; ╬ : Top-mounting with PC board terminals; ☐ : Surface-mounting

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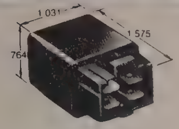
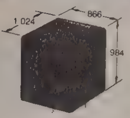
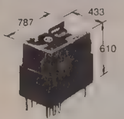
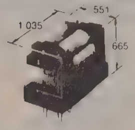
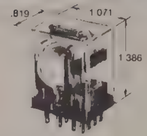
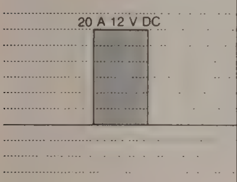
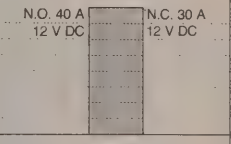
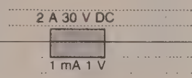
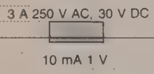
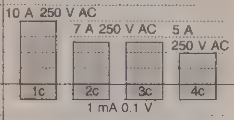
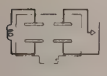
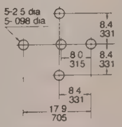
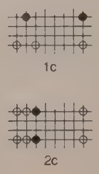
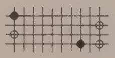
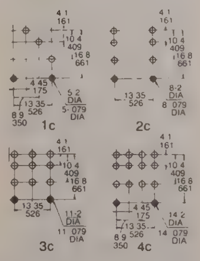
Automotive Power **CA-RELAY**	High Power Automotive Relay **CB-RELAY**	Subminiature DIL **HB-RELAY**	Subminiature **HA-RELAY**	Miniature Power **HC-RELAY**
 1 031 1 575 764	 1 024 866 984		 1 035 551 665	 .819 1 071 1 386
• Small size • Light weight • Completely water tight • Automotive direct plug-in	• 40 A rating at 85°C 185°F • ISO type terminals • High shock resistance for drop test requirements • Low temperature rise	• DIP terminal • Flux-resistant • Àg-Pd contacts type available	• Compact size • AC coils	• Wide applications • Versatile range • Foot print compatible with competitive types
●	●	●	●	●
Silver alloy	Silver alloy	Silver nickel (Silver palladium)	Silver nickel	Gold-flashed silver alloy
				
1a, 1b	1a, 1c	1c, 2c	1c	1c 2c 3c 4c
10^5	10^5	2×10^5	10^5	2×10^5
2×10^5	10^6	10^7	10^7	(DC) 10^8 (AC) 5×10^7
500Vrms	500Vrms	500Vrms	750Vrms	700Vrms
—	—	500Vrms	—	700Vrms
500Vrms	500Vrms	1,000Vrms	1,500Vrms	2,000Vrms
—	—	—	—	—
—	—	—	—	—
(DC) 5, 9, 12, 24V	(DC) 12, 24V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48V (AC) 6, 12, 24, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220/240V
1.8W	1.4W	(1C) 360mW (2C) 576mW	(DC) 360mW (AC) 0.9VA	(DC) 0.9W (AC) 1.2VA
 (Terminal layout)	 5-2 5 dia 5- 098 dia 8.4 331 8 0 315 8.4 331 8 4 331 17 9 705 (PCB type)			 4 1 161 10 4 409 16 8 661 4 45 175 5 2 DIA 5- 079 DIA 13 35 526 8 9 350 1c 8-2 DIA 8 079 DIA 2c 11-2 DIA 11 079 DIA 3c 14 2 DIA 14 079 DIA 4c
—	—	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), VDE, CSA (LR26550), TV rating

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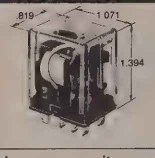
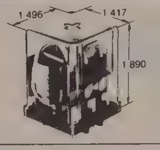
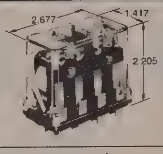
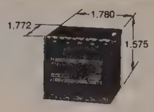
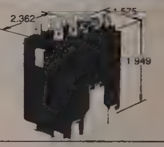
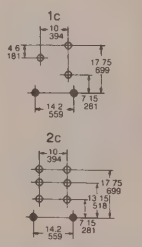
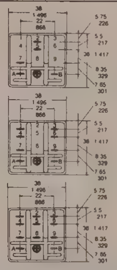
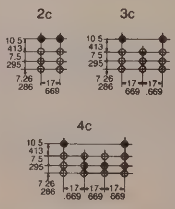
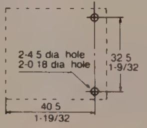
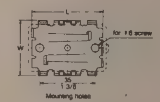
Relay Selector Chart

		Compact Power	10 Amp Power	20 Amp Power	Polarized High Power Relay	Heavy Duty Power
		HL-RELAY	**HP-RELAY**	**HG-RELAY**	**PC-5 RELAY**	**VC-RELAY**
• Type of relay	inch	 .819 1 071 1.394	 1 496 1 417 1 890	 2.677 1.417 2 205	 1.772 1.780 1.575	 2.362 1.575 1 949
• Features		• Large capacity • Compact size • Foot print compatible with competitive types	• Long life • Foot print compatible with competitive types	• Large capacity 20A	• Direct motor drive by IC output • Surge suppression circuit incorporated • Screw terminals	• Large capacity with Form X contacts • Screw terminals available
• Sealed types availability						
• Latching types availability						
• Contact material		Silver alloy	Silver alloy	Silver-cadmium-oxide	Silver alloy	Silver-cadmium-oxide
• Contact rating chart Maximum (cos φ = 1)	20 A 10 A 8 A 5 A 3 A 2 A 1 A	15 A 125 V AC 10 A 250 V AC	10 A 250 V AC	20 A 250 V AC	15 A 120 V AC X contact 10 A 240 V AC Y contact	20 A 220 V AC
Minimum	1 mA 100 µA 10 µA	1 mA 1 V 1 mA 1 V	10 mA 10 V	10 mA 1 V		
• Contact arrangement		1c 2c	1c, 2c, 3c	2c, 3c, 4c	4X, 3X1Y, 2X2Y	1X, 2X, 3X, 4X, 1X1Y, 2X1Y, 2X2Y, 3X1Y
• Life (Min. operation)	Electrical	5×10⁵	2×10⁵	2×10⁵	25×10⁴	2.5×10⁵
	Mechanical	(DC) 10⁸ (AC) 5×10⁷	10⁷	(DC) 10⁶ (AC) 10⁷	10⁷	10⁶
• Breakdown voltage	Between open contacts	1,000Vrms	(HP31, 32) 1,000Vrms (HP33) 2,000Vrms	2,000Vrms	2,500Vrms	2,500Vrms
	Between contact sets	1,500Vrms	2,000Vrms	2,000Vrms	—	2,500Vrms
	Between contacts and coil	2,000Vrms	2,000Vrms	2,000Vrms	—	2,500Vrms
	Between live parts and ground	—	—	—	—	—
• Surge withstand voltage		—	—	—	—	—
• Coil voltage		(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220/240V		(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 12, 24V	(AC) 24, 48, 110, 120, 220, 240V (DC) 12, 24, 48V
• Nominal operating power		(DC) 0.9 to 1.0W (AC) 1.2 to 1.3VA	(DC) 1.5W (AC) 2.0VA	(2c) 1.4W (DC) 3.6VA (AC) (3c) 1.6W (DC) 5.2VA (AC) (4c) 2.0W (DC) 7.6VA (AC)	500mW	5.0 to 6.6VA
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid)	mm inch	 1c 10 394 4 6 181 17 75 699 7 15 281 14 2 559 2c 10 394 17 75 699 13 15 518 7 15 281 14.2 559	 38 1 496 22 866 5 75 226 5 5 217 36 1 417 8 35 329 7 65 301 A B	 2c 3c 4c 10 5 413 7.5 295 7.26 286 17 669	Drilling dimensions for mounting screw  2-4 5 dia hole 2-0 18 dia hole 32 5 1-9/32 40 5 1-19/32	 L W for #6 screw 35 1 3/8 Mounting holes Mounting bracket L / W Bracket A: 45 1.772 / 35 1.378 Bracket B: 50 1.969 / 45 1.772
• Standards		UL (E57520), TV rating, CSA (LR26550)	UL (E57520), VDE, CSA (LR26550)	UL (E57520), CSA (LR26550)	UL (E57520), CSA (LR52199-6)	UL (E57520), VDE, CSA (LR26550), TÜV
• Mounting method		┳ ⍜ ▇	⍜	⍜	Screw terminal	▇

Note: Meaning of symbol marks ┳ : PC board terminal; ⍜ : Plug-in; ▇ : Top-mounting; ▇┳ : Top-mounting with PC board terminals; ▭ : Surface-mounting

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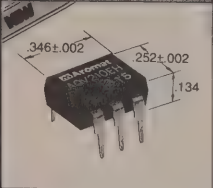
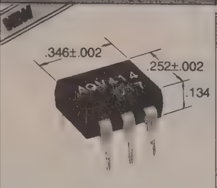
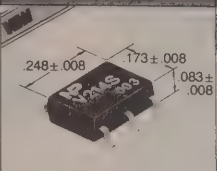
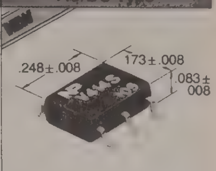
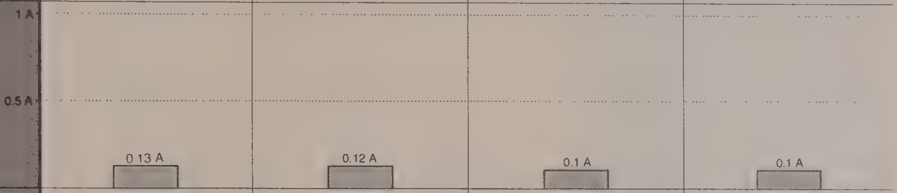
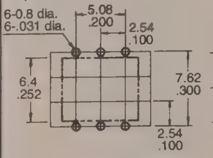
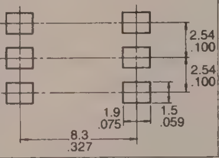
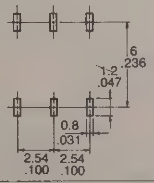
PhotoMOS Relay

			PhotoMOS Relay			
			AQV210EH Types	AQV41 Types	AQV214S Types	AQV414S Types
			AC/DC Type	AC/DC Type	AC/DC Type	AC/DC Type
• Type of relay inch						
• Features			• High sensitivity • Control low-level input signals	• Normally-closed type (1 Form B) • Low on-resistance	• SOP type • Control low-level input signals	• SOP type • Normally-closed type (1 Form B)
• Output	Load voltage	Peak AC	350 V	400 V	400 V	400 V
		DC	350 V	400 V	400 V	400 V
	Continuous load current		0.13 A	0.12 A	0.1 A	0.1 A
	Peak load current		0.3 A	0.3 A	0.3 A	0.3 A
	Power dissipation*		500 mW	500 mW	450 mW	450 mW
	ON resistance	Typical Maximum	23 Ω 35 Ω	26 Ω 50 Ω	30 Ω 50 Ω	26 Ω 50 Ω
	Off state leakage current		Max. 1 µA	Max. 1 µA	Max. 1 µA	Max. 1 µA
• Input	LED forwad current*		50 mA	50 mA	50 mA	50 mA
	LED reverse voltage*		3 V	3 V	3 V	3 V
	Peak forward current		1 A	1 A	1 A	1 A
	Power dissipation*		75 mW	75 mW	75 mW	75 mW
	LED operate current [LED operate (OFF) current]	Typical Maximum	1.6 mA 3 mA	1 mA 3 mA	0.7 mA 3 mA	0.6 mA 3 mA
	LED turn off current [LED reverse (ON) current]	Minimum Typical	0.4 mA 1.5 mA	0.4 mA 0.95 mA	0.4 mA 0.65 mA	0.4 mA 0.55 mA
	LED dropout voltage	Typical Maximum	1.14 V 1.5 V	1.14 V 1.5 V	1.14 V 1.5 V	1.14 V 1.5 V
• Turn on time [Operate (OFF) time]		Typical Maximum	0.7 msec. 2.0 msec.	0.47 msec. 1.0 msec.	0.25 msec. 0.5 msec.	0.47 msec. 1 msec.
• Turn off time [Reverse (ON) time]		Typical Maximum	0.05 msec. 1.0 msec.	0.28 msec. 1.0 msec.	0.05 msec. 0.2 msec.	0.28 msec. 1 msec.
• Total power dissipation*			550 mW	550 mW	500 mW	500 mW
• I/O isolation voltage*			5,000 V AC	1,500 V AC	1,500 V AC	1,500 V AC
• Temperature limits	Operating*		–20°C to +85°C –4°F to +185°F	–20°C to +80°C –4°F to +176°F	–20°C to +80°C –4°F to +176°F	–20°C to +80°C –4°F to +176°F
	Storage*		–40°C to +100°C –40°F to +212°F	–40°C to +100°C –40°F to +212°F	–40°C to +100°C –40°F to +212°F	–40°C to +100°C –40°F to +212°F
• I/O capacitance		Typical Maximum	0.8 pF 1.5 pF	0.8 pF 1.5 pF	0.8 pF 1.5 pF	0.8 pF 1.5 pF
• Intial I/O isolation resistance			1,000 MΩ	1,000 MΩ	1,000 MΩ	1,000 MΩ
• Terminal layout (.100, inch grid) mm inch			Through hole terminal (Bottom view)  6-0.8 dia. 6-.031 dia. 5.08 .200 2.54 .100 6.4 .252 7.62 .300 2.54 .100 Tolerance: ±0.1 ±.004	Surface mount terminal Mounting pad (Top view)  2.54 .100 2.54 .100 1.9 .075 1.5 .059 8.3 .327	Mounting pad (Top view)  6 .236 1.2 .047 0.8 .031 2.54 .100 2.54 .100	
• Standards			UL (E57521), CSA (LR26550), TÜV			
• Mounting method						

*The values are absolute maximum ratings (25˚C 77˚F). [ ]: Representation in case of Form B contact type.

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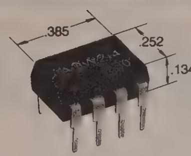
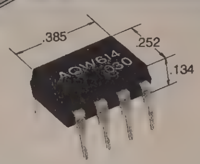
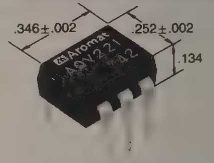
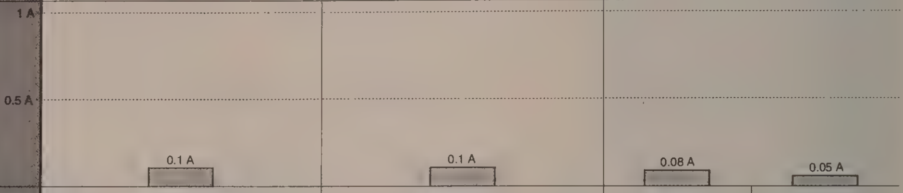
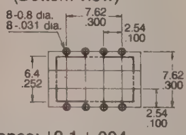
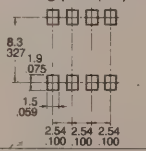
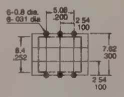
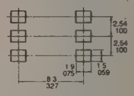
PhotoMOS Relay

		PhotoMOS Relay			
		AQW21 Types	AQW61 Types	AQV22 Types	
		AC/DC Type	AC/DC Type	AC/DC Type	
• Type of relay inch					
• Features		• Approx. 1/2 smaller compared with proximity mounting of two 1 Form A units • Applicable to 2 Form A units	• 1 Form A 1 Form B type • High speed switching	• For high fequency applications • Low "off state" leakage current	
• Output	Load voltage* Peak AC	400 V	400 V	40 V	80 V
	Load voltage* DC	400 V	400 V	40 V	80 V
	Continuous load current				
	Peak load current	0.3 A	0.3 A	0.18 A	0.15 A
	Power dissipation*	800 mW	800 mW	230 mW	
	ON resistance Typical	30 Ω	27 Ω	22 Ω	36 Ω
	ON resistance Maximum	50 Ω	50 Ω	35 Ω	50 Ω
	Off state leakage current	Max. 1 µA	Max. 1 µA	Max. 10 nA	
• Input	LED forwad current*	50 mA	50 mA	50 mA	
	LED reverse voltage*	3 V	3 V	3 V	
	Peak forward current	1 A	1 A	1 A	
	Power dissipation*	75 mW	75 mW	75 mW	
	LED operate current [LED operate (OFF) current] Typical	1 mA	0.7 mA (N.O.) 0.9 mA (N.C.)	0.9 mA	
	LED operate current [LED operate (OFF) current] Maximum	3 mA	3 mA	3 mA	
	LED turn off current [LED reverse (ON) current] Minimum	0.4 mA	0.4 mA	0.4 mA	
	LED turn off current [LED reverse (ON) current] Typical	0.79 mA	0.6 mA (N.O.) 0.8 mA (N.C.)	0.85 mA	
	LED dropout voltage Typical	1.14 V	1.14 V	1.14 V	
	LED dropout voltage Maximum	1.5 V	1.5 V	1.5 V	
• Turn on time [Operate (OFF) time]	Typical	0.31 msec.	0.28 msec. (N.O.) 0.43 msec. (N.C.)	0.10 msec.	
	Maximum	0.5 msec.	1 msec.	0.3 msec.	
• Turn off time [Reverse (ON) time]	Typical	0.05 msec.	0.04 msec. (N.O.) 0.3 msec. (N.C.)	0.03 msec.	
	Maximum	0.2 msec.	1 msec.	0.1 msec.	
Total power dissipation*		850 mW	850 mW	280 mW	
• I/O isolation voltage*		1,500 V AC	1,500 V AC	1,500 V AC	
• Temperature limits	Operating*	–20°C to +80°C –4°F to +176°F	–20°C to +80°C –4°F to +176°F	–20°C to +80°C –4°F to +176°F	
	Storage*	–40°C to +100°C –40°F to +212°F	–40°C to +100°C –40°F to +212°F	–40°C to +100°C –40°F to +212°F	
• I/O capacitance	Typical	0.8 pF	0.8 pF	0.8 pF	
	Maximum	1.5 pF	1.5 pF	1.5 pF	
• Initial I/O isolation resistance		1,000 MΩ	1,000 MΩ	1,000 MΩ (min.)	
• Terminal layout (.100, inch grid) mm inch		Through hole terminal (Bottom view)  8-0.8 dia. 8-.031 dia. 7.62 .300 2.54 .100 6.4 .252 7.62 .300 2.54 .100 Tolerance: ±0.1 ±.004	Surface mount terminal Mounting pad (Top view)  8.3 327 1.9 .075 1.5 .059 2.54 2.54 2.54 .100 .100 .100	Through hole terminal (Bottom view)  6-0.8 dia. 6-.031 dia. 5.08 .200 2.54 100 8.4 .252 7.62 300 2.54 100	Surface mount terminal Mounting pad (Top view)  2.54 100 2.54 100 1.9 075 1.5 059 8.3 327
• Standards		UL (E57521), CSA (LR26550), TÜV			
• Mounting method					

*The values are absolute maximum ratings (25°C 77°F).

[ ]: Representation in case of Form B contact type.

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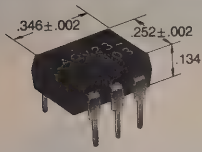
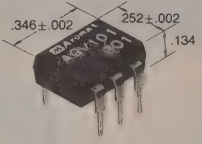
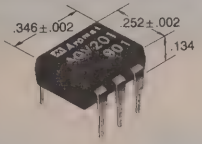
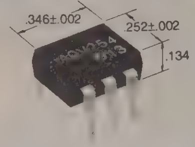
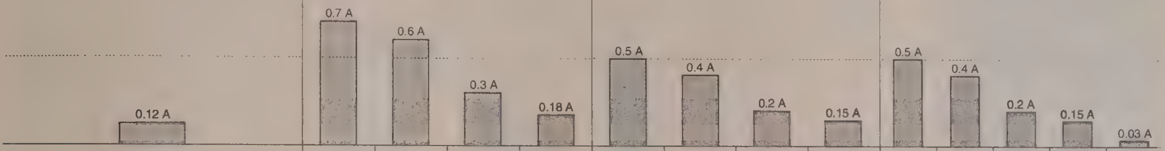
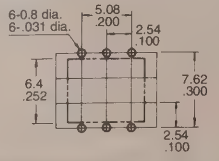
PhotoMOS Relay													
AQV23 Types	AQV10 Types				AQV20 Types				AQV25 Types				
AC/DC Type	DC Type				AC/DC Type				AC/DC Type				
													
• Highest sensitivity LED operate current: typical 0.31 mA	• Low on-resistance • Control with an input current of 10 mA								• Control low-level input signals • Highly sensitive and low on-resistance				
400 V	—	—	—	—	40 V	60 V	250 V	400 V	40 V	60 V	250 V	400 V	1,000 V
400 V	40 V	60 V	250 V	400 V	40 V	60 V	250 V	400 V	40 V	60 V	250 V	400 V	1,000 V

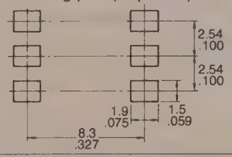


0.3 A	1.8 A	1.5 A	0.6 A	0.5 A	1.8 A	1.5 A	0.6 A	0.5 A	1.8 A	1.5 A	0.6 A	0.5 A	0.09A
500 mW	360 mW				360 mW				360 mW				
30 Ω 50 Ω	0.3 Ω 0.5 Ω	0.37 Ω 0.7 Ω	2.7 Ω 4 Ω	6.3 Ω 8 Ω	0.6 Ω 1 Ω	0.74 Ω 1.4 Ω	5.5 Ω 8 Ω	12.4 Ω 16 Ω	0.6 Ω 1 Ω	0.74Ω 1.4 Ω	5.5 Ω 8 Ω	12.4Ω 16 Ω	85 Ω 200 Ω
Max. 1 µA	Max. 1 µA				Max. 1 µA				Max. 1 µA				Max. 10 µA
50 mA	50 mA				50 mA				50 mA				
3 V	6 V				6 V				3 V				
1 A	1 A				1 A				1 A				
75 mW	150 mW				150 mW				75 mW				
0.31 mA 0.5 mA	2.3 mA 5 mA				2.4 mA 5 mA				0.9 mA 3 mA				
0.1 mA 0.29 mA	0.8 mA 2.2 mA				0.8 mA 2.2 mA				0.4 mA 0.8 mA				
1.1 V 1.5 V	2.3 V 3 V				2.3 V 3 V				1.14 V 1.5 V				
0.89 msec. 2 msec.	0.23 msec. 1 msec.	0.22 msec. 1 msec.	0.13 msec. 1 msec.	0.09 msec. 1 msec.	0.38 msec. 1 msec.	0.41 msec. 1 msec.	0.21 msec. 1 msec.	0.18 msec. 1 msec.	1.7 msec. 3 msec.	1.4 msec. 3 msec.	0.8 msec. 2 msec.		0.6 msec. 1 msec.
0.22 msec. 1 msec.	0.07 msec. 1 msec.	0.07 msec. 1 msec.	0.07 msec. 1 msec.	0.08 msec. 1 msec.	0.08 msec. 1 msec.	0.08 msec. 1 msec.	0.07 msec. 1 msec.	0.07 msec. 1 msec.	0.07 msec. 0.2 msec.		0.06 msec. 0.2 msec.	0.05 msec. 0.2 msec.	0.04 msec. 0.5 msec.
550 mW	410 mW				410 mW				410 mW				
1,500 V AC	1,500 V AC				1,500 V AC				1,500 V AC				
–20°C to +80°C –4°F to +176°F	–20°C to +80°C –4°F to +176°F				–20°C to +80°C –4°F to +176°F				–20°C to +80°C –4°F to +176°F				
–40°C to +100°C –40°F to +212°F	–40°C to+100°C –40°F to+212°F				–40°C to+100°C –40°F to+212°F				–40°C to +100°C –40°F to +212°F				
0.8 pF 1.5 pF	1.3 pF 3 pF				1.3 pF 3 pF				1.3 pF 3 pF				
1,000 MΩ (min.)	1,000 MW (min.)				1,000 MΩ (min.)				1,000 MΩ				

Through hole terminal (Bottom view)



Surface mount terminal
Mounting pad (Top view)



UL (E57521), CSA (LR26550), TÜV

▼ □

Note: Meaning of symbol marks ▼ : PC board terminal; ▽ : Plug-in; ▲ : Top-mounting; ▲ : Top-mounting with PC board terminals; □ : Surface-mounting

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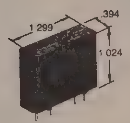
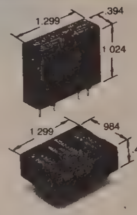
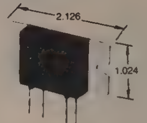
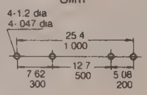
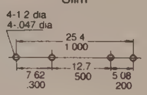
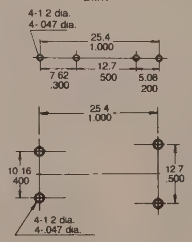
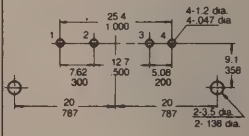
Solid State Relay

	AQ1 Solid State Relay			
	Photo-Transistor			
	—	—	Zero-cross	
	1A (DC output)	2 A (DC output)	2 A	5 A
● Types of relay inch	 1.299 .394 1.024	1.299 .394 1.024	 1.299 .394 1.024 1.299 .984 .472	
● Load side — Load voltage — AC	—	—	75 to 250 V	
● Load side — Load voltage — DC	10 to 200 V	3 to 60 V	—	—
● Load side — Max. load current (40 A, 20 A, 10 A, 8 A, 5 A, 3 A, 2 A, 1 A)	1 A	2 A	2 A	5 A
● Load side — Off state leakage current, max.	1 mA		5 mA	
● Load side — Non-repetitive surge current	5 A (1 sec.)		80 A	100 A
● Input side — Input voltage	3 to 28 V DC		3 to 28 V DC	
● Input side — Input impedance, approx.	1.6 kΩ		1.6 kΩ	
● Input side — Drop-out voltage, min.	0.8 V			
● Operate time, max.	0.5 msec.		1/2 cycle of voltage sine wave+1 msec.	
● Release time, max.	2 msec.		1/2 cycle of voltage sine wave+1 msec.	
● Breakdown voltage	3,000 V AC		3,000 V AC	1,500 V (between input and output) 3,000 V (between input, output and case)
● Ambient temperature	−30°C to +80°C −22°F to +176°F		−30°C to +80°C −22°F to +176°F	
● Snubber circuit integrated	—	—	●	●
● LED operation indicator	—	—	—	—
● Terminal layout (Bottom view) mm inch	Slim  4-1.2 dia 4-.047 dia 25.4 1.000 12.7 .500 7.62 .300 5.08 .200	Slim  4-1.2 dia 4-.047 dia 25.4 1.000 12.7 .500 7.62 .300 5.08 .200	Slim  4-1.2 dia. 4-.047 dia. 25.4 1.000 12.7 .500 7.62 .300 5.08 .200 25.4 1.000 10.16 .400 12.7 .500 4-1.2 dia. 4-.047 dia.	 1 2 3 4 25.4 1.000 4-1.2 dia. 4-.047 dia. 12.7 .500 9.1 .358 7.62 .300 5.08 .200 20 .787 20 .787 2-3.5 dia. 2-.138 dia.
● Standards	UL (E57521), CSA (LR26550)		UL (E57520), CSA (LR26550), TÜV	
● Mounting method	┳		┳	

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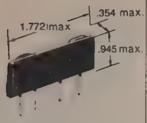
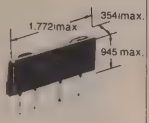
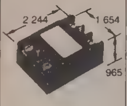
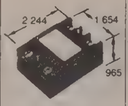
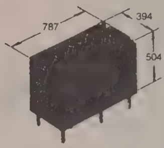
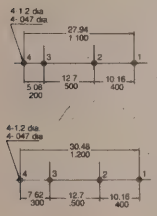
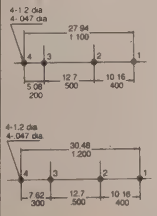
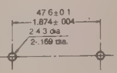
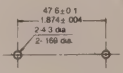
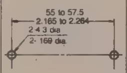
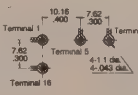
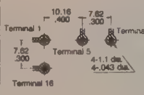
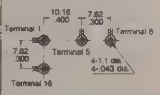
AQ8 Solid State Relay		AQ-P Solid State Relay			AQ-C Solid State Relay		
Photo-Triac		Photo-Transistor			Photo-Triac		Photo-Transistor
Zero-cross	Non zero-cross	Zero-cross			Zero-cross	Non zero-cross	—
2 A		10 A	20 A	40 A	1 A		1 A (DC output)
 1.772 max .354 max. .945 max.	 1.772 max .354 max. .945 max.	 2.244 1.654 .965	 2.244 1.654 .965	2.756 1.969 1.008			
75 to 125 V 75 to 250 V		75 to 250 V			75 to 125 V 75 to 250 V		—
—	—	—	—	—	—	—	3 to 60 V
2 A	2 A	10 A	20 A	40 A	1 A	1 A	1 A
5 mA	5 mA	7 mA	10 mA	10 mA	1.1 mA		0.1 mA
30 A	30 A	150 A	220 A	440 A	20 A		1.5 A
5 V DC 12 V DC 24 V DC	5 V DC 12 V DC 24 V DC	4 to 30 V DC			4 to 6 V 9.6 to 14.4 V 21.6 to 26.4 V	4 to 6 V 9.6 to 14.4 V 21.6 to 26.4 V	4 to 6 V 9.6 to 14.4 V 21.6 to 26.4 V
0.18 kΩ 0.55 kΩ 1.4 kΩ	0.18 kΩ 0.55 kΩ 1.4 kΩ	1.5 kΩ			0.3 kΩ 0.8 kΩ 1.8 kΩ	0.3 kΩ 0.8 kΩ 1.8 kΩ	430 Ω 1.2 kΩ 2.8 kΩ
0.5 V 1.2 V 2.4 V	0.5 V 1.2 V 2.4 V	0.8 V			0.5 V 1.2 V 2.4 V	0.5 V 1.2 V 2.4 V	0.8 V
1/2 cycle of voltage sine wave+1 msec.	1 msec.	1/2 cycle of voltage sine wave +1 msec.			(1/2 cycle at voltage sine wave)+1 msec.	1 msec.	0.5 msec.
1/2 cycle of voltage sine wave +1 msec.	1/2 cycle of voltage sine wave +1 msec.	1/2 cycle of voltage sine wave +1 msec.			(1/2 cycle of voltage since wave)+1 msec.		1 msec.
3,000 V AC		1,500 V AC			2,500 V AC		
–30°C to +80°C –22°F to +176°F		–30°C to 80°C –22°F to +176°F			–30°C to +80°C –22°F to +176°F		
●	●	●	●	●	●	●	—
—	—	●	●	●	—	—	—
 4-1.2 dia 4-.047 dia 27.94 1.100 4 3 2 1 5.08 .200 12.7 .500 10.16 .400 4-1.2 dia. 4-.047 dia 30.48 1.200 7.62 .300 12.7 .500 10.16 .400	 4-1.2 dia 4-.047 dia 27.94 1.100 4 3 2 1 5.08 .200 12.7 .500 10.16 .400 4-1.2 dia. 4-.047 dia. 30.48 1.200 7.62 .300 12.7 .500 10.16 .400	 47.6±0.1 1.874±.004 2-4.3 dia 2-.169 dia.	 47.6±0.1 1.874±.004 2-4.3 dia 2-.169 dia.	 55 to 57.5 2.165 to 2.264 2-4.3 dia 2-.169 dia.	 10.16 .400 7.62 .300 Terminal 1 Terminal 8 7.62 .300 Terminal 5 4-1.1 dia. 4-.043 dia. Terminal 16	 10.16 .400 7.62 .300 Terminal 1 Terminal 8 7.62 .300 Terminal 5 4-1.1 dia. 4-.043 dia. Terminal 16	 10.16 .400 7.62 .300 Terminal 1 Terminal 8 7.62 .300 Terminal 5 4-1.1 dia. 4-.043 dia. Terminal 16
UL (E57520), CSA (LR26550), TÜV		—			—		
		—					

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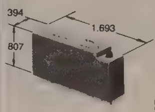
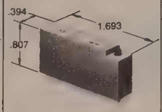
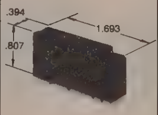
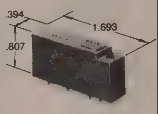
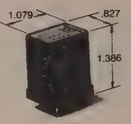
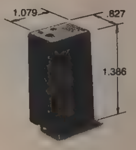
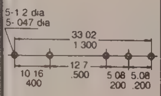
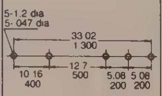
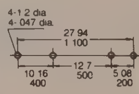
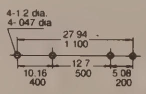
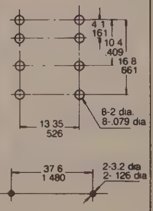
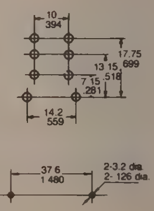
Relay Selector Chart

		I/O Relay				H-OP Relay	
		Photo-Transistor				Hybrid-output	
		—	—	Zero-cross	—	Non zero-cross	
		AC Input modules	DC Input modules	AC Output modules	DC Output modules	5 A	10 A
• Types of relay	inch						
Load side	Load voltage AC	—	—	75 to 125 V 75 to 250 V	—	75 to 250 V	
	Load voltage DC	4 to 15 V 10 to 32 V		—	3 to 60 V 10 to 200 V	—	—
	Max. load current	15 mA	15 mA	2 A	2 A 1 A	5 A	10 A
	Off state leakage current, max.	100 µA		5 mA	1 mA	2 mA	3 mA
	Non-repetitive surge current	—	—	30 A	5 A (1 sec.)	80 A	170 A
•Input side	Input voltage	80 to 140 V AC 160 to 280 V AC	3 to 32 V DC	3/15, 4/15, 10/32 V DC		3, 5, 12, 24 V	3, 5, 12, 24 V
	Input impedance, approx.	— —	—	1.6, 1.7, 5.6 kΩ		—	—
	Drop-out voltage, min.	10 V AC 20 V AC	0.8 V	0.8 V		10% of input voltage	
• Operate time, max.		20 msec.	5 msec.	1/2 cycle of voltage sine wave+1 msec.	0.5 msec.	8 msec.	15 msec.
• Release time, max.		20 msec.	2 msec.	1/2 cycle of voltage sine wave+1 msec.	2 msec.	8 msec.+1/2 cycle	15 msec.+1/2 cycle
• Breakdown voltage		4,000 V AC		4,000 V AC		3,000 V AC	3,750 V AC
• Ambient temperature		−30°C to +80°C −22°F to +176°F		−30°C to +80°C −22°F to +176°F		−30°C to +60°C −22°F to +140°F	
• Snubber circuit integrated		—	—	●	—	●	●
• LED operation indicator		●	●	●	●	●	●
• Terminal layout (Bottom view)	mm inch						
• Standards		UL (E57521), CSA (LR26550)		UL (E57521), CSA (LR26550)		UL (E57521), CSA (LR26550)	UL (E57520), CSA (LR26550), TÜV
• Mounting method							

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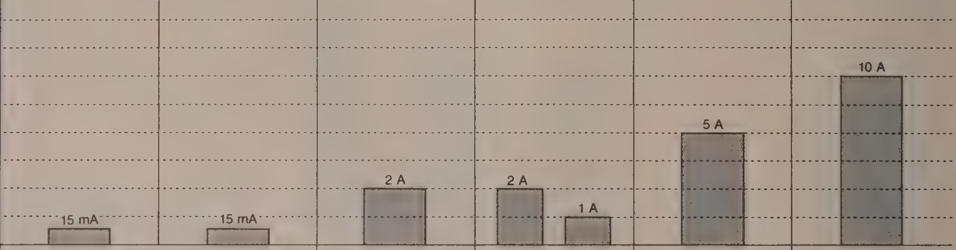

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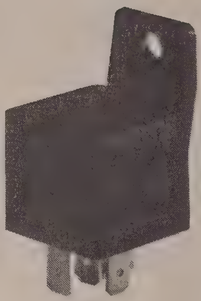
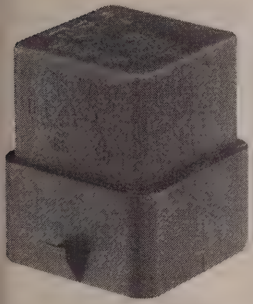
BOSCH Relays

The Mini-Giants®

The Mini-Giants® Micro Relays

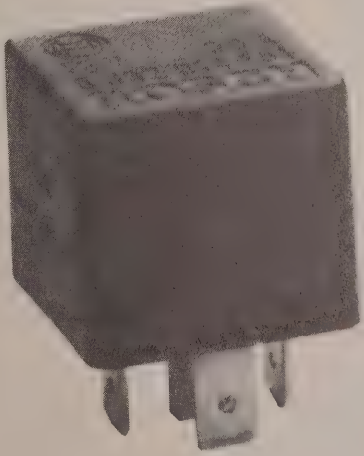

The Mini-Giants® Electrical Relays


The Skirted Mini-Giants® Electrical Relays

The Sealed Skirted Mini-Giants® Electrical Relays

PART NUMBER	VOLTAGE	DESCRIPTION	N.O. Contact		N.C. Contact		Switching Cycles			
			Resistive Load	Motor Load	Resistive Load	Motor Load	Resistive Load N.O.	Resistive Load N.C.	Motor Load N.O.	Motor Load N.C.
332 017 102	12V	SPST W/BRACKET	20A	20A	—	—	100,000	—	50,000	—
332 207 101	12V	SPST W/BRACKET	20A	20A	10A	10A	100,000	100,000	50,000	50,000
332 207 105	12V	SPDT PCS MOUNT	20A	20A	10A	10A	100,000	100,000	50,000	50,000
332 204 184	12V	SPDT W/RESISTOR W/BRACKET	30A	15A	20A	15A	100,000	50,000	100,000	50,000
332 014 150	12V	SPST W/BRACKET	30A	15A	—	—	50,000	—	50,000	—
332 204 150	12V	SPDT W/BRACKET	30A	15A	20A	15A	50,000	50,000	50,000	50,000
332 204 159	12V	SPDT W/RESISTOR (GMC)	30A	15A	20A	15A	100,000	50,000	100,000	50,000
332 204 171	12V	SPDT W/RESISTOR 65 OHM COIL W/BRACKET (GMC)	30A	15A	20A	15A	100,000	50,000	50,000	50,000
332 204 164	12V	SPDT PCB MOUNT	30A	15A	20A	15A	100,000	50,000	100,000	100,000

Bosch, The Right Relay 99.999% Of The Time



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CP CLARE Corporation

Clare•ification Chart Electromagnetic Relays

RELAYS FORM A, B

Product Name	Contact Form	Contact Material	Maximum Switching Power (VA)	Maximum Switching Voltage (VDC)	Maximum Switching Current (A)	Nominal Input Power (mW) Reference 5V Version	Operate Time (ms) (Typical)	Life @ Signal (10 VDC, 10 mA) Level Loads (No. Operations)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	Packaged Type
MRBS	1A	RUTHENIUM	5	75	0.15	10	1.30	200 x 10^6	NO	BSI	METAL
PRMA	1A, 2A, 1B	RUTHENIUM	10	100	0.50	50	0.25	200 x 10^6	YES	UL, VDE	MOLDED
DSS4	1A	RUTHENIUM	10	100	0.50	50	0.25	200 x 10^6	YES	UL	MOLDED
CUP V	1A, 2A, 1B, 1A1B, 2A2B	RUTHENIUM	10	200	0.75	175	0.45	300 x 10^6	NO	BSI, PTB	PLASTIC
CUP 1	1A THRU 5A, 1B, 2B	RUTHENIUM	10	200	0.75	73	0.70	300 x 10^6	NO		PLASTIC
DSS7	1A	RUTHENIUM	10	100	0.50	50	0.25	200 x 10^6	NO	BSI, VDE	MOLDED
PRME	1A	RUTHENIUM	10	100	0.50	50	0.25	200 x 10^6	NO		MOLDED
MRB	1A, THRU 6A, 1B, 2B	RUTHENIUM	10	200	0.50	111	1.00	200 x 10^6	NO	UL	METAL
951	1A THRU 5A	RUTHENIUM	10	150	0.75	132	0.50	200 x 10^6	NO		MOLDED
MSS2	1A	MERCURY	30	350	0.75	178	1.20	200 x 10^6	YES	VDE	MOLDED
MSS4	1A	MERCURY	30	350	0.75	178	1.20	200 x 10^6	YES		MOLDED
MSS6	2A	MERCURY	30	350	0.75	312	1.20	200 x 10^6	YES		PLASTIC
MSS7	1A	MERCURY	30	350	0.75	178	1.20	20 x 10^6	YES	BSI, VDE	MOLDED
CUP 6	1A THRU 5A, 1B	MERCURY	30	350	0.75	179	2.00	200 x 10^6	YES		PLASTIC
CUP 5	1A THRU 5A, 1B	MERCURY	30	350	1.00	179	1.60	100 x 10^6	YES		PLASTIC
MMRB	1A THRU 5A	MERCURY	30	350	0.75	125	1.60	200 x 10^6	YES		METAL
MRBV	1A, 1B	RUTHENIUM	40	200	1.00	125	2.00	100 x 10^6	NO		METAL
HRM	1A, 2A	MERCURY	50	350	1.00	75	1.60	1000 x 10^6	YES		METAL
HRB	1A THRU 6A	MERCURY	50	350	1.00	125	2.00	1000 x 10^6	YES		METAL
CTR5	1A	PLATINUM/NICKEL-NICKEL/IRON	50	350	1.00	150	1.30	1 x 10^6	NO		OPEN
851	1A THRU 5A	MERCURY	50	350	1.00	208	2.00	1000 x 10^6	YES		MOLDED

RELAYS FORM C

Product Name	Contact Form	Contact Material	Maximum Switching Power (VA)	Maximum Switching Voltage (VDC)	Maximum Switching Current (A)	Nominal Input Power (mW) Reference 5V Version	Operate Time (ms) (Typical)	Life @ Signal (10 VDC, 10 mA) Level Loads (No. Operations)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	Packaged Type
PRMA	1C	RHODIUM	3	100	0.25	125	1.50	20 x 10^6	NO		MOLDED
LSR	2C	RHODIUM	3	100	0.20	200	1.00	100 x 10^5	NO	BSI	PLASTIC
922	1C THRU 4C	RHODIUM	3	28	0.25	125	2.00	20 x 10^6	NO		METAL
HGZM	1C, 2C	MERCURY	50	350	1.00	568	2.50	100 x 10^6	YES		PLASTIC
LX	2C	SILVER-PD, GOLD	60	220	2.00	200	2.00	100 x 10^6	YES	UL, CSA	PLASTIC
LM44	2C	SILVER-PD, GOLD	60	150	2.00	150	3.00	10 x 10^6	YES	UL, CSA	PLASTIC
LQ	2C	SILVER ALLOY, GOLD	62	220	2.00	140	6.00	5 x 10^5	YES	UL, CSA	PLASTIC
MHC	1C, 2C	MERCURY	50	350	1.00	161	2.00	1000 x 10^6	YES		PLASTIC
HGJM	1C. 2C	MERCURY	100	500	2.00	200	1.00	2000 x 10^6	YES	UL	METAL
HGWM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	213	1.00	2000 x 10^6	YES		METAL
HGRM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	357	1.75	2000 x 10^6	YES	UL	METAL
HGSM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	290	1.75	2000 x 10^6	YES		METAL
HGSR	1C, 1D	MERCURY	100	500	2.00	357	1.75	2000 x 10^6	YES		METAL
HGM	1D, 2D	MERCURY	250	500	5.00	2100	3.00	2000 x 10^6	YES		METAL
HG	1D, 2D	MERCURY	250	500	5.00	625	3.00	2000 x 10^6	YES		METAL

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Clare • ification Chart Reed Switches

Product Name	Contact Form	Contact Material	Maximum Switching			Nominal Input Power (mW) Reference 5V Version	Operate Time (ms) (Typical)	Life @ Signal (10 VDC, 10 mA) Level Loads (No. Operations)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	Packaged Type
			Power (VA)	Voltage (VDC)	Current (A)						
REED SWITCHES											
MIN	1A	RUTHENIUM	5	200	0.50	10-40 OP NI	0.50	800 X 10³			GLASS
FR 2	1A	RUTHENIUM	10	200	0.50	10-40 OP NI	0.50	200 X 10⁶			GLASS
MA 1	1A	MERCURY	30	350	0.75	30-70 OP NI	1.00	200 X 10⁶			GLASS
MH 3	1A	MERCURY	50	350	1.00	30-65 OP NI	2.00	1000 X 10⁶			GLASS
HGZ	1C	MERCURY	50	350	1.00	35-70 OP NI	2.50	1000 X 10⁶			GLASS
HG W	1C	MERCURY	100	500	2.00	60 NI MAX	1.00	2000 X 10⁶			GLASS
HG 1	1D	MERCURY	250	500	5.00	120-180 OP NI	3.00	2000 X 10⁶			GLASS

Solid State Products Division

Clare • ification Chart Solid State Relays

Product Name	Contact Form	Output Switch Device	Typical Output Characteristics			Typical Control Characteristics (mA)	Typical Operate Time (mS)	I/O Isolation Typ. (Vrms)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	Package Type
			Blocking Voltage	Load Current (A)	On-Resistance (Ohms)						
AC/DC SWITCHES											
LCA	1A, 2A	MOS FET	350	.170	8	2	1	3750	YES	UL, BABT	6PIN, 8 PIN
XCA	1A, 2A	MOS FET	300	.100	25	5	1	3750	YES	UL, BABT	6 PIN, 8 PIN
PLA	1A	MOS FET	400	.100	4	2	0.4	3750	YES	UL, BABT	6 PIN, 8 PIN
LCB	1B, 2B	MOS FET	350	.120	8	2	1	3750	YES	UL, BABT	6 PIN, 8 PIN
LAA	2A	MOS FET	350	.170	8	2	1	3750	YES	UL, BABT	8 PIN DIP
LBB	2B	MOS FET	350	.170	8	2	1	3750	YES	UL, BABT	8 PIN DIP
LCC	1C	MOS FET	350	.170	16	5	1	3750	YES	UL, BABT	8 PIN DIP
LBA	1A/1B	MOS FET	350	.170	8	2	1	3750	YES	UL, BABT	8 PIN DIP
AC POWER SWITCHES											
PM	1A	SCR	600	.500	N/A	5	8.3	3750	N/A	UL	6 PIN DIP
PD	1A	SCR	600	1	N/A	5	8.3	3750	N/A	UL	16 PIN DIP
PS	1A	SCR	500	1	N/A	5	8.3	3750	N/A	UL	8 PIN DIP
OF'02	1A	SCR	500	1.5	N/A	16	8.3	4000	N/A	UL	PLASTIC
OF'05D	1A	TRIAC	500	3	N/A	16	8.3	4000	N/A	UL	PLASTIC
MX	1A	TRIAC	500	1	N/A	15	32	3750	N/A	UL, CSA	PLASTIC
JT	1A	TRIAC	500	10	N/A	15	32	3750	N/A	UL, CSA	PLASTIC
OF'05	1A	TRIAC	500	5	N/A	16	8.3	4000	N/A	UL, CSA	PLASTIC
OF'10	1A	TRIAC	500	10	N/A	16	8.3	4000	N/A	UL, CSA	PLASTIC
SPECIALTY PRODUCTS											
LDA1XX	N/A	TRANSISTOR	50	.100	N/A	6	N/A	3750	YES	UL, BABT	6 PIN DIP
LDA2XX	N/A	TRANSISTOR	50	.100	N/A	6	N/A	3750	YES	UL, BABT	8 PIN DIP
TS	1A, 1B	MOS FET/ TRANSISTOR	400/50	.170/.100	12	2	1	3750	YES	UL, BABT	8 PIN DIP
FDA	FET DRIVER	IC	N/A	N/A	N/A	2	1	3750	N/A		8 PIN DIP

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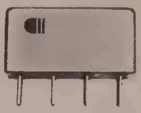
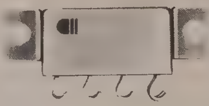
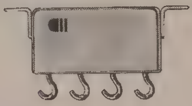
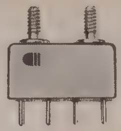
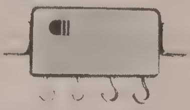
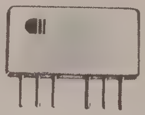
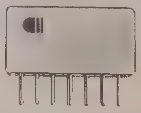
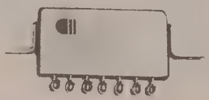
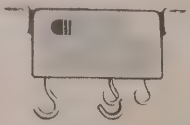
Military Grade/Half Size Relays

RELAY		CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
	**HFW** (Standard Sensitivity)	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating -65°C to +125°C • Qualified to MIL-R-39016/6 level L, M & P (Request Brochure Half Size 1-91)
	**HFW4A** (4 Amp Rating)	• Low Level to 4.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Low contact resistance • Excellent RF switching • Ambient temp rating -65°C to +125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)
	**HFW5A** (5 Amp Rating)	• Low Level to 5.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating -65°C to +125°C • Qualified to MIL-R-39016/6 level L, M & P (Request Brochure Half Size 1-91)
	**HMS** (Sensitive Series)	• Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 36.0 VDC	• Low contact resistance • Energy saving 100/125 milliwatt sensitivity • Excellent RF switching • Ambient temp rating -65°C to +125°C • Qualified to MIL-R-39016/44 level L, M & P (Request Brochure Half Size 1-91)
	**HMB** (Bifilar Coil)	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6 to 26.5 VDC	• Low contact resistance • Bifilar transient suppression • Excellent RF switching • Ambient temp rating -65°C to +125°C • Qualified to MIL-R-39016/22 level L, M & P (Request Brochure Half Size 1-91)
	**LS** (2 Pole Latching)	• Low Level to 2.0 Amps • 2 Form C, (DPDT)	5 to 48.0 VDC	• Low contact resistance • Single or dual latch version • Excellent RF switching • Qualified to MIL-R-39016/45 level L, M (Request Brochure Half Size 1-91)
	**LR** (4 Pole Latching)	• Low Level to 2.0 Amps • 4 Form C, (4PDT)	5 to 48.0 VDC	• Low contact resistance • Four pole design • Ambient temp rating -65°C to +125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)
	SR (4 Pole Version)	• Low Level to 2.0 Amps • 4 Form C, (4PDT)	6 to 26.5 VDC	• Low contact resistance • Four pole design • Ambient temp rating -65°C to +125°C • Qualified to MIL-R-39016/40 level L, M (Request Brochure Half Size 1-91)
	**SS** (6 Pole Version)	• Low Level to 2.0 Amps • 6 Form C, (6PDT)	6 to 26.5 VDC	• Low contact resistance • Six pole hi-density design • Ambient temp rating -65°C to +125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)
	**C-10 AMP** (10 Amp Series)	• Low Level to 10 Amps • 1 Form C, (SPDT)	6 to 26.5 VDC	• Low contact resistance • Unique hi-current design package • Ambient temp rating -65°C to +125°C • Designed to MIL-R-39016 (Request Brochure Half Size 1-91)

SIZE (Case Size): in./(mm) H-.410 (10.41), D-.410 (10.41) & W-.810 (20.57) All relays have welded, hermetically sealed enclosures.

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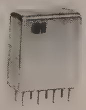
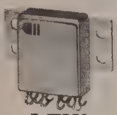
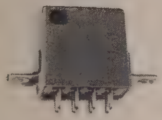
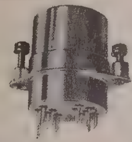
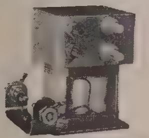
See Volume B Section 4550 for CII Solenoids

Military Grade/Full Size Relays

RELAY	SIZE in./(mm) (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
FW (3 Amp Series)  **FW5A** (5 Amp Version)  **LFW** (Latching Series)	H- .875 (22.23) * D- .400 (10.16) W- .800 (20.32)	FW & LFW • Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A FW5A • Low Level to 5.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.3 to 110.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available (FW only) • Excellent RF switching • Ambient temp rating -65° to +125°C • One and two coil operation (LFW only) • Qualified to 5757/10 (FW only) (Request Data Sheet FW6-89)

Military Grade/Other Relays

PF 10 Amp Power Relay	H- 1.300 (33.02) D- .515 (13.08) W- 1.075 (27.31)	• Low Level to 10.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.0 to 115.0 VDC	• Welded, hermetically sealed enclosures • Very low contact resistance • Package volume .72 cubic inch • Excellent RF switching • Ambient temp rating -65° to +125°C • Designed to MIL-R-5757/23 & 28 (Request Data Sheet PF-85)
 **07**	H- 1.000 (25.40) D- .515 (13.08) W- 1.015 (25.78)	• Low Level to 10.0 Amps • 2 Form C	6.0 to 120.0 VDC or 115.0 VAC 60/400 Hz	• Qualified to MIL-R-5757/23 & MIL-R-6106 (MS27245 & MS27247) • 10 Amp contact rating • DC & AC coils
RD 4&6 Pole Relays	H- 1.34 (34.04) D- 1.14 (28.96) W- 1.06 (26.92)	• Low Level to 2.0 Amps • 4 Form C, 6 Form C	26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Welded construction • 100G Shock • Ambient temp rating -65° to +125°C • Qualified to MIL-R-5757/1 & 7 (Request Data Sheet RD-83)
02	H- 1.575 (40.01) D- .718 (18.24) W- 1.062 (26.97)	• Low Level to 2.0 Amps • 2 Form C	6.0 to 50.0 VDC	• Compact 2 pole design • Military construction • Hermetically sealed • Qualified to M5757/8
03 	H- 1.407 (35.74) D- 1.320 (33.53) W- 1.843 (46.81)	• Low Level to 2.0 Amps • 6 Form C	6.0 to 48.0 VDC	• Efficient 6 pole design • Military construction • Hermetically sealed
82 	H- 3.093 (78.56) D- 4.375 (111.13) W- 4.250 (107.95)	• 150.0 Amps • 1 Form X to 4 Form X	6.0 to 120.0 VDC	• 150 Amp contact rating • High power switching • Up to 4 pole contacts • Optional hermetic sealing
SF 40 MW Sensitive Relay **SF5A** 80 MW (5 Amp Version)	H- 1.281 (32.54) D- .400 (10.16) W- .800 (20.32)	**SF & SF5A** • Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	1.8 to 40.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • 40 milliwatt sensitivity (SF 5A 80 milliwatts) • Excellent RF switching • Ambient temp rating -65° to +125°C • Designed to MIL-R-5757/13 (Request Data Sheet SF-85)
MFW ⅙th Size Relay	H- .410 (10.41) D- .230 (5.84) W- .500 (12.70)	• Low Level to 1.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	3.5 to 53.0 VDC	• Hermetically sealed enclosures • Low contact resistance • Total volume only .046 cubic inch • Excellent RF switching • Ambient temp rating -65° to +125°C • Qualified to MIL-R-39016/34, L & M level (Request Data Sheet MFW6-88)

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TO-5 Military Relays

TM/TMD

SIZE in./(mm)

- Diameter:
  - Enclosure (max): .335 (8.51)
  - Base (max): .370 (9.40)
- Height (max): .270 (6.86)
- All welded construction, hermetically sealed

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp/ 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	50 Ω
6.0 VDC	98 Ω
9.0 VDC	220 Ω
12.0 VDC	390 Ω
18.0 VDC	880 Ω
26.5 VDC	1560 Ω
30.0 VDC	2500 Ω

FEATURES

TM Military Relay

- Qualified to MIL-R-39016/9
- 130mW Sensitivity
- -65°C to +125°C
- 30G Vibration
- 75G Shock

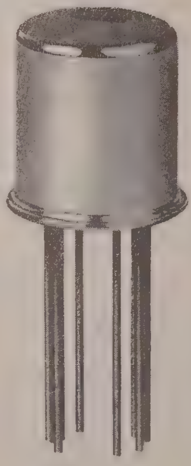
TMD Military Relay

- Qualified to MIL-R-39016/15
- Diode Coil Supression
- 130mW Sensitivity
- -65°C to +125°C
- 30G Vibration
- 75G Shock

Options for all TO-5 Military Relays

- Terminal Lengths
- Special Coils
- Ground Pins
- Spreader Pads

Available with and without diodes.



TS/TSD

SIZE in./(mm)

- Diameter:
  - Enclosure (max): .335 (8.51)
  - Base (max): .370 (9.40)
- Height (max): .375 (9.53)
- All welded construction, hermetically sealed

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp/ 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	100 Ω
6.0 VDC	200 Ω
9.0 VDC	400 Ω
12.0 VDC	850 Ω
18.0 VDC	1600 Ω
26.5 VDC	3300 Ω
36.0 VDC	6500 Ω
48.0 VDC	11000 Ω

FEATURES

TS Military Relay

- Qualified to MIL-R-39016/11
- -65°C to +125°C
- 60mW Sensitivity
- 30G Vibration
- 75G Shock

TSD Military Relay

- Qualified to MIL-R-39016/16
- Diode Coil Supression
- -65°C to +125°C
- 60mW Sensitivity
- 30G Vibration
- 75G Shock

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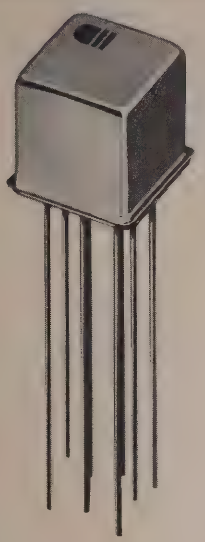
.100 Grid Military Relays



TC/TCD

SIZE in./(mm)

- Width & Depth:
  - Enclosure (sq. max): .335 (8.51)
  - Base (sq. max): .370 (9.40)
- Height (max): .270 (6.86)
- All welded construction, hermetically sealed

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp/ 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	50 Ω
6.0 VDC	98 Ω
9.0 VDC	220 Ω
12.0 VDC	390 Ω
18.0 VDC	880 Ω
26.5 VDC	1560 Ω
30.0 VDC	2500 Ω

FEATURES

TC Military Relay

- Qualified to MIL-R-39016/17
- -65°C to +125°C
- 130mW Sensitivity
- 30G Vibration
- 75G Shock

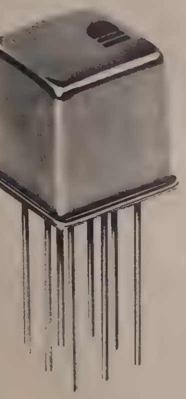
TCD Military Relay

- Qualified to MIL-R-39016/18
- Diode Coil Supression
- -65°C to +125°C
- 130mW Sensitivity
- 30G Vibration
- 75G Shock

Options for all .100 Grid Military Relays

- Terminal Lengths
- Special Coils
- Ground Pins
- Mounting Pads

Available with and without diodes.



TCS/TCSD

SIZE in./(mm)

- Width & Depth:
  - Enclosure (sq. max): .335 (8.51)
  - Base (sq. max): .370 (9.40)
- Height (max): .375 (9.53)
- All welded construction, hermetically sealed

QPL PENDING

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp/ 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	100 Ω
6.0 VDC	200 Ω
9.0 VDC	400 Ω
12.0 VDC	800 Ω
18.0 VDC	1600 Ω
26.5 VDC	3200 Ω
36.0 VDC	6500 Ω
48.0 VDC	11000 Ω

FEATURES

TCS Military Relay

- Built in accordance with MIL-R-39016/41
- QPL Version Pending
- -65°C to +125°C
- 60mW Sensitivity
- 30G Vibration
- 75G Shock

TCSD Military Relay

- Built in accordance with MIL-R-39016/42
- QPL Version Pending
- Diode Coil Supression
- -65°C to +125°C
- 60mW Sensitivity
- 30G Vibration
- 75G Shock

Communications Instruments, Inc.™
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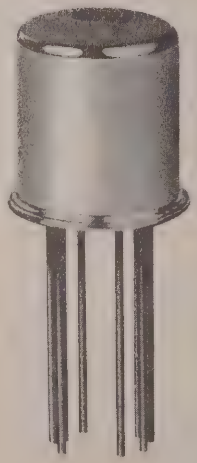
TO-5 Commercial Relays

	SIZE in./(mm)	CONTACTS	COILS	FEATURES
 HM/HMD	• Diameter • Enclosure (max): .335 (8.51) • Base (max): .370 (9.40) • Height (max): .270 (6.86) • All welded construction, hermetically sealed	• DC Rating: • Resistive — low level to 1 amp/28 VDC • Contact Resistance: • 0.1 ohm max before life • 0.2 ohm max after life • Contact Arrangement: • 2 Form C (DPDT) • State-of-the-art cleaning techniques and precious metal contact material with gold plating	**Nominal Voltage** **Coil Resistance** 5.0 VDC 50 Ω 6.0 VDC 98 Ω 9.0 VDC 220 Ω 12.0 VDC 390 Ω 18.0 VDC 880 Ω 26.5 VDC 1560 Ω 30.0 VDC 2500 Ω	**HM Commercial Relay** • 180mW Sensitivity • -65°C to +85°C • 10G Vibration • 30G Shock **HMD Commercial Relay** • Diode Coil Supression • 180mW Sensitivity • -65°C to +85°C • 10G Vibration • 30G Shock

Options for all TO-5 Commercial Relays

- Terminal Lengths
- Special Coils
- Ground Pins
- Mounting Pads

Available with and without diodes.

	SIZE in./(mm)	CONTACTS	COILS	FEATURES
 **HS/HSD**	• Diameter • Enclosure (max): .335 (8.51) • Base (max): .370 (9.40) • Height (max): .375 (9.53) • All welded construction, hermetically sealed	• DC Rating: • Resistive — low level to 1 amp/28 VDC • Contact Resistance: • 0.1 ohm max before life • 0.2 ohm max after life • Contact Arrangement: • 2 Form C (DPDT) • State-of-the-art cleaning techniques and precious metal contact material with gold plating	**Nominal Voltage** **Coil Resistance** 5.0 VDC 100 Ω 6.0 VDC 200 Ω 9.0 VDC 400 Ω 12.0 VDC 850 Ω 18.0 VDC 1600 Ω 26.5 VDC 3300 Ω 36.0 VDC 6500 Ω 48.0 VDC 11000 Ω	**HS Commercial Relay** • -65°C to +85°C • 90mW Sensitivity • 10G Vibration • 30G Shock **HSD Commercial Relay** • Diode Coil Supression • -65°C to +85°C • 90mW Sensitivity • 10G Vibration • 30G Shock

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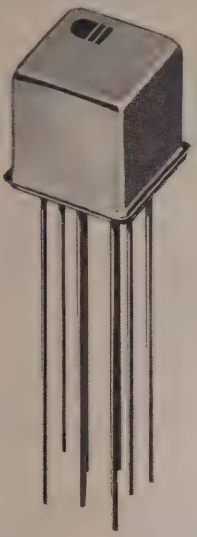
.100 Grid Commercial Relays



HC/HCD

SIZE in./(mm)

- Width & Depth
  - Enclosure (sq. max): .335 (8.51)
  - Base (sq. max): .370 (9.40)
- Height (max): .270 (6.86)
- All welded construction, hermetically sealed

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp/28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	64 Ω
6.0 VDC	98 Ω
9.0 VDC	220 Ω
12.0 VDC	400 Ω
18.0 VDC	880 Ω
26.5 VDC	1600 Ω

FEATURES

HC Commercial Relay

- -65°C to +85°C
- 180mW Sensitivity
- 10G Vibration
- 30G Shock

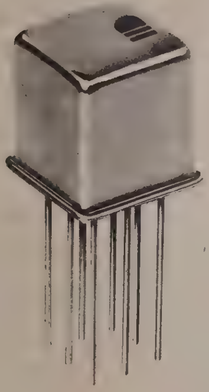
HCD Commercial Relay

- Diode Coil Supression
- -65°C to +85°C
- 180mW Sensitivity
- 10G Vibration
- 30G Shock

Options for all .100 Grid Commercial Relays

- Terminal Lengths
- Special Coils
- Ground Pins
- Mounting Pads

Available with and without diodes.



HCS/HCSD

SIZE in./(mm)

- Width & Depth:
  - Enclosure (sq. max): .335 (8.51)
  - Base (max): .370 (9.40)
- Height (max): .375 (9.53)
- All welded construction, hermetically sealed

CONTACTS

- DC Rating:
  - Resistive — low level to 1 amp/28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

COILS

Nominal Voltage	Coil Resistance
5.0 VDC	100 Ω
6.0 VDC	200 Ω
9.0 VDC	400 Ω
12.0 VDC	800 Ω
18.0 VDC	1600 Ω
26.5 VDC	3200 Ω
36.0 VDC	6500 Ω
48.0 VDC	11000 Ω

FEATURES

HCS Commercial Relay

- -65°C to +85°C
- 90mW Sensitivity
- 10G Vibration
- 30G Shock

HCSD Commercial Relay

- Diode Coil Supression
- -65°C to +85°C
- 90mW Sensitivity
- 10G Vibration
- 30G Shock

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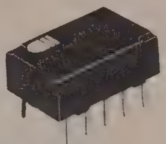
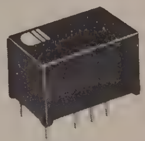
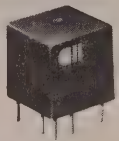
Commercial Relays

RELAY	SIZE (Case Size) in./(mm)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **MQ**	H- .197 (5.0) D- .354 (9.0) W- .551 (14.0)	• 2 Form C (DPDT) • Low Level up to 1 Amp 30 VDC Resistive	1.5 VDC 3 VDC 4.5 VDC 5 VDC 6 VDC 9 VDC 12 VDC 18 VDC 24 VDC 48 VDC	• Bifurcated contacts gold clad silver-palladium. • Rated low level to 1 Amp switching. • Long Life—Mechanical 100 million ops. • High sensitivity. • Completely sealed. • UL recognized file #E45026. • CSA recognized file #LR35579. • Meets FCC Part 68, 1000 VAC & 1500 V peak. (Request Brochure MQ3-93)
 **MN**	H- .385 (9.8) D- .295 (7.5) W- .590 (15.0)	• 1 Form C (SPDT) • Low Level up to 1 Amp 30 VDC	1.5 VDC 3 VDC 4.5 VDC 5 VDC 6 VDC 9 VDC 12 VDC 18 VDC 24 VDC 48 VDC	• One form C contacts gold overlaid silver alloy. • Completely sealed. • Contact rating from low level to 1.0 Amp switching – 2 Amps carry. • Low contact resistance. • UL recognized file #E45026. • Conforms to FCC Part 68, 1000 VAC & 1500 V peak. • CSA approved #LR35579. (Request Data Sheet MN3-93)
 **MM**	H- .428 (10.87) D- .410 (10.41) W- .410 (10.41)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT) 1 Form C (SPDT) 1 Form A (SPST-NO) 2 Form A (DPST-NO)	3 VDC 4 VDC 5 VDC 6 VDC 12 VDC 24 VDC 48 VDC	• Bifurcated contacts gold clad silver-palladium. • Rated low level to 2.0 Amp switching. • Long Life—Mechanical 100 million ops. • .1 inch (2.54 mm) footprint. • Low contact resistance. • UL recognized file #E90612 • Completely sealed. • Meets FCC Part 68, 1000 VAC & 1500 V peak. (Request Data Sheet MM 5-89)
 MS	H- .413 (10.5) D- .413 (10.5) W- .606 (15.4)	• 1 Form C (SPDT) • Low Level up to 2.0 Amps 24 VDC	3 VDC 5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• One form C bifurcated contacts gold clad silver-palladium. • Completely sealed. • Contact rating from low level to 2.0 Amp switching – 3.0 Amps carry. • Low contact resistance. • UL recognized file #E90612. • Conforms to FCC Part 68, 1000 VAC & 1500 V peak. • CSA approved #LR65354-1. (Request Data Sheet MS 3-93)
 MDP	H- .394 (10.0) D- .398 (10.1) W- .795 (20.2)	• 2 Form C (DPDT) • Low Level up to 1.0 Amp 24 VDC	1.5 VDC 3 VDC 4.5 VDC 5 VDC 6 VDC 9 VDC 12 VDC 18 VDC 24 VDC 48 VDC	• Two form C bifurcated contacts gold clad silver-palladium. • One & two coil latching versions available. • Completely sealed. • Contact rating from low level to 1.0 Amp switching – 2.0 Amps carry. • Low contact resistance. • UL recognized file #E45026. • Conforms to FCC Part 68, 1000 VAC & 1500 V peak. • CSA approved #LR35579. (Request Data Sheet MDP 3-93)
 MD	H- .472 (12.0) D- .394 (10.0) W- .795 (20.2)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT)	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Two form C bifurcated contacts gold clad silver-palladium. • Completely sealed. • Contact rating from low level to 2.0 Amp switching – 3.0 Amps carry. • Low contact resistance. • UL recognized file #E90612. • Conforms to FCC Part 68, 1000 VAC & 1500 V peak. • CSA approved #LR65354-1. (Request Data Sheet MD 4-90)
 MP4	H- .45 (11.5) D- .96 (24.5) W- 1.20 (30.5)	• 4 Form C (4PDT) 4 Form D (4PDT M-B) 2 Form C + 2 Form D • Low Level up to 2.0 Amps 30 VDC	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Bifurcated contacts gold clad silver-palladium. • Completely sealed. • Contact rating from low level to 2.0 Amp switching – 3.0 Amps carry. • Low contact resistance. • UL recognized file #E90612. • Conforms to FCC Part 68, 1000 VAC & 1500 V peak. • CSA approved #LR65354-1. (Request Data Sheet MP4)

Communications Instruments, Inc.
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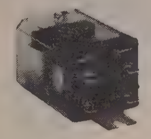
See Volume B Section 4550 for CII Solenoids

MIDTEX DIVISION COMMUNICATIONS INSTRUMENTS, INC.

9-B2 Butterfield Trail
El Paso, Texas 79906

Phone: (915) 772-1061
(800) 643-8392
FAX: (915) 772-1116

General Purpose Relays/ Industrial/Power Relays

		
SERIES	**188**	**136**
FEATURES	30 Ampere relay is an expanded version of the Type 187 20 amp 2PDT relay, utilizing a common coil/mates structure. The 188 is limited to single-pole switching, in order to provide for the 30 amp contact ratings.	A small power relay that will switch 20 amps for industrial use in multipole configuration and 30 amps in multipole configuration at 120 VAC or 240 VAC for applicance use under UL #508.
EPOXY SEALED	NO	NO
CONTACT ARRANGEMENTS	Form X Form Y Form Z	1 Form C 2 Form C 2PST-NC 2PST-NO 1PST-NO-DM 1PST-NC-DB 3PST-NO
CONTACT MATERIAL RATINGS	Material –100 1/4″ Silver 30 amp 120 240/277 VAC 30 amp 28 VDC 15 amp 480/600 VAC 1 hp 120 VAC, 1 phase 1-1/2 hp 240 VAC, 1 phase –200 1/4″ Silver Cadmium Oxide Ratings Identical for –100 & –200 contacts.	Material –3/8″ diameter Silver 20 amp, 120/240 VAC 20 amp, 28 VDC –3/8″ diameter Silver Cadmium Oxide (UL recognized) Industrial Use 1/4 hp, 120 VAC 15 amp, 120 VAC 10 amp, 240 VDC 1 kw tungsten, 120 or 240 VAC Appliance Use 1/4 hp, 120 VAC 20 amp, 28 VDC 30 amp, 120 or 240 VAC 1 kw tungsten, 120 or 240 VAC
COIL VOLTAGE	5, 6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 240 (AC) and Specials	6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 240 (AC) and Specials
POWER RATING	Nominal–2.0 VA (AC); 1.2 watts (DC) Maximum continuous-3.1 VA (AC); 1.9 watts (DC)	Maximum continuous-10 VA (AC); 2.9 watts max. (DC)
DIELECTRIC	Greater than 750 VAC RMS 60 Hz across open contacts Greater than 2500 VAC RMS 60 Hz all other mutually insulated elements.	
LIFE EXPECTANCY	**Mechanical**–10 million operations. **Electrical**–100,000 operations at rated loads.	**Mechanical**–5 million operations. **Electrical**–100,000 operations at rated load
MAX. SIZE IN INCHES (L×W×H)	1.400×1.525×1.905	2 375×1.75×2.80
TERMINALS—PC SOLDER/PLUG-IN	Yes Yes	No Yes
OPTIONS	Lamp in parallel with coil Class B Coil Varnished Coil Special Customer Requirements	Special Customer Requirements
AGENCY APPROVALS	UL/CSA	UL

MERCURY RELAYS

Mercury-wetted contacts represent the nearest thing to the perfect contact yet developed, being characterized by such parameters as: Bounce-free operation; very low and stable contact resistance; hermetic protection; fast operating speeds; Form C or Form D contact action; contact life measured in billions of operations.

	TWO-AMPERE RATED RELAYS						FIVE-AMPERE RATED RELAYS		
PARAMETER	**TYPE 159**	**TYPE 160**	**TYPE 161**	**TYPE 162**	**TYPE 166**	**TYPE 168**	**163**	**164**	**165**
COILS									
Single wound—max. ohms	8,600	9,000	43,500	3,500	9,000	11,000	4,000	4,000	4,300
Double wound—max. ohms	4,275	4,500	21,700	1,750	4,275	5,500	2,000	2,000	8,000
Rating—watts continuous	2.0	1.75	3.0	3.0	1.5	2.0	4.0	4.0	4.0
Temp. rise—° C per watt	30°	35°	20°	30°	35°C	30°	20°	20°	20°
Dielectric breakdown —RMS, 60Hz	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Insulation resistance megohms—500 VDC	1,000	1,000	1K–10K	1K–10K	1,000	1,000	100	100	100
Capacitance—armature to coil pf, typical	9.0	9.0	9.0	9.0	9.0	7.0	12	12	14
Electrostatic shielding optional	yes	yes	yes	yes	yes	yes	yes	yes	yes
Typical operate times—MS, 2X must operate	1-3	1-3	1-3	1-3	1-3	1-3	3.5	3.5	3 0
Typical release times—MS 2X	2.5	2.5	3.0	3.0	2.8	3.0	4.5	4.5	4.2
Contact form available	C, D	C, D	2C, 2D	2C, 2D	C, D	C, D	D	D	D
Adjustments available									
Single-side-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bi-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Polar 1% balance	yes	yes	no	no	yes	yes	yes	yes	yes
Temperature range									
Operating ° C	All types -38.8°C to +85°C								
Storage ° C	All types -65°C to +100°C								
Weight—ounces	2.0	0.5	2.3	1.6	0.5	4.0	4	4	3
Encapsulant	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth	Polyureth.	Polyureth.
Mounting method	PCB	PCB	PCB	PCB	PCB	Octal	Octal	Octal	PCB

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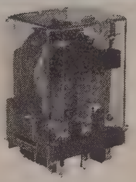
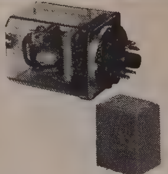
9-B2 Butterfield Trail
El Paso, Texas 79906

Phone: (915) 772-1061
(800) 643-8392
FAX: (915) 772-1116

Miniature/General Purpose Relays

						
SERIES	**156**	**156** HERMETICALLY SEALED	**157**	**157** MAGNETIC LATCHING SERIES	**158**	**187**
FEATURES	Compact & versatile 2&4-pole industrial relay. Low level switching. Available with many options.	***New MIDTEX 156 Hermetically Sealed Relays*** ***Socket Mountable*** ***3 and 5 amp Relays***	The 157 is a General Purpose/ Industrial control relay, available in 1, 2, or 3-pole versions with multiple contact load capabilities up to 15 amps. All ratings are specified to UL Recognition and CSA Approvals for Industrial Control Equipment. They are approved as motor controllers up to 1/2HP at 240/480/600 VAC (1/3HP at 120 VAC).	The magnetic latching relay is ideal for use on applications where there is a need to conserve power, retain logic function during power outages or improve reliability over mechanical latching designs. All electrical specifications of the standard type 157 are retained. No mechanical latches or permanent magnets are used which could result in advertent operations. Units are available in single, or dual coils. **TIMING** Latching time: 13 MS nominal with a one second pulse of nominal voltage. Unlatch time: 13 MS nominal with a one second pulse of nominal unlatch voltage after latching with a one second pulse of nominal latch voltage. A latch pulse of 50 MS min. at nominal voltage is recommended to insure positive latching. **DESIGN & CONSTRUCTION** Insulation material, weight, marking, shock, vibration, dielectric breakdown, insulation resistance and temperature range are identical to the Type 157 relay. UL/CSA	Designed for UL Component Recognition for Motor Controllers through 240 VAC in accordance with UL Std 508, Industrial Control Equipment. Available in Octal Plug-in version.	DPDT power relay is rated at 20 amps; DPST-NO and NC contact arrangements are rated at 25 amps. Open stud mounted or dust covered versions with 1/4" quick-connect terminals.
EPOXY SEALED	YES	NO	NO		YES	NO
CONTACT ARRANGEMENTS	2 Form C 4 Form C	**FEATURES** **Enclosure Available:** • Hermetically Sealed Metal Cover • Offers Fine Silver, Gold Diffused, Silver Cadmium Oxide with Gold Flash or Silver Gold Flash **Voltages:** • Available in – 5, 6, 12, 24, 48, 90, 110 VDC or 6, 12, 24, 48, 120, 240 VAC Voltages **Contact Arrangements:** • DPDT or 4PDT **Nominal Power:** 1.2 VA (AC), 0.9 watts (DC) Pick up Voltage 85% of nominal AC 75% **Time:** Operate time 13 MS MAX Release time 10 MS MAX **Typical Applications:** For: Offshore Oil Rigs, Marine Equipment, Mining Equipment.	1 Form C 2 Form C 3 Form C 2 Form A 2 Form B 1 Form X 1 Form Y		1 Form C 2 Form C Form A Form B Form X Form Y Form C (1 & 2PDT) Octal	2 Form C 2A, DPST 2B, DPST 1 Form X 1 Form Y
CONTACT MATERIAL RATINGS	**Material** –100 3/32" Silver (Gold Flash) *3 amps, 28 VDC/120 VAC, 80% pf 2 amps, 240 VAC, 80% pf –700 3/32" Fine silver gold diffused 3 amps, 28 VDC/120 VAC 80% pf 2 amps, 240 VAC, 80% pf –200 3/32" Silver Cadmium Oxide (Gold flash) *5 amp, 28 VDC/120 VAC, 80% pf 3 amp, 24 VAC, 80% pf *1/10 horsepower, 125 VA, 120/240 VAC		**Material:** –100 1/8" Fine Silver (golf flash) 5 amp **Ratings:** 5 amp, 28 VDC/120/240 VAC, 80% pf 2 amp, 480/600 VAC, 80% pf 1/8 hp, 120 VAC 1/4 hp, 240 VAC –200 3/16" Silver Cadmium Oxide 10 amp 10 amp, 28 VDC/120/240 VAC, 80% pf 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC 3 amp, 480/600 VAC, 80% pf –300 3/16" Silver Cadmium Oxide 15 amp (UL on 1 & 2PDT only) 15 amp, 120 VAC 10 amp, 240 & 277 VAC 28 VDC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC –700 1/8" Fine Silver Gold Diffused 5 amp, 28 VDC/120/240 VAC, 80% pf 2 amp, 480/600 VAC, 80% pf 1/8 hp, 120 VAC 1/4 hp, 240 VAC All hp ratings are single phase		**Material** –200 5/32" Silver Cadmium Oxide –10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC –700 5/32" pure fine Silver (Gold flash) –10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC	**Material** –100 1/4" Diameter Fine Silver 20 amp, 28 VDC 20 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1-1/2 hp, 240 VAC –200 1/4" Diameter Silver Cadmium Oxide 20 amp, 28 VDC 20 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1-1/2 hp, 240 VAC –300 3/16" Diameter Silver Cadmium Oxide 10 amp, 28 VDC 15 amp, 120/240/277 VAC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC –400 3/16" Silver Cadmium Oxide High Conductivity Blade 10 amp, 28 VDC 10 amp, 120/240 VAC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC –600 1/4" Silver Cadmium Oxide (On contacts 2A & 2B only) 25 amp, 28 VDC 25 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1-1/2 hp, 240 VAC
CONTACT VOLTAGE	5, 6, 12, 24, 48, 90, 110 DC & 6, 12, 24, 48, 120, 240 AC and "Specials"		5, 6, 12, 24, 48, 90, 110 (DC) & 6, 12, 24, 120, 240 (AC) and "Specials"		5, 6, 12, 24, 48, 90, 110 (DC) 6, 12, 24, 48, 120, 240 (AC) and "Specials"	5, 6, 12, 24, 48, 110, (DC) & 6, 12, 24, 120, 208, 240 (AC) and "Specials"
POWER RATING	**Nominal** (AC) 1.2 VA (DC) 0.9 watts **Maximum continuous** (AC) 2.0 VA (DC) 2.0 watts		**Nominal**–1.7 VA (1 & 2-pole AC); 2.0 VA (3-pole AC); 1.2 watts (DC). **Max continuous**–2.7 VA (1 & 2-pole AC); 3.1 VA (3-pole AC); 1.9 watts (DC)		**Nominal** 1.2 VA (AC) **Maximum continuous** 2.0 VA AC 2.0 watts (DC)	**Nominal**–2.7 VA (AC); 1.2 watts (DC) **Maximum continuous**–3.4 VA (AC); 1.9 watts (DC)
DIELECTRIC	Greater than 500 VAC RMS 60 Hz across open contacts Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements		Greater than 750 VAC RMS 60 Hz across open contacts Greater than 2500 VAC, RMS 60 Hz all other mutually insulated elements	**MAGNETIC LATCHING OPTION ALSO AVAILABLE ON 187 AND 188 SERIES**	Greater than 500 VAC RMS 60 Hz across open contacts Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements	Greater than 750 VAC RMS 60 Hz across open contacts Greater than 500 VAC RMS 60 Hz all other mutually insulated elements
LIFE EXPECTANCY	**Mechanical**–in excess of 50 million operations. **Electrical**–100,000 operations minimum at rated load		**Mechanical**– 10 million operations. **Electrical**– 100,000 operations at rated load		**Mechanical**–in excess of 50 million operations. **Electrical**–100,000 operations minimum at rated load	**Mechanical**– 10 million operations. **Electrical**– 100,000 operations at rated loads
MAX SIZE IN INCHES (LxWxH)	1.190 x .859 x 1.281 (Dust Cover)		1.400 x 1.525 x 1.905 (Dust Cover)		1.109 x .859 x 1.281 (Dust Cover)	1.400 x 1.525 x 1.905
TERMINALS — PC SOLDER/PLUG-IN	Yes Yes	Yes Yes	Yes Yes		Yes Yes	Yes Yes
OPTIONS	Opposite Polarity Barrier Push Button Diode across coil (DC only) Lamp across coil Lamp & Push Button		Lamp across coil Class B Coil Push Button Actuator Open style Varnished coil		Opposite Polarity Barrier Push Button Actuator Diode across coil (DC only) Lamp across coil Lamp & Push Button	Class B Coil Varnished Coil Lamp in Parallel with Coil Special Customer Requirements
AGENCY APPROVALS	UL/CSA	UL/CSA	UL/CSA		UL/CSA	UL/CSA

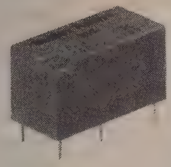
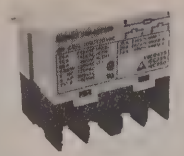
See Volume B Section 4550 for CII Solenoids

MIDTEX DIVISION COMMUNICATIONS INSTRUMENTS, INC.

9-B2 Butterfield Trail
El Paso, Texas 79906

Phone: (915) 772-1061
(800) 643-8392
FAX: (915) 772-1116

Miniature/General Purpose Relays

					
SERIES	**190**	**258**	**296**	**340**	**358**
FEATURES	"The Dipper" Low level switching up to 2 amps, 16 pin dip. Sealed for PC board mounting & immersion.	Economical 2 PDT – 10 amp PCB or quick connect terminals available.	Economical and reliable. Available in 3 amp, 5 amp and 10 amp. Epoxy sealed.	High capacity, flame resistant, quick connect and screw terminals available.	Octal plug in 2 and 3-pole, 10 amp. Manual pushbutton actuator.
EPOXY SEALED	YES	NO	YES	NO	NO
CONTACT ARRANGEMENTS	2 Form C	1 Form C 2 Form C 3 Form C 4 Form C	1 Form C 1 Form A	1 Pole DM 2 Form A	2 Form C 3 Form C
CONTACT MATERIAL RATINGS	**Material** –2U0 Silver/Gold Clad Bifurcated 2.0 amps, 30 VDC, resistive 2.0 amps, 120 VAC, resistive	**Material** –200 5/32" Silver Cadmium Oxide SPDT–15 amps at 110 VAC 15 amps at 24 VDC DPDT, 3 PDT, 4PDT 10 amps at 110 VAC 10 amps at 24 VDC	**Material** –200 5/32" Silver Cadmium Oxide 5 amps at 30VDC Resistive (UL) 1/8 HP 120 VAC (UL) 1/10 HP 120 VAC; 125 VA Pilot Duty (UL) –300 Silver Cadmium Oxide 10 amps at 120 VAC Resistive (UL) 8 amps at 30 VDC Inductive (UL)	**Material** 1 pole 30 amps 120/240 VAC 28 VDC 2 pole 25 amps 120/240 VAC 28 VDC	**Material** 10 amps at 120/240 VAC 28 VDC
COIL VOLTAGE	5, 6, 12, 24, 48 DC	6, 12, 24, 48, 110 (DC) 6, 12, 24, 50, 120, 240 (AC)	5, 6, 9, 12, 24, 48 DC	5, 6, 12, 24, 48, 110 VDC 6, 12, 24, 120, 240 VAC	5, 6, 12, 24, 48, 110 VDC 6, 12, 24, 120, 240 VAC
POWER RATING	**–2u0** **Nominal** – 550 mw **Maximum continuous** – 860 mW **–2S0** **Nominal**–360 mV **Maximum continuous**– 620 mV	**Nominal** 1.5 VA (AC) 0.9 Watts (DC) **Maximum continuous** 2.0 VA (AC), 2.0 Watts (DC)	**Nominal**–400 MW **Maximum continuous**– 562 MW	**Nominal** 1.9 Watts (DC) **Maximum continuous**– 1.7 to 2.5 VA (AC coils)	**Nominal** 1.2 Watts (DC coils) **Maximum continuous**– 2.7 VA (AC coils)
DIELECTRIC	(Meets FCC Part 68) 1000 VAC coil to poles 1000 VAC between poles 750 VAC across open contact (1500 VDC FCC surge)	Greater than 100 VAC RMS 60 Hz Across Open Contacts Greater than 2000 VAC RMS 60 Hz all other mutually insulated elements	2000 VAC, RMS 60 Hz all mutually insulated terminals (Open Contacts 750 VAC)	4000 VAC All Mutually Insulated Points 2000 VAC Across Open Contacts	2500 VAC All Mutually Insulated Points 750 VAC Across Open Contacts
LIFE EXPECTANCY	**Mechanical**– in excess of 15 million operations. **Electrical**– 100,000 operations minimum at rated loads.	**Mechanical**– in excess of 5 million operations. **Electrical**– 100,000 operations minimum at rated loads.	**Mechanical**– in excess of 10 million operations. **Electrical**– 100,000 operations minimum at rated loads.	**Mechanical**– in excess of 10 million operations. **Electrical**– 100,000 operations minimum at rated loads.	**Mechanical**– in excess of 10 million operations. **Electrical**– 100,000 operations minimum at rated loads.
MAX SIZE IN INCHES (LxWxH)	800 x .398 x .425	1.42 x 1.10 x 8.5 (DPDT, plain cover w/quick connect)	.890 x .65 x .75	2.7 x 2.3 x 1.2	2.6 x 2.3 x 2.3
TERMINALS — PC SOLDER/PLUG-IN	Yes No	Yes Yes	Yes No	1/4" Quick Connects Screw Terminals	8 Pin Octal 11 Pin Octal
OPTIONS	Sensitive coils				
AGENCY APPROVALS	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

See Volume B Section 4550 for CII Solenoids

MIDTEX DIVISION COMMUNICATIONS INSTRUMENTS, INC.

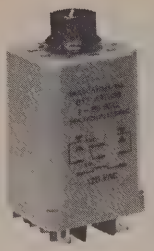
9-B2 Butterfield Trail
El Paso, Texas 79906

Phone: (915) 772-1061
(800) 643-8392
FAX: (915) 772-1116

Time Delay Relays/ Line Monitoring Devices

REED RELAYS

The Midtex dry reed relay series offers hermetically sealed, non-position sensitive switching in a small size with rapid response and low actuate power requirements. Available contact forms include A, B, C and D with dry reeds and forms A and B with mercury wetted. Contact arrangements include 1 to 5 Form A, 1 to 4 Form C, and 1 to 3 Form B, or any combination within the 5 pole bobbin. Consult the factory for details.



612 SERIES

Delay-on release timer which utilizes an R-C solid state trigger circuit to drive a secondary solid state switch, which in turn controls the integral 10 amp output relay.

Electrical/Mechanical Characteristics
All ratings at 25°C ambient.
Repeatability ±3%
Total timing variation ±10%
Operate time (max.) 100ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits –
AC ±10%
DC ±25%
Power requirements –
AC (approx.) 1.5 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
–Fine Silver contact (Gold flash)
5 amp, 28 VDC/120, 240 VAC: 80% pf 1/8 hp, 120 VAC
–Silver Cadmium Oxide
10 amp, 28 VDC/120, 240 VAC; 80% pf, 1/3 hp, 120 VAC 1/2 hp, 240 VAC
Delay types
Delay-on-release
Momentary transfer upon timing cycle interruption. . . . . .NO

Temperature Range
–operating: –10°C to +55°C
–storage: 40°C to +85°C

Shock
15 g's, 11 ± 1ms, 1/2 sinewave (non-operating test)

Vibration
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)

Timing Set
Fixed
External Resistor
Knob Adjust

614 SERIES

Identical to the 612 series, except it functions as a **delay-on-operate**. Available with "fixed," "external resistor" adjust time setting, or "knob adjust," through an overall range of 1 to 300 seconds delay.

Electrical Characteristics
All ratings at 25°C ambient.
Repeatability ±3%
Total timing variation ±10%
Reset (release) time (max.) 50ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits –
AC ±10%
DC ±25%
Power requirements –
AC (approx.) 3.0 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
–Fine Silver contact (Gold flash)
5 amp, 28 VDC/120 VAC; 3 amp, 240 VAC 80% pf 1/8 hp, 120 VAC
–Silver Cadmium Oxide (Gold flash)
10 amp, 28 VDC/120, 1/3 hp, 120 VAC 6 amp, 240 VAC, 80% pf 1/2 hp, 240 VAC
Delay types
Delay-on-operate
Momentary transfer upon timing cycle interruption. . . . . .NO

Temperature Range
–operating: –10°C to +55°C
–storage: 40°C to +85°C

Shock
15 g's, 11 ± 1ms, 1/2 sinewave (non-operating test)

Vibration
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)

Timing Set
Fixed
External Resistor
Knob Adjust

655 SERIES

Delay-on-operate timers which use solid state timing circuits to control an integral relay.

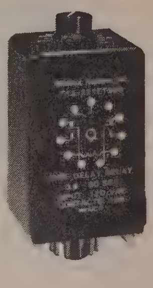
Electrical Characteristics
All ratings at 25°C ambient.
Repeatability ±3%
Total timing variation ±10%
Reset time 50ms
Recycle time (max.) 100ms
Input voltage limits –
AC ±10%
DC ±25%
Power requirements –
AC (approx.) 3 VA at 120 VAC
DC (approx.) 1.2 watts
Switching action 1, 2, 4PDT
Switching rating
5 amp, 28 VDC
120 VAC
10 amp, 28 VDC
120 VAC
Delay types
Delay-on-operate
Momentary transfer upon timing cycle interruption. . . . . .NO

Temperature Range
–operating: –10°C to +55°C
–storage: 40°C to +85°C

Shock
15 g's, 11 ± 1ms, 1/2 sinewave

Vibration
10 g's, 10 to 55 Hz

Terminals
Solder, PC, Plug-In.



715 SERIES

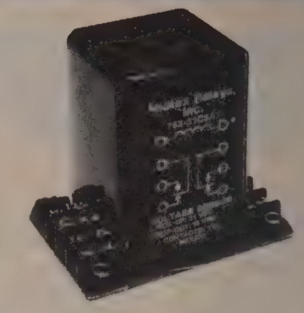
Multi-function time delay relay industry standard 8 and 11 pin octal, side terminal strip for flush mounting, and the 11 pin square base to fit the Midtex Type 157 relay sockets.

Electrical Characteristics
All ratings at 25°C ambient.
Repeatability ±2%
Total timing variation ±10%
Reset time – 24 ms typical, 50 ms max. (release of delay-on-operate)
Recycle time – 50 ms typical, 100 ms max. (minimum off time between timing intervals)
Input voltage limits –
AC ±10%
DC ±25%
Power requirements –
AC (approx.) 2.5 VA
DC (approx.) 1.5 watts
Switching action 2PDT
Switching rating (max.)
–Silver Cadmium Oxide
10 amp, 28 VDC/120, VAC; 1/3 hp, 120/240 VAC
Delay types
Delay-on-operate,
Delay-on-release,
Interval-momentary start timing.
Momentary transfer upon timing cycle interruption. . . . . .NO

Temperature Range
–operating: –10°C to +55°C
–storage: 40°C to +85°C

Shock
15 g's, 11 ± 1ms, 1/2 sinewave (non-operating test)

Vibration
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)



753/754 SERIES

Line Monitoring Relays. The 753 Series are Voltage Sensors, designed to sense fluctuations in Line Voltages, they are available in Preset, Adjustable, and also in a High/Low Voltage Sense Model.

The 754 Series are 3 Phase Sequence Sensors designed to detect Phase Loss or Reverse Sequence in conventional 3 Phase Delta, or 4 Wire Wye 60 HZ systems. They will also detect loss of Neutral where applicable.

Electrical Characteristics
All ratings at 25°C ambient.

CONTACTS	**DPDT (753 only) SPDT (1 Form C)**
Material	**Rating**
–100 Silver/ Gold Flashed	3 amps at 24 VDC or 125 VAC resistive 1 amp at 24 VDC or 125 VAC inductive 1.5 amps at 250 VAC resistive 0.5 amps at 250 VAC inductive
–200 Silver Cadmium Oxide	5 amps at 24 VDC or 125 VAC resistive 2 amps at 24 VDC or 125 VAC inductive 2.5 amps at 250 VAC resistive 1 amp at 250 VAC inductive
–300 Silver Cadmium Oxide	10 amps at 24 VDC or 125 VAC resistive 4 amps at 24 VDC or 125 VAC inductive 5 amps at 250 VAC resistive 2 amps at 250 VAC inductive

ENVIRONMENTAL CHARACTERISTICS

Temperature Range
–operating: –10°C to +55°C
–storage: –40°C to +85°C

Shock
15 g's, 11 ± 1ms, 1/2 sinewave (non-operating test)

Vibration
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)

CUSTOM CHARACTERISTICS

Both series are available with delay-on-operate or reset functions as an option.

All Midtex Time Delay Relays and Line Monitors can be custom designed to your requirements. For further information consult Midtex Technical Assistance.

See Volume B Section 4550 for CII Solenoids

SEALED RELAYS

Made in the USA by:
Comus International
263 Hillside Avenue
Nutley, N.J. 07110
PHN: 1-800-35-COMUS
FAX: 1-800-78-COMUS

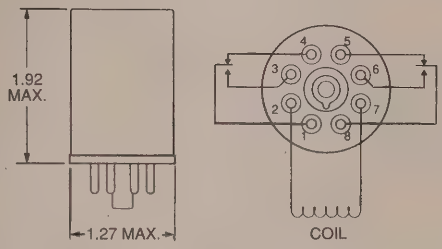
Hermetically Sealed 10 Amp Relay

Specifications **Part No. SEM100-120A**

Contact Rating: 10 Amp, 240 VAC or 28 VDC.
Operating Temperatures: -45°C to +70°C
Coil Voltage: 120 VAC, 50-60 Hz.
Mountng: Standard octal plug.

Features

- True Hermetic Sealing
- Filled with Dry Inert Gas
- Rugged Plated Steel Housing
- Fast Plug-In Installation
- Moderate cost
- 2 Form C Contacts (DPDT)



Designed for reliable service in servere environments that subject the relay to dirt, high humidity, or wide changes in ambient temperatures.

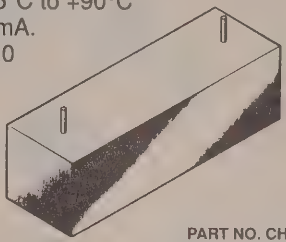
High Voltage Relay

Specifications

Contact Rating:
CHV-750, switches up to 5000 VDC;
CHV-1000, switches up to 7500 VDC.
50 Watts max.; 3 Amps max.
Coil to Contact Resistance: 10,000 Megohms min.
Coil to Contact Dielectric: 25,000 VDC min.
Coil Voltage: 24 VDC.
Coil Resistance: 1400 ohms.
Operating Temperature: -35°C to +90°C
Maximum Coil Current: 22 mA.
Dimensions: 3.25 x 1.0 x 1.0 (inches)

Features

- Epoxy Sealed Housing
- Hermetically Sealed Contact
- PCB Mounting



PART NO. CHV-750
PART NO. CHV-1000

A convenient and inexpensive solution to the problem of switching high voltages in power supplies, test sets, medical equipment and communications systems.

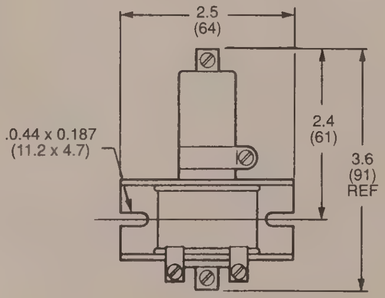
Mercury Displacement Relays
35 AMPS and 60 AMPS / 1 – 2 – 3 Poles

Typical Applications

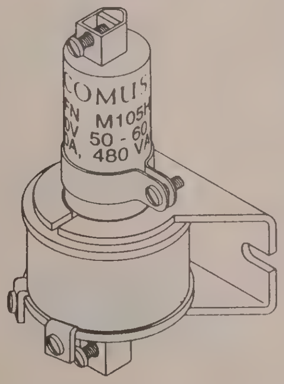
- **Heating Systems**
- **Lighting Controls**
- **Traffic Controls**

Specifications

Pull In Voltage: 65% of rated voltage.
Operate and Release Time: 47 ms. typ.
Contact Bounce: None.
Contact Resistance: 4 milliohm typical.
Rate of Operation: 60 per minute max.
Mounting: Within 10° of vertical.



1 POLE (FN)



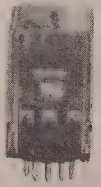
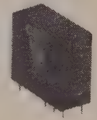
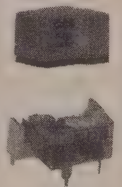
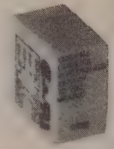
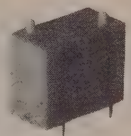
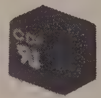
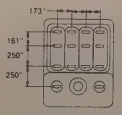
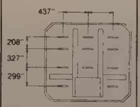
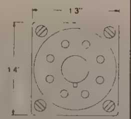
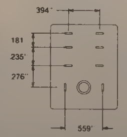
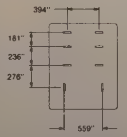
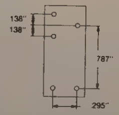
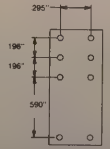
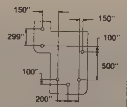
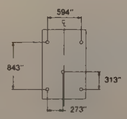
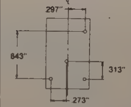
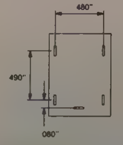
Using the time proven principle of mercury displacement, these relays are recognized for long life and consistent performance when switching heavy electrical loads.

Poles	Part Number	D.C. Resistive Amps			A.C. Resistive 60 Hz Amps	Tungsten Lamps 60 Hz Amps	A.C. Motor H.P. 60 Hz		
		48V	120V	240V	48V to 600V	120 VAC	120V	208V	240V
1	FNM 80A	35	—	—	35	35			
	FNM 80H	35	25	15	35	30	2	3	3
	FNM 105A	60	—	—	60	60			
	FNM 105H	60	30	20	60	60	3	5	5
2	TKM 80A	35	—	—	35	35			
	TKM 80H	35	25	15	35	30	2	3	3
	TKM 105A	60	—	—	60	60			
	TKM 105H	60	30	20	60	60	3	5	5
3	WTM 80A	35	—	—	35	35			
	WTM 80H	35	25	15	35	30	2	3	3
	WTM 105A	60	—	—	60	60			
	WTM 105H	60	30	20	60	60	3	5	5

Coil Data: 120 VAC, 75 mA, 1005 ohms. Part No. 35. (Other voltages are available.)

CDE CORNELL DUBILIER
1605 East Rodney French Blvd. • New Bedford, MA 02741-9990 • Phone: (508) 996-8564 ext 3360 • Fax: (508) 996-3830

Relay Selector Chart

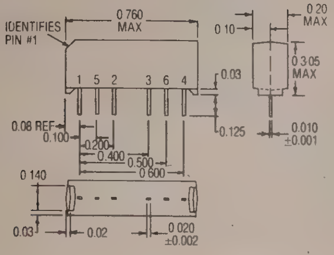
STYLE	GENERAL PURPOSE				MINIATURE						SUB-MINIATURE
											
TYPE	CDR10	CDR20	CDR30	CDR40	CDR50	CDR63	CDR64	CDR80	600	692	CDR70
VOLTAGE	6-120VDC 12-240VAC	6-120VDC 12-240VAC	6-125VDC 6-240VAC	6-120VDC 12-240VAC	6-120VDC 12-240VAC	5-48VDC	5-48VDC	5-48VDC	3-48VDC 12-115VAC	3-48VDC	3-48VDC
SAFETY APPROVAL	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA
CONTACT RATING	5A, 28 VDC 5A, 250VAC	10A, 28 VDC 10A, 240VAC	10A, 28 VDC 10A, 120VAC	10A, 28 VDC 10A, 240VAC	15A, 28 VDC 15A, 240VAC	10A, 30 VDC 10A, 250VAC	5A, 30 VDC 5A, 240VAC	20A, 240VAC 30A, SPNO	UP TO 15A, 150VAC	UP TO 5A, 240VAC	5A,30 VDC 12A, 125 VAC
CONTACT FORM	DPDT, 4PDT	UP TO 3PDT	UP TO 3PDT	DPST, DPDT	SPST, SPDT	SPST, SPDT	DPST, DPDT	SPST, SPDT	SPST, SPDT, DPDT	BI-STABLE	SPST, SPDT
NOMINAL OPERATING POWER	.9W DC 1.2VA AC	1.2W DC 2.0VA AC	1.2W DC 2.0VA AC	.9W DC 1.2VA AC	.9W DC 1.2VA AC	530MW	530MW	900MW	100MW (5A) 240MW (15A) 360MW (DPDT)	850MW	360MW
NOM. OPERATE TIME	15MS	15MS	15MS	15MS	15MS	15MS	15MS	15MS	10MS	30MS	10MS
NOM. RELEASE TIME	10MS	10MS	10MS	10MS	10MS	10MS	10MS	10MS	8MS	30MS	10MS
MECHANICAL LIFE	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6
LIFE @ RATED LOAD	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4	10×10^4
DIELECTRIC: CONTACT-CONTACT CONTACT-COIL LIVE PARTS-GROUND	500V 1,500V 1,500V	500V 1,500V 1,500V	500V 1,500V 1,500V	500V 1,500V 1,500V	500V 1,500V 1,500V	1,000V 5,000V 3,000V	1,000V 5,000V 3,000V	1,500V 1,500V 1,500V	500V 1,000V 1,000V	500V 1,000V 1,000V	500V 1,000V 1,000V
SEALED VERSION	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	YES
TERMINAL TYPE	SOLDER LUG/ PLUG-IN P.C.	SOLDER LUG/ QUICK CONNECT; P.C.	8 PIN PLUG/ 11 PIN PLUG	SOLDER LUG/ QUICK CONNECT; P.C.	SOLDER LUG/ QUICK CONNECT; P.C.	SOLDER LUG/ QUICK CONNECT; P.C.	P.C.	P.C.	SOLDER LUG/ P.C.	SOLDER LUG/ P.C.	P.C.
CASE SIZE (L × W × H)	1.08×.846×1.41	1.38x1.51x1.875	1.37×1.29×2.14	1.08×.846×1.41	1.08×.850×1.38	1.14×.511×1.00	1.14×.511×1.00	1.25×1.08×.72	1.24×.766×1.20	1.46×.750×1.18	.826×.614×.688
FOOTPRINTS: ALL DIMENSIONS ARE IN THOUSANDTHS											

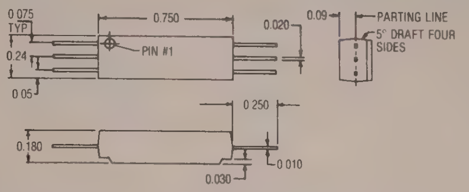
COTO WABASH

55 DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

MOLDED REED RELAYS SIP (SERIES 9000) AND SURFACE MOUNT (SERIES 9200)

MECHANICAL SPECIFICATIONS

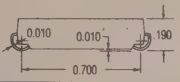




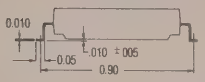
TERMINAL STYLE

LOCATION AND COPLANARITY TOLERANCE ±.003

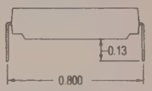
9201-2 'J' BEND



9201-2 GULL WING



9201-2 RADIAL



ORDERING INFORMATION

To order a Coto relay, assemble a part number from the data to describe the desired parameters.

SIP

90XX – XX – XX

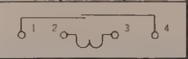
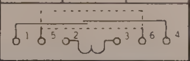
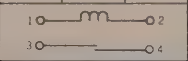
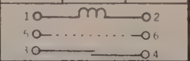
Model Number
01 = SPST, 4 Pin SIP
02 = 50Ω Coxial Shield.SPST, 6 Pin SIP
03 = SPST, 4 Pin SIP, Recommended For Load Switching
Coil Voltage
05 = 5 Volts Nominal
12 = 12 Volts Nominal
00 = No Option – Omit 0's
01 = Internal Diode*

SURFACE MOUNTED

92XX – XX – X0

Model Number
01 = SPST, Recommended For Low Level Switching 4 Pin
02 = SPST, 50Ω Coaxial Shield 6 Pin
Coil Voltage
05 = 5 Volts Nominal
12 = 12 Volts Nominal

Terminal Style
0 = Gull Wing
1 = Axial
2 = 'J'
3 = Radial

MODEL NUMBER			9001			9002			9201			9202		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	450	500	550	315	350	385	225	250	275	135	150	165
	12 VOLT COIL	Ω	900	1000	1100	675	750	825	585	650	715	585		715
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	5	6.5	—	5	6.5	—	5	6.5	—	5	6.5
	12 VOLT COIL	VDC	—	12	15	—	12	15	—	12	15	—	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	—	3.75	—	—	3.75	—	—	3.75	—	—	3.75
	12 VOLT COIL	VDC	—	—	9.0	—	—	9.0	—	—	9.0	—	—	9.0
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	—	—	0.4	—	—	0.4	—	—	0.4	—	—
	12 VOLT COIL	VDC	1.0	—	—	1.0	—	—	1.0	—	—	1.0	—	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	200	—	—	200	—	—	200	—	—	200
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	—	0.5	—	—	0.5	—	—	0.5	—	—	0.5
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	1.0	—	—	1.0	—	—	1.0	—	—	1.0
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	—	10	—	—	10	—	—	10	—	—	10
LIFE EXPECTANCY	(@ Signal Level < 1.0 V, .010A)	× 10^6	500	—	—	500	—	—	500	—	—	500	—	—
	(Switching >1.0 V, Consult Factory)	× 10^6	—	—	—	—	—	—	—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, .010A)		Ω	—	—	0.150	—	—	0.150	—	—	.150	—	—	.150
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	0.200	—	—	0.200	—	—	.200	—	—	.200
INSULATION RESISTANCE (Between all isolated pins)	25°C, 40% RH	Ω	10^{10}	10^{13}	—	10^{10}	10^{13}	—	10^{12}	10^{13}	—	10^{12}	10^{13}	—
MEASURED WITH 100 V @	40°C, 95% RH	Ω	10^{10}	10^{12}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—
DIELECTRIC STRENGTH (DC/Peak AC)	ACROSS OPEN CONTACTS:	Volts	250	—	—	250	—	—	250	—	—	250	—	—
	CONTACTS TO SHIELD:	Volts	—	—	—	500	—	—	—	—	—	500	—	—
	CONTACTS & SHIELD TO COIL:	Volts	500	—	—	500	—	—	500	—	—	500	—	—
CAPACITANCE ACROSS OPEN CONTACTS	No shield	pf	—	0.70	1.00	—	—	—	—	0.70	1.0	—	—	—
	Shield floating	pf	—	—	—	—	0.80	1.0	—	—	—	—	0.80	0.80
	Shield guarding	pf	—	—	—	—	0.10	0.30	—	—	—	—	0.10	0.30
OPEN CONTACTS TO COIL	No shield	pf	—	1.4	2.0	—	—	—	—	1.4	2.0	—	—	—
	Shield floating	pf	—	—	—	—	1.4	2.0	—	—	—	—	1.4	2.0
	Shield guarding	pf	—	—	—	—	—	1.0	—	—	—	—	0.2	0.4
CONTACT TO SHIELD	Contacts open and shield floating	pf	—	—	—	—	1.4	1.6	—	—	—	—	1.4	1.6
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	0.35	1.0	—	0.35	1.0	—	0.35	1.0	—	0.35	1.0
RELEASE TIME	No supression	msec.	—	0.05	0.10	—	0.05	0.10	—	0.05	0.10	—	0.05	0.10
	Diode supression	msec.	—	0.35	0.50	—	0.35	0.50	—	0.35	0.50	—	0.35	0.50
	Diode & Zener suppressed	msec.	—	0.10	0.20	—	0.10	0.20	—	0.10	0.20	—	0.10	0.20
TEMPERATURE RANGE	Operate:	°C	–20	—	70	–20	—	70	–20	—	70	–20	—	70
	Storage:	°C	–50	—	100	–50	—	100	–50	—	100	–50	—	100
	Max. allowable temp during mounting process:	°C			221			221			221			221
ALL RATINGS AT 25°C UNLESS NOTED.														
PIN DIAGRAMS (Top View) *If diode is selected, pin #2 is positive.			 1 2 3 4			 1 5 2 3 6 4			 1 2 3 4			 1 2 5 6 3 4		

COTO WABASH

55 DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

ULTRA-LOW THERMAL EMF MICROMINIATURE REED RELAYS

ULTRA-LOW THERMAL EMF REED RELAYS

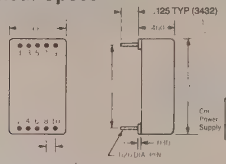
For low-level data acquisition systems

Ratings. Thermal EMF is specified differentially between the two thermal EMF switches (pins 5-6 and 7-8). It is directly proportional to coil power or the square of the applied voltage. When the relays are operated in a scanning mode, the thermal EMF is also proportional to the coil duty cycle.

Coto Series 3600 relays are available with maximum differential thermal EMF ratings of <5μV, <3μV, <1μV, or <0.5μV.

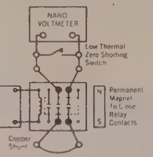
Note: The must operate and must release voltages and the coil resistance are specified at 25°C. These values vary by approximately 0.4%/°C as the ambient temperature varies. Vibration: 20G's to 2000Hz. Shock: 50 G's.

Mechanical Specs



All dimensions are nominal.
Pin 9 is the electrostatic shield pin.

Thermal EMF Test Circuit


NANO VOLTMETER
Low Thermal Zero Shorting Switch
Coil Power Supply
N
S
Permanent Magnet To Close Relay Contacts
Copper Shunt

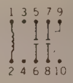
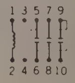
Ordering Information (3602,3660)

To order - assemble a part number from the parameters.

36XX-XX-X X

Model Number (02, 50, 60)
Coil Voltage (05 or 12)
Thermal
Suffix: 9 (<5μV); 8(<3μV); 7(<1μV); or 5(<0.5μV).
Pin Length
Standard (0.135 ± 0.020") "2" - Suffix 2 VME (0.110"± 0.010) "3" - Suffix 3

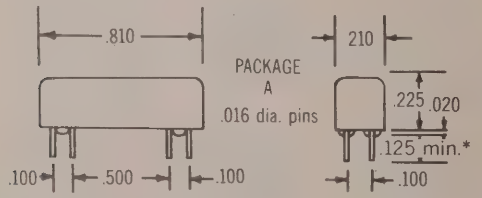
Note:
1. Consists of 20V Zener-diode and 1N4002 diode in series connected in parallel to coil.
2. For Series 3660, the third non-low thermal switch (9-10) is connected in common with the electrostatic shield at pin 9.

MODEL NUMBER			3602		3660	
CONTACT ARRANGEMENT			2A DRY		3A DRY	
PARAMETERS & TEST CONDITIONS		UNIT	MIN	MAX	MIN	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	315	385	315	385
	12 VOLT COIL	Ω	1800	2200	1800	2200
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	6.5	—	6.5
	12 VOLT COIL	VDC	—	15	—	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	3.8	—	3.8
	12 VOLT COIL	VDC	—	9	—	9
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	—	0.4	—
	12 VOLT COIL	VDC	1.0	—	1.0	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	150	—	150
SWITCHING CURRENT (DC/Peak AC, Resistive)		mA	—	250	—	250
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	1.5	—	1.5
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	5	—	5
LIFE	(@ Signal Level <1.0V, .010A)	$\times 10^6$	500	500	500	
EXPECTANCY	(Switching >1.0V, Consult Factory)	$\times 10^6$	—		—	
STATIC CONTACT RESISTANCE (Max. initial, Measured with .050 V, 10mA Contact Lead		Ω	—	0.100	—	0.100
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	0.200	—	0.200
INSULATION RESISTANCE (Between all isolated pins)	25°C, 40% RH	Ω	10^{10}	—	10^{12}	—
MEASURED WITH 100 V @	40°C, 95% RH	Ω	—	—	—	—
DIELECTRIC STRENGTH	ACROSS OPEN CONTACTS:	VDC	250	—	250	—
	CONTACTS TO SHIELD:	VDC	500	—	500	—
	CONTACTS & SHIELD TO COIL:	Vrms	1500	—	1500	—
CAPACITANCE ACROSS OPEN CONTACTS	Shield floating	pf	—	—	—	—
	Shield guarding	pf	—	—	—	—
OPEN CONTACTS TO COIL AND SHIELD		pf	—	—	—	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	1.0	—	1.0
RELEASE TIME	Diode & Zener suppressed.[1]	msec.	—	500	—	500
TEMPERATURE RANGE	Operate:	°C	-20	+70	-20	+70
	Storage:	°C	-50	+100	-50	+100
ALL RATINGS AT 25°C UNLESS NOTED.						
PIN DIAGRAM (Bottom View) Switches connected to pins 5-6 and 7-8 are the low thermal EMF switches			 1 3 5 7 9 / 2 4 6 8 10		 1 3 5 7 9 / 2 4 6 8 10	

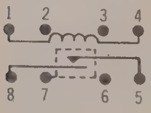
MICROMINIATURE REED RELAYS SERIES 2200

For a complete product line catalog, technical assistance, life test data or other ordering information, please contact us directly. Our philosophy incorporated working hand-in-hand with our customers (Partners in Design) to develop custom designed reed relays that meet their special design requirements.

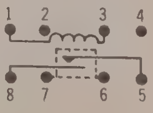
Mechanical Specs



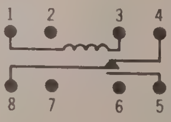
Schematics (Bottom View) Not to scale



2201-2301



2200-2302



2211-05-200

Unused pins are omitted.
Pin numbers for reference only.
Black dot on top of relay denotes pin #1.

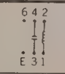
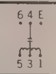
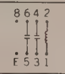
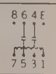
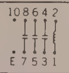
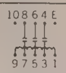
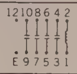
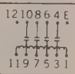
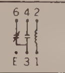
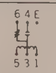
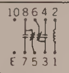
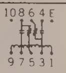
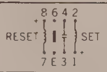
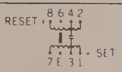
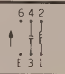
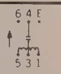
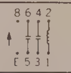
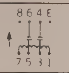
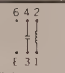
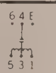
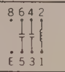
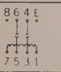
MODEL NUMBER			2200-2301		2200-2302		2211-05-200	
Contact Form			1A		1A		1C	
Package Size			A		A		A	
Available Shield Options			Electrostatic 5 pin relay		Co-Axial 6 pin relay		N/A	
PARAMETERS & TEST CONDITIONS		UNIT	MIN	MAX	MIN	MAX	MIN	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	135	165	135	165	135	165
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	6.5	—	6.5	—	6.5
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	3.6	—	3.6	—	—
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.5	—	0.5	—	0.4	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	150	—	150	—	—
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	0.5	—	0.5	—	—
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	1.0	—	1.0	—	—
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	10	—	10	—	—
LIFE	(@ Signal Level <1.0V, .010A)	$\times 10^8$	—	—	—	—	—	—
EXPECTANCY (Switching >1.0V, Consult Factory)			—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, Measured with .050 V, 10MA contact lead)		Ω	—	0.150	—	0.150	—	0.150
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	0.200	—	0.200	—	0.200
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C, 40% RH		Ω	10^{10}	—	10^{10}	—	10^9 Min. 10" Optional	
DIELECTRIC STRENGTH	ACROSS OPEN CONTACTS:	Volts						
	CONTACTS TO SHIELD:	pf	250	—	250	—	200	—
	CONTACTS & SHIELD TO COIL:	pf	1000	—	1000	—	1000	—
CAPACITANCE ACROSS OPEN CONTACTS	Shield floating	pf	—	—	—	—	—	—
	Shield guarding	pf	—	—	—	—	—	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	0.55	—	0.55	—	—
RELEASE TIME	Diode & Zener suppressed.[1]	msec.	—	—	—	—	—	—
TEMPERATURE RANGE	Operate:	°C	-20	+70	-20	+70	-20	+70
	Storage:	°C	-50	+100	-50	+100	-50	+100
ALL RATINGS AT 25°C UNLESS NOTED.								

1. Consists of 20V Zener-diode and 1N4002 diode in series connected in parallel to coil.

COTO WABASH

DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

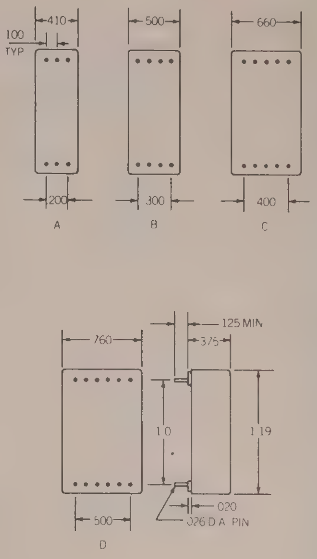
HIGH RELIABILITY REED RELAYS
SERIES 7000

Contact Type	Contact Form	Part No.	Coil V.D.C.	Res. Ohms ±10% @ 25°C	Max. Pick-up V.D.C. @ 25°C	Min. Drop-out V.D.C. @ 25°C	DWG.	Pin Diagram Bottom View • End to End	Pin Diagram Bottom View • Same End
DRY STANDARD	1A	7101	5 12 24	300 1600 4200	3.75 9 18	0.4 1.0 2.0	A		
	2A	7102	5 12 24	150 1000 3500	3.75 9 18	0.4 1.0 2.0	B		
	3A	7103	5 12 24	100 800 2400	3.75 9 18	0.4 1.0 2.0	C		
	4A	7104	5 12 24	80 550 2000	3.75 9 18	0.4 1.0 2.0	D		
	1C	7141	5 12 24	175 1100 4200	3.75 9 18	0.4 1.0 2.0	A		
	2C	7142	5 12 24	65 490 1550	3.75 9 18	0.4 1.0 2.0	C		
	1A Latch *	7150	5 12	550/550 1750/1750	3.75 9	0.4 1.0	B		
MERCURY WETTED	1A	7201	5 12 24	70 450 1785	3.75 9 18	0.4 1.0 2.0	A		
	2A	7202	5 12 24	60 340 1330	3.75 9 18	0.4 1.0 2.0	B		
HIGH VOLTAGE	1A	7301	5 12 24	175 1100 4200	3.75 9 18	0.4 1.0 2.0	A		
	2A	7302	5 12 24	100 640 2450	3.75 9 18	0.4 1.0 2.0	B		

• Black dot on top of relay denotes Pin #1.

* These relays contain bias magnets. Correct polarity must be observed. Diode coil suppression is required for proper operation of latching relays. If internal diode option is selected on 7150 Pińs #1 and #8 are positive. On all other relays Pin #1 is Positive.

Package and Pin Configuration
(Bottom View)



MODEL NUMBER		7100						7200			7300		
CONTACT TYPE		DRY STANDARD						MERCURY WET			HIGH VOLTAGE		
CONTACT FORM		A's AND B's			C's			A's			A's		
PARAMETERS & TEST CONDITIONS	UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
SWITCHING VOLTAGE (DC/Peak AC, Resistive)	Volts	—	—	200	—	—	150	—	—	500	—	—	500
SWITCHING CURRENT (DC/Peak AC, Resistive)	Amps	—	—	0.5	—	—	0.250	—	—	1.0	—	—	0.5
CARRY CURRENT (DC/Peak AC, Resistive)	Amps	—	—	2.0	—	—	1.0	—	—	2.0	—	—	2.0
CONTACT POWER RATING (DC/Peak AC, Resistive)[3]	W	—	—	10	—	—	3	—	—	50	—	—	10
LIFE EXPECTANCY (@ Signal Level <1.0 V, .010A) ‡	CYC	—	10^8	—	—	10^8	—	—	10^9	—	—	10^8	—
LIFE EXPECTANCY (Switching>1.0V, Consult Factory)	CYC	—	*	—	—	*	—	—	10^8	—	—	*	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, 10 mA Contact Load)	Ω	—	—	.100	—	—	.150	—	—	.050	—	—	.100
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)	Ω	—	—	.150	—	—	.200	—	—	.100	—	—	.150
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C, 40% RH	Ω	10^{10}	10^{12}	—	10^9	10^{11}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—
DIELECTRIC STRENGTH (DC/Peak AC) GS ACROSS OPEN CONTACTS:	Volts	250	—	—	200	—	—	1000	—	—	1200	—	—
CONTACTS TO SHIELD	Volts	500	—	—	500	—	—	500	—	—	500	—	—
CONTACTS & SHIELD TO COIL:	VRMs	1500	—	—	1500	—	—	1500	—	—	1500	—	—
CAPACITANCE ACROSS OPEN CONTACTS WITHOUT SHIELD	pf	—	1.0	—	—	2.0	—	—	1.0	—	—	1.0	—
SHIELD GROUNDED	pf	—	0.2	—	—	1.0	—	—	0.2	—	—	0.2	—
OPERATE TIME (Incl. bounce @ Nom. voltage)	msec	—	1.0	—	—	2.0	—	—	2.0	—	—	1.0	—
RELEASE TIME Diode & Zener suppressed	msec	—	0.100	—	—	2.5	—	—	1.0	—	—	0.100	—
TEMPERATURE RANGE (C°) Operate:	C°	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70
Storage:	C°	−50	—	+100	−50	—	+100	−50	—	+100	−50	—	+100
ALL RATINGS AT 25°C UNLESS NOTED.													

ORDERING INFORMATION

To order a Coto relay, assemble a part number from the data to describe the desired parameters.

7XXX – XX – XXXX

Contact Type:
Dry Standard = 1
Mercury Wet = 2
High Voltage = 3

Contact Form

Coil Voltage

Options:

Insulation Resistance
0 = 10^{10} Ohms (Form A's)
10^9 Ohms (Form C's)
1 = 10^{12} Ohms (Form A's)
10^{11} Ohms (Form C's)

Coil Termination
0 = End to End
1 = Same End

Electrostatic Shield*
0 = Omit
1 = Include

Diode
0 = Omit
1 = Include

*E-pin indicates electrostatic shield pin.

---

* Life expectancy at full rated load is dependent upon the combination current/voltage switched. While typical life expectancy is $>5 \times 10^6$. Consult factory for life data at your load levels.

‡ Consists of 20V Zener-Diode and IN4002 Diode in series, connected in parallel to coil.

610 East Tenth Street
Oakland, CA 94606
FAX: (510) 452-3620

BRILL ELECTRONICS

1220 Olympic Boulevard
Santa Monica, CA 90404
Tel: (310) 452-8002

(510) 834-5888

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- Amphenol
- Cablewave
- E.F. Johnson
- Kulka
- Manhattan
- Paladin
- Panduit
- Pomona
- Superior
- Switchcraft

COUNTERS
- Hecon
- Kessler-Ellis
- Redington
- Stemco

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- AMP
- Amphenol
- Belden Cable
- Madison

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- Curtis
- J.W. Miller
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- Clarostat
- Ohmite

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- Dormeyer
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- Coto
- Gordos
- Guardian
- ITT
- Line Electric
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- Sigma
- Struthers-Dunn
- Theta-J

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- Mallory
- Ohmite

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- Semitronics

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- Arrow Hart
- AMP
- C & K
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- G.C.
- McGill
- Omron
- Oslo
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- Switchcraft
- Unimax

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- AMP
- Buchanan
- Curtis
- Electrovert
- Magnum
- RDI
- Siemen
- USD
- Vernitron-Beau
- Weidmuller

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- Fluke
- Simpson Electric
- Triplett

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- Agastat
- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- SSAC

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- AMP
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- Kester
- OK Machine & Tool
- Paladin
- Portasol
- Ungar
- Weller
- Xcelite
- Helper Winch

TRANSFORMERS
- Dormeyer
- Jeffersons
- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

TUBES
- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

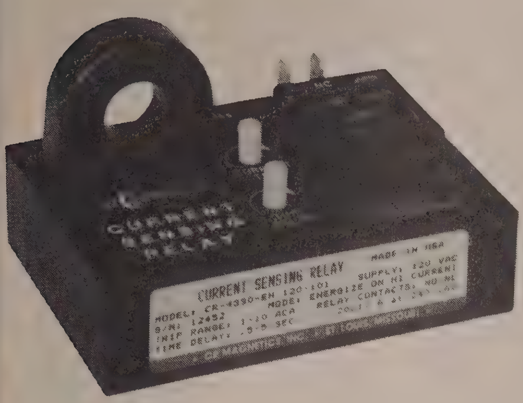
WIRE & CABLE
- Alpha
- Belden
- Cablewave
- Carol
- Iboco
- Madison
- Manhattan
- Quabbin

AMERICAN ZETTLER

CRYDOM

CR MAGNETICS INC™

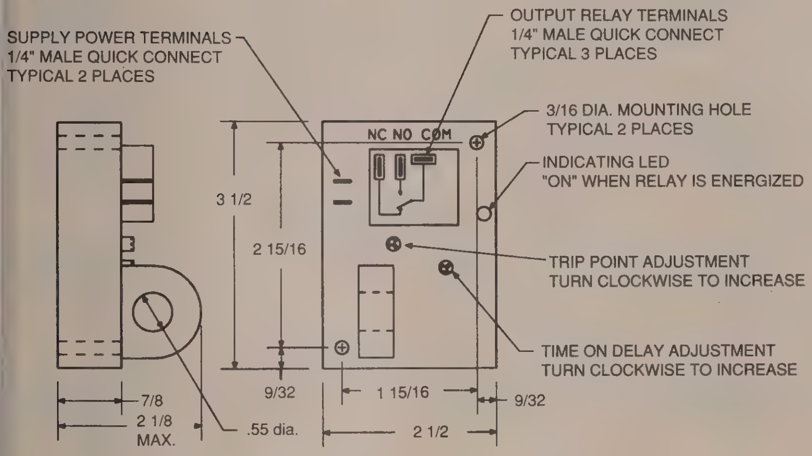
CURRENT SENSING RELAY

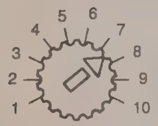

CURRENT SENSING RELAY
MADE IN USA
MODEL: CR-4390-EH 120-101
SUPPLY: 120 VAC
S/N: 12452
MODE: ENERGIZE ON HI CURRENT
TRIP RANGE: 1-10 ACA
RELAY CONTACTS: NO NC
TIME DELAY: .5-5 SEC

- ***Monitor Electrical Heater Elements***
- ***Sense Motor Over/Under loads***
- ***Detect Lamp Burn-Out***
- ***Indicate Phase Loss***

FEATURES

- Variable trip point and time delay
- Monitors currents from 10 ma. to 60 AC Amps
- Electrical isolation between circuits
- Output relay rated up to 20 Amps
- LED relay status indicator
- Dead band prevents relay chatter
- Calibrated dial option available


SUPPLY POWER TERMINALS
1/4" MALE QUICK CONNECT
TYPICAL 2 PLACES
OUTPUT RELAY TERMINALS
1/4" MALE QUICK CONNECT
TYPICAL 3 PLACES
3/16 DIA. MOUNTING HOLE
TYPICAL 2 PLACES
INDICATING LED
"ON" WHEN RELAY IS ENERGIZED
TRIP POINT ADJUSTMENT
TURN CLOCKWISE TO INCREASE
TIME ON DELAY ADJUSTMENT
TURN CLOCKWISE TO INCREASE
NC NO COM
3 1/2
2 15/16
9/32
1 15/16
9/32
2 1/2
7/8
2 1/8
MAX.
.55 dia.


1
2
3
4
5
6
7
8
9
10

The -CD option provides a large calibrated dial for precise setting of trip point (1.0 to 10 Amp range shown).

PART NUMBERS:

CR-4390-XX-XXX-XXX-X-XX

RELAY TRIP STATUS	SUPPLY VOLTAGE	TRIP RANGES	TIME ON DELAY	OPTIONS
EH-Relay Energized on high current (above trip point) EL-Relay Energized on low current (below trip point)	120-120VAC ± 10% 230-230 VAC ± 10% 024-24 VAC ± 10%	.01.1-.01 to 0.1 ACA 110-1.0 to 10 ACA 330-3.0 to 30 ACA 660-6.0 to 60 ACA	A-.5 to 6 Sec. B-2 to 25 Sec.	CD-Calibrated trip point dial

CALL OR FAX FOR COMPLETE TECHNICAL INFORMATION

CR MAGNETICS, INC.
308 AXMINSTER DR.
FENTON, MO 63026
314-343-8518
(FAX) 314-343-5119

SEE SECTION 5500
FOR INFORMATION ON OUR WATT AND CURRENT TRANSDUCERS.

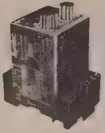
SEE SECTION 5600
FOR INFORMATION ON OUR CURRENT INDICATORS & TRANSFORMERS.

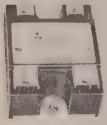
CONTROL RELAYS

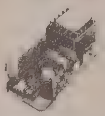
Syrelec

Crouzet Corporation
3237 Commander Drive
Carrollton, TX 75006-2506
Tel: 214-250-1647
1-800-677-5311 • Fax: 214-250-3865

Crouzet offers several variations of Syrelec control relays. Five models for liquid level controls, 3 phase 220V, 380V and 440V for phase loss or reversal protection, current and voltage detection and control, motion detection, solid state relays, and alternating relays are also available. If a standard control requires modification or a special product is needed to meet your exact needs, please call us or the Crouzet Sales Representative nearest you. *Most Controls are UL recognized and CSA approved.*







SERIES	FUNCTION	FEATURES	OUTPUT
WRU Phase Control Relay	Motor phase control 3 phase 220V 60 Hz. 3 Phase 380V 60 Hz. 3 Phase 440V 60 Hz. 3 Phase 575V 60 Hz. Consult factory for 50 Hz.	Motor phase control relay monitors: phase sequence, loss of any phase (even if induced voltage reaches 95% of normal voltage), under and over voltage.	10 Amp SPDT
IART + TIXP3 Current Control Relay	Output when current overshoots selected level 5 to 100 Amps AC using a current transformer (TIXP3).	Control of AC current level. Selection of threshold and hysteresis separate. LED Status indicator. Hysteresis adjustment 5 to 50% of current point.	10 Amp SPDT
DUR Voltage Control Relay	Output when voltage exceeds selected threshold. 0.1 to 10V, 0.4 to 40V, 4.0 to 400V.	AC or DC control. From 0.1V to 400V. Threshold and hysteresis selection separately. LED state of relay indicator. Latching in "ON" state possible.	10 Amp SPDT
FMR Analog Control Relay	Output relay is energized when voltage or current exceeds threshold. Din-rail mounting.	Settable threshold selection from 0 to 30VDC or from 0 to 30 mA DC. Pushbutton Presetting. Low alarm output at 4 mA. Din-rail mounting.	10 Amp SPDT
ARS Solid State Relay	Operates as an open or closed switch. Control input: 90 to 280VAC (AC Version) or 3 to 32VDC (DC Version).	10, 25 or 40 Amp output. Zero voltage switching. Opto-isolated to 4000V.	10, 25 or 40 Amp Triac Solid State
RKT, RIT RPT General Purpose Relay	Blade Plug-in, Ice Cube or 8 and 11 Plug-in Versions.	Surface mount, Indicating light also available.	DPDT or 3PDT 10 Amp
FJR 3 Triplexor	Control of multi-pump systems. Replaces mechanical duplexor and triplexor controls.	Triplex or duplex mode selectable by jumper. LED status indicators.	3 x SPDT 5 Amp
JR Alternating Relay	Duplex or alternating action output relay.	LED status indicators. Transient protected, low cost 12, 24, 110, 220VAC 50/60HZ.	10 Amp SPDT 10 Amp SPDT DPDT Crosswired
NNR Liquid Level Control	Pump-up or Pump-down, slide switch selectable. May be used in fresh water, sea water, sewage or chemical solutions.	Adjustable sensitivity from 4.7K to 47K ohms. Senses changes in resistance across probes. Open PC board design or enclosed with three mounting styles. Several accessories available.	1 Amp AC 1 Amp DC SPDT Relay
NR NRU Liquid Level Control	Control of two liquid levels. Relay will energize when liquid reaches the high or low probe.	Automatic regulation and control of liquid levels, completely solid state detection, sensitivity adjustment on front panel, conventional relay mounting.	10 Amp AC 1 Amp DC SPDT
DVLR LVLR Under Speed Monitor	Output when speed drops below preset threshold. Inhibit time adjustable at factory of .1 to 20 sec.	Detection and control of underspeed, stopping or jamming condition. Operates from 3 wire proximity switch, contact closure or voltage input. Timimg range .06 sec. to 10 hrs. with four subranges.	10 Amp AC 1 Amp DC SPDT

Crouzet Corporation 3237 Commander Dr., Carrollton, TX 75006-2506 • Tel: 214-250-1647 • 1-800-677-5311 • Fax: 214-250-3865

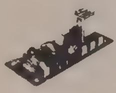
TIME DELAY RELAYS

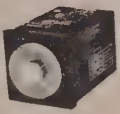
Syrelec

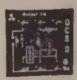
Crouzet Corporation
3237 Commander Drive
Carrollton, TX 75006-2506
Tel: 214-250-1647
1-800-677-5311 • Fax: 214-250-3865

Crouzet Corporation offers a broad line of Syrelec Timers to meet the requirements of most industrial and instrument applications. Numerous accessories and options are available for convenient and compatible installation. If a standard Syrelec Timer does not meet your exact requirements, a custom designed or modified standard device could be the solution to fit your need Contact your nearest Crouzet Sales Office or our Customer Service Department at 1-800-677-5311, for information regarding custom Timers and Controls. *Most Timers are UL recognized and CSA approved.*

SERIES	FUNCTION	FEATURES
LR2 Multi-Function Relay	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Interval Timer *Single Function Relay	Four functions in one unit. 0.06 sec.-640 min. in 2 time ranges, each with four subranges. 12VDC to 220VAC, 50/60 Hz. Din-rail; plug-in; panel mount. **OUTPUT:** 10 Amp DPDT relay
LRU/LRZU Multi-function Relay **CRU/CRZU** Series	1. Delay on Make 2. Single Shot 3. Delay on break 4. Interval Delay on Break	4 delay functions in one unit. Timing Range from .1 sec to 10 hrs in one unit **OUTPUT:** 10 Amp SPDT or 10 Amp DPDT
813 Multi-function LCD or LED Timer	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Interval 5. Repeat Cycle	3 Digit LCD or LED. Timing Range from .1 sec. to 999 hours. Push-button presetting. Multi-voltage **OUTPUT:** 5 Amp SPDT
LR2 U Multi-function Relay	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Interval	Timing Range from .1 sec. to 10 hours in one unit. Direct reading. Big setting Dial. **OUTPUT:** 10 Amp DPDT
88220 Multi-function Motor timer	Multi-function motor driven timer. Din-rail, 8 pin plug-in and panel mounting.	Five functions in one unit. Timing range from .3 sec to 12 hours. Direct reading. Memory. **OUTPUT:** 8 Amp 2X SPDT
AXR 2 Timing Relay	Delay on Make DPDT or Delay on Make + one Instantaneous Output Relay.	Timing range from .1 sec. to 10 hours in one unit. Direct Reading. Big Setting Dial. **OUTPUT:** 10 Amp 2X SPDT
AR2 Timing Relay	Delay on Make electronic timing relay. Din-rail, 8 and 11 pin plug-in, 11 pin spade, and panel mounting.	2 time range models available: 0.06 sec. to 160 sec. or 15 sec. to 640 min. LED relay status indicator. Five input power voltages. **OUTPUT:** 10 Amp DPDT
AR U/ARZU Timing Relay	Delay on Make Din-rail and 8 pin plug-in mounting.	Timing range from .1 sec to 10 hours in one unit. Direct reading. Dual voltage. **OUTPUT:** 10 Amp SPDT or 10 Amp DPDT
813 AX2 Timing Relay	Delay on Make DPDT or Delay on Make + one Instantaneous Output Relay	3 Digit LCD Timing Range from .1 sec. to 999 hours. Push-button Presetting. **OUTPUT:** 5 Amp 2X SPDT







SERIES	FUNCTION	FEATURES
NAR 2 **NBR 2** **NCR 2**	Delay on Make Single Shot Delay on Break	Timing range potentiometer fine tuned. Models in two ranges: 0.06 sec. - 160 sec. or 15 sec. - 640 min. Open PC board. Time range slide switch selected. **OUTPUT:** 10 Amp DPDT
AR2C Preset Timer Preset Counter	Delay on Make timer or Preset Counter. Count to 999 at 10 Hz. speed in count mode. Din-rail, 11 or 8 pin plug-in.	Count or time preset selectable with thumbwheel switches on top of enclosure. 24 VAC to 220 VAC, 50/60 Hz. **OUTPUT:** 10 Amp DPDT
DR2 U Repeat Cycle Timer	Repeat cycle. Both OFF and ON time independently set. Din-rail, 8 and 11 pin plug-in mounting.	Timing Range from .1 sec. to 10 hours for ON and OFF time selectable in one unit. Direct reading. **OUTPUT:** 10 Amp DPDT
DR2 Repeat Cycle Timer	Repeat cycle. Both OFF and ON time selectable. Din-rail, 8 and11 pin plug-in or panel mounting: T1 is OFF and T2 is ON time	2 time ranges available for OFF and ON time functions. Separate controls for ON and OFF setting. Each time range with four subranges. Five input power voltages. **OUTPUT:**10 AMP SPDT
DR U/DRZU Repeat Cycle Timer	Repeat cycle. Both OFF and ON time independently set. Din-rail and 8 pin plug-in mounting.	Timing range from .1 sec to 10 hours in one unit. Direct reading. Dual Voltage. **OUTPUT:** 10 Amp SPDT or 10 Amp DPDT
SAS **SHS** Solid State Timer	Delay on Make Interval Fast-on Terminals Small Size 1.77" x 1.96"	Available in fixed timing, external potentiometer and internal potentiometer models. Economical, epoxy encapsulated, 10 to 260VAC. 50/60 Hz. **OUTPUT:** Solid State .7 Amp SCR
QAS **QHS** Solid State Timer	Delay on Make Interval 2" x 2" Package Fast on Terminals	Available in fixed timing, external potentiometer and internal potentiometer models. Economical, epoxy encapsulated, 10 to 260VAC. 50/60 Hz. **OUTPUT:** Solid State 1 Amp SCR
QBS **QCS** Solid State Timer	Single Shot Delay on Break 2" x 2" Package Fast on Terminals	Available in fixed timing, external potentiometer and internal potentiometer models. Economical, epoxy encapsulated, 10 to 260VAC. 50/60 Hz. **OUTPUT:** Solid State 1 Amp SCR
QDS 1 & 2 Solid State Timer	Repeat Cycle Off/On or On/Off 2" x 2" Package Fast on Terminals	Independent Off and On timing. Available in fixed timing, external potentiometer and internal potentiometer models 10 to 260VAC. 50/60 Hz. **OUTPUT:** Solid State 1 Amp SCR

SOLID STATE RELAYS

GORDOS

PANEL MOUNT AC OUTPUT SOLID STATE RELAYS

G, GA Series Power Relays
- Current Ratings to 90A
- Output Voltage Ratings to 660 VAC with 24VAC Minimum
- AC or DC Inputs
- 4KV Optical Isolation
- Zero Voltage Turn-on (Random Available)
- RC Snubber Network for Inductive Loads
- UL Recognized, CSA Certified
- VDE Approval on Many Models

G Series Power Relays
- Back-to-back (dual) SCR Output for Severe Inductive Loads
- Superior False Turn-on Immunity and Positive Turn-off at High dv/dt

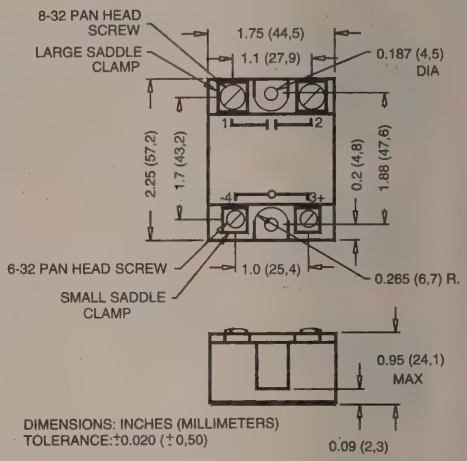
GA Series Power Relays
- Economical Triac Output for General Purpose Applications

G and GA Series

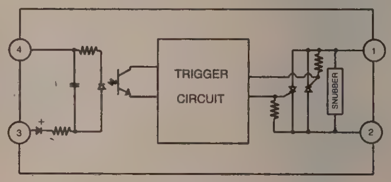
G SERIES

MODELS	MAX. OUTPUT VOLTAGE RATING (VAC)	OUTPUT CURRENT RATING	CONTROL VOLTAGE
G120A10	140	10A	90-280VAC
G120A25	140	25A	90-280VAC
G120A45	140	45A	90-280VAC
G240A10	250	10A	90-280VAC
G240A25	250	25A	90-280VAC
G240A45	250	45A	90-280VAC
G280A10	280	10A	90-280VAC
G280A25	280	25A	90-280VAC
G280A45	280	45A	90-280VAC
G280A75	280	75A	90-280VAC
G280A90	280	90A	90-280VAC
G480A10	480	10A	90-280VAC
G480A25	480	25A	90-280VAC
G480A50	480	50A	90-280VAC
G480A75	480	75A	90-280VAC
G480A90	480	90A	90-280VAC
G575A10	660	10A	90-280VAC
G575A25	660	25A	90-280VAC
G575A50	660	50A	90-280VAC
G575A75	660	75A	90-280VAC
G575A90	660	90A	90-280VAC
G120D10	140	10A	3-32VDC
G120D25	140	25A	3-32VDC
G120D45	140	45A	3-32VDC
G240D10	250	10A	3-32VDC
G240D25	250	25A	3-32VDC
G240D45	250	45A	3-32VDC
G280D10	280	10A	3-32VDC
G280D25	280	25A	3-32VDC
G280D45	280	45A	3-32VDC
G280D75	280	75A	3-32VDC
G280D90	280	90A	3-32VDC
G480D10	480	10A	3-32VDC
G480D25	480	25A	3-32VDC
G480D50	480	50A	3-32VDC
G480D75	480	75A	3-32VDC
G480D90	480	90A	3-32VDC
G575D10	660	10A	3-32VDC
G575D25	660	25A	3-32VDC
G575D50	660	50A	3-32VDC
G575D75	660	75A	3-32VDC
G575D90	660	90A	3-32VDC
G120E10	140	10A	18-36VAC
G120E25	140	25A	18-36VAC
G120E45	140	45A	18-36VAC
G240E10	250	10A	18-36VAC
G240E25	250	25A	18-36VAC
G240E45	250	45A	18-36VAC
G280E10	280	10A	18-36VAC
G280E25	280	25A	18-36VAC
G280E45	280	45A	18-36VAC
G280E75	280	75A	18-36VAC
G280E90	280	90A	18-36VAC
G480E10	480	10A	18-36VAC
G480E25	480	25A	18-36VAC
G480E50	480	50A	18-36VAC
G480E75	480	75A	18-36VAC
G480E90	480	90A	18-36VAC
G575E10	660	10A	18-36VAC
G575E25	660	25A	18-36VAC
G575E50	660	50A	18-36VAC
G575E75	660	75A	18-36VAC
G575E90	660	90A	18-36VAC

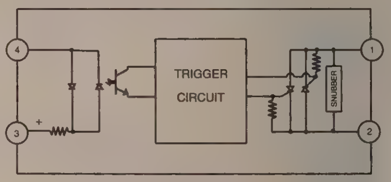
Specify Suffix "R" for Random Turn-on Modules



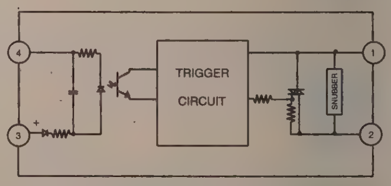
DIMENSIONS: INCHES (MILLIMETERS)
TOLERANCE:±0.020 (±0,50)



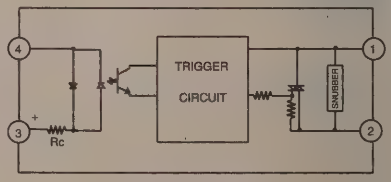
G SERIES AC INPUT EQUIVALENT CIRCUIT



G SERIES DC INPUT EQUIVALENT CIRCUIT



GA5 SERIES AC INPUT EQUIVALENT CIRCUIT



GA5 SERIES DC INPUT EQUIVALENT CIRCUIT

See Gordos Data Acquisition & Control Products in Section 2325 and Custom Hybrid Circuits in Section 3130.
Products and specifications subject to change without notice.
Consult factory for application assistance.

SOLID STATE RELAYS

GORDOS

PANEL MOUNT AC OUTPUT SOLID STATE RELAYS

GA SERIES

MODEL	MAX. OUTPUT VOLTAGE RATING (VAC)	OUTPUT CURRENT RATING	CONTROL VOLTAGE
GA5-2A10	140	10A	90-280VAC
GA5-2A25	140	25A	90-280VAC
GA5-4A10	250	10A	90-280VAC
GA5-4A25	250	25A	90-280VAC
GA5-6A10	280	10A	90-280VAC
GA5-6A25	280	25A	90-280VAC
GA5-2D10	140	10A	3-32VDC
GA5-2D25	140	25A	3-32VDC
GA5-4D10	250	10A	3-32VDC
GA5-4D25	250	25A	3-32VDC
GA5-6D10	280	10A	3-32VDC
GA5-6D25	280	25A	3-32VDC
GA5-2E10	140	10A	18-36VAC
GA5-2E25	140	25A	18-36VAC
GA5-4E10	250	10A	18-36VAC
GA5-4E25	250	25A	18-36VAC
GA5-6E10	280	10A	18-36VAC
GA5-6E25	280	25A	18-36VAC

GT and GF Series

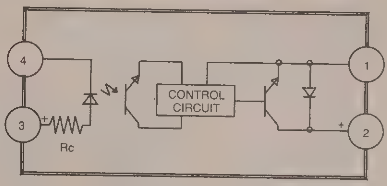
PANEL MOUNT DC OUTPUT SOLID STATE RELAYS

GF Models Utilize FET Output

- Low leakage of 10µA
- Milliohm On-Resistance
- 1500 VAC Optical Isolation
- Long Life Switching of DC Loads to 30A

GT Series Utilize Transistor Output

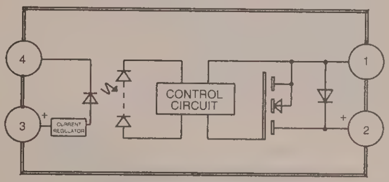
- Cost Effective General Purpose DC SSR
- Long Life Switching DC Loads to 10A
- 4KV Optical Isolation
- Fast 25µSec Maximum Turn-on Time


4
3
Rc
CONTROL CIRCUIT
1
2
+
+

GT SERIES EQUIVALENT CIRCUIT

GT AND GF SERIES

MODEL	MAX. OUTPUT VOLTAGE RATING (VDC)	OUTPUT CURRENT RATING	CONTROL VOLTAGE
GF50D30	1-50	30A	3-32VDC
GF100D15	1-100	15A	3-32VDC
GF200D10	1-200	10A	3-32VDC
GT60D10	3-60	10A	3-32VDC

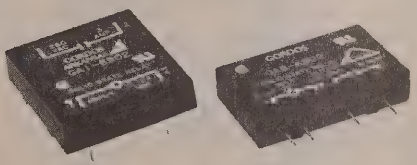

4
3
CURRENT REGULATOR
CONTROL CIRCUIT
1
2
+
+

GF SERIES EQUIVALENT CIRCUIT

PRINTED CIRCUIT BOARD MOUNTABLE AC OUTPUT SOLID STATE RELAYS

GA1, GA8, Series SSR

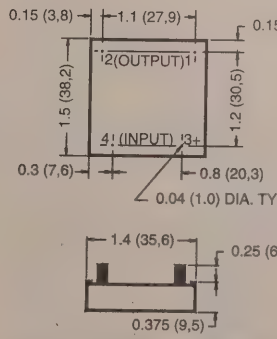
- Industry Standard Packaging, SIP or Flat Pack
- 4KV Optical Isolation
- 100A Surge Capability
- UL Recognized, CSA Certificate
- VDE Approval on Some Models



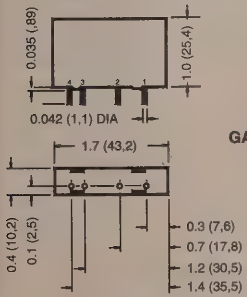
G1 and GA8 Series

GA1 AND GA8 SERIES

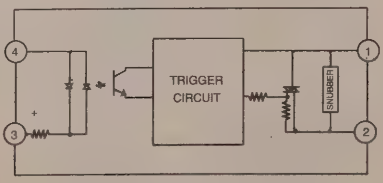
MODEL	MAX. OUTPUT VOLTAGE RATING (VAC)	OUTPUT CURRENT RATING @ 25°C TA	CONTROL VOLTAGE
GA1-2B02	120	4A	3-24VDC
GA1-4B02	250	4A	3-24VDC
GA1-6B02	280	4A	3-24VDC
GA8-2B02	120	4A	3-24VDC
GA8-4B02	250	4A	3-24VDC
GA8-6B02	280	4A	3-24VDC


0.15 (3,8)
1.1 (27,9)
0.15 (3,8)
2(OUTPUT)1
1.5 (38,2)
1.2 (30,5)
4 (INPUT) 3+
0.3 (7,6)
0.8 (20,3)
0.04 (1.0) DIA. TYP.
1.4 (35,6)
0.25 (6,4)
0.375 (9,5)

GA1 Series


0.035 (.89)
1.0 (25,4)
4 3 2 1
0.042 (1,1) DIA
1.7 (43,2)
0.4 (10,2)
0.1 (2,5)
0.3 (7,6)
0.7 (17,8)
1.2 (30,5)
1.4 (35,5)

GA8 Series


4
3
+
TRIGGER CIRCUIT
SNUBBER
1
2

GA1 & GA8 SERIES DC INPUT EQUIVALENT CIRCUIT

DIMENSIONS: INCHES (MILLIMETERS)
TOLERANCE:±0.020 (±0,50)

DIMENSIONS: INCHES (MILLIMETERS)
TOLERANCE:±0.020 (±0,50)

See Gordos Data Acquisition & Control Products in Section 2325 and Custom Hybrid Circuits in Section 3130.
Products and specifications subject to change without notice.
Consult factory for application assistance.

I/O MODULES & MOUNTING BOARDS

GORDOS

MODULE BOARDS

Gordos I/O Mounting Boards are available for Standard, SM, Quad and Miniature I/O module sizes and everything you need to interface with any 5, 15, or 24 volt logic unit is included. Since the function is self-contained in each module, you determine the layout of your own system boards. The plug-in modules with single hold-down screw make later revisions easy; modules are replaceable without disconnecting the wires.

- Plug-compatible logic contacts on 8, 16, 24, and 32 position boards. Screw terminal logic connections on 4 position boards.
- Barrier strip with screw terminals for load connections
- Circuitry for pull-up resistors
- 5 amp field replaceable fuses
- LED status indicators
- All even pins logic GND

MODULE BOARDS FOR STANDARD MODULES

MODEL	POSITION
PB-4	4
PB-4R*	4
PB-8	8
PB-16	16
PB-24	24
PB-32D	32

FOR MINIATURE MODULES

MODEL	POSITION
PB-8M	8
PB-16M	16
PB-24M	24
PB-32M	32

Module Boards

FOR QUAD-PACK MODULES

PB-16Q	4
PB-24Q	6
PB-32Q	8

*Output I/O only

FOR SM MODULES

PB-8SM	8
PB-16SM	16
PB-24SM	24
PB-32SM	32

FOR MINI-8 MODULES

PB-16M8	16

MINIATURE I/O MODULES (M AND SM)

Gordos I/O Modules get a minimum of 300% testing-multiple component and functional tests that made Gordos the reliability standard in SSRs. Across the line, Gordos' average field return rate is well below the industry average.

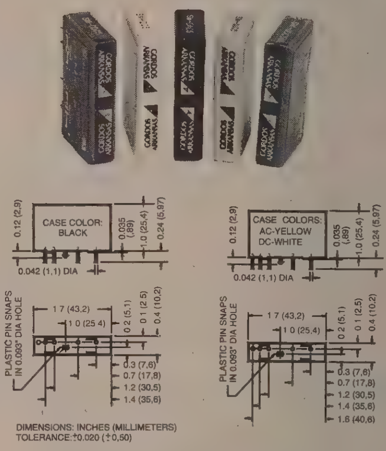
- High Current Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- 33% Thinner than Standard I/O Modules
- UL Recognized/CSA Certified

M and SM SERIES

- Zero or Random Turn-on available in AC output
- SM plug into standard I/O Mounting Boards or SM Series Mounting Borads
- M plug into M Series Mounting Boards Only

SM SERIES

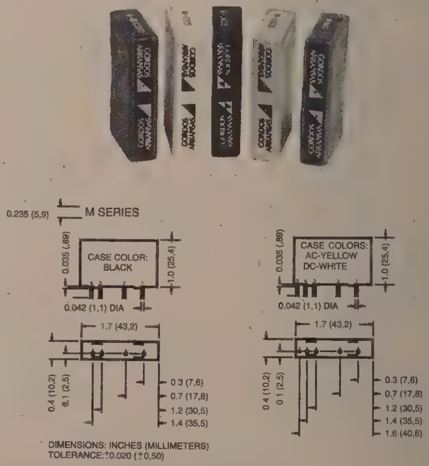
	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
INPUT MODULES	SM-IAC5	90-140VAC/VDC	5	50MADC
	SM-IAC15	90-140VAC/VDC	15	50MADC
	SM-IAC24	90-140VAC/VDC	24	50MADC
	SM-IAC 5A	90-280VAC/VDC	5	50MADC
	SM-IAC24A	90-280VAC/VDC	24	50MADC
	SM-IDC5	3.3-32VDC	5	50MADC
	SM-IDC15	3.3-32VDC	15	50MADC
	SM-IDC24	3.3-32VDC	24	50MADC
OUTPUT MODULES	MODEL		OUTPUT VOLTAGE RATING	
	SM-OAC5	5VDC	12-140VAC	3.5Arms
	SM-OAC15	15VDC	12-140VAC	3.5Arms
	SM-OAC24	24VDC	12-140VAC	3.5Arms
	SM-OAC5A	5VDC	24-280VAC	3.5Arms
	SM-OAC24A	24VDC	24-280VAC	3.5Arms
	SM-ODC5	5VDC	3-60VDC	3.0A
	SM-ODC15	15VDC	3-60VDC	3.0A
	SM-ODC24	24VDC	3-60VDC	3.0A
	SM-ODC5A	5VDC	3-250VDC	3.0A


0.12 (2,9)
CASE COLOR: BLACK
0.035 (.89)
1.0 (25,4)
0.24 (5,97)
0.042 (1,1) DIA
CASE COLORS: AC-YELLOW DC-WHITE
PLASTIC PIN SNAPS IN 0.093" DIA HOLE
1 7 (43,2)
1 0 (25 4)
0 2 (5,1)
0 1 (2.5)
0.4 (10,2)
0.3 (7,6)
0.7 (17,8)
1.2 (30,5)
1.4 (35,6)
1.6 (40,6)
DIMENSIONS: INCHES (MILLIMETERS)
TOLERANCE:±0.020 (±0,50)

SM Series I/O Module

M SERIES

	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
INPUT MODULES	M-IAC5	90-140VAC/VDC	5	50MADC
	M-IAC15	90-140VAC/VDC	15	50MADC
	M-IAC24	90-140VAC/VDC	24	50MADC
	M-IAC5A	90-280VAC/VDC	5	50MADC
	M-IAC24A	90-280VAC/VDC	24	50MADC
	M-IDC5	3.3-32VDC	5	50MADC
	M-IDC15	3.3-32VDC	15	50MADC
	M-IDC24	3.3-32VDC	24	50MADC
OUTPUT MODULES	MODEL		OUTPUT VOLTAGE RATING	
	M-OAC5	5VDC	12-140VAC	3.5Arms
	M-OAC15	15VDC	12-140VAC	3.5Arms
	M-OAC24	24VDC	12-140VAC	3.5Arms
	M-OAC5A	5VDC	24-280VAC	3.5Arms
	M-OAC24A	24VDC	24-280VAC	3.5Arms
	M-ODC5	5VDC	3-60VDC	3.0A
	M-ODC15	15VDC	3-60VDC	3.0A
	M-ODC24	24VDC	3-60VDC	3.0A


0.235 (5,9)
M SERIES
0.035 (.89)
CASE COLOR: BLACK
1.0 (25,4)
0.042 (1,1) DIA
CASE COLORS: AC-YELLOW DC-WHITE
1.7 (43,2)
0.4 (10,2)
0.1 (2,5)
0 3 (7,6)
0.7 (17,8)
1.2 (30,5)
1.4 (35,5)
1.6 (40,6)
DIMENSIONS: INCHES (MILLIMETERS)
TOLERANCE:±0.020 (±0,50)

M Series I/O Module

See Gordos Data Acquisition & Control Products in Section 2325 and Custom Hybrid Circuits in Section 3130.
Products and specifications subject to change without notice.
Consult factory for application assistance.

Crouzet Corporation 3237 Commander Dr., Carrollton, TX 75006-2506 • Tel: 214-250-1647 • 1-800-677-5311 • Fax: 214-250-3865

I/O MODULES & MOUNTING BOARDS

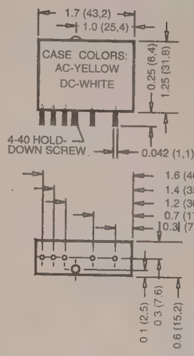
GORDOS

STANDARD SIZE I/O MODULES

- Zero AC or Random Turn-on Output Modules
- Industry Standard Packaging
- Plug into Standard I/O Mounting Racks

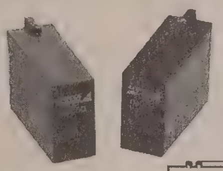
	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
INPUT MODULES	IAC5	90-140VAC/VDC	5	50MADC
	IAC15	90-140VAC/VDC	15	50MADC
	IAC24	90-140VAC/VDC	24	50MADC
	IAC5A	90-280VAC/VDC	5	50MADC
	IAC24A	90-280VAC/VDC	24	50MADC
	IDC5	3.3-32VDC	5	50MADC
	IDC15	3.3-32VDC	15	50MADC
	IDC24	3.3-32VDC	24	50MADC
OUTPUT MODULES	MODEL	OUTPUT VOLTAGE RATING		
	OAC5	5VDC	12-140VAC	3.5Arms
	OAC15	15VDC	12-140VAC	3.5Arms
	OAC24	24VDC	12-140VAC	3.5Arms
	OAC5A	5VDC	24-280VAC	3.5Arms
	OAC24A	24VDC	24-280VAC	3.5Arms
	ODC5	5VDC	3-60VDC	3.0A
	ODC15	15VDC	3-60VDC	3.0A
	ODC24	24VDC	3-60VDC	3.0A
	ODC5A	5VDC	3-250VDC	3.0A

Standard Size I/O Modules

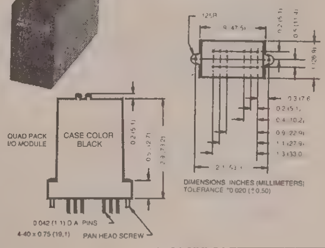

1.7 (43,2)
1.0 (25,4)
CASE COLORS:
AC-YELLOW
DC-WHITE
0.25 (6,4)
1.25 (31,8)
4-40 HOLD-DOWN SCREW
0.042 (1,1) DIA
1.6 (40,6)
1.4 (35,6)
1.2 (30,5)
0.7 (17,8)
0.3 (7,6)
0.1 (2,5)
0.3 (7,6)
0.6 (15,2)

QUAD PACK MODULES

	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
INPUT MODULES	IAC5Q	90-140VAC/VDC	5	50MADC
	IAC5AQ	90-280VAC/VDC	5	50MADC
	IAC5EQ	18-36VAC/VDC	5	50MADC
	IDC5Q	10-60VDC	5	50MADC
	IDC5BQ	4-32VDC	5	50MADC
OUTPUT MODULES	MODEL		OUTPUT VOLTAGE RATING	
	OAC5Q	5VDC	12-140VAC	3.5Arms
	ODC5Q	5VDC	3-60VDC	3.0A



Quad Pack Modules

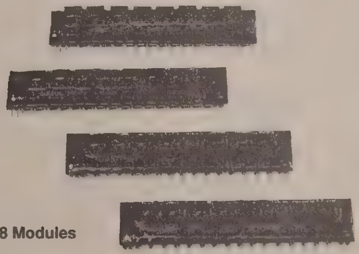

QUAD PACK I/O MODULE
CASE COLOR BLACK
0.042 (1,1) D.A. PINS
4-40 x 0.75 (19,1)
PAN HEAD SCREW
DIMENSIONS: INCHES (MILLIMETERS)
TOLERANCE ±0.020 (±0.50)

MINI-8 MODULE

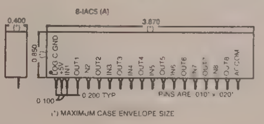
- Thick Film Hybrid Construction, Superior Reliability
- Ceramic Substrate for better Thermal Management
- Solder or Plug into PC Boards
- 2.5KV Optical Isolation
- UL/CSA Approvals Pending
- 8 Modules in a SIP Package
- Saves 80% Board Space of Standard Size Module

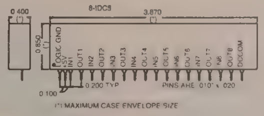
	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
INPUT MODULES	8-IAC5	90-140VAC/VDC	5	50MADC
	8-IAC5A	90-280VAC/VDC	5	50MADC
	8-IAC5E	18-36VAC/VDC	5	50MADC
	8-IDC5	10-60VDC	5	50MADC
OUTPUT MODULES	MODEL		OUTPUT VOLTAGE RATING	
	8-OAC5	5VDC	12-140VAC	3.5Arms
	8-OAC5A	5VDC	24-280VAC	3.5Arms
	8-ODC5	5VDC	3-60VDC	3.0A

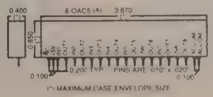
**Maximum Output for any channel, at 40° C, derate by 50 mA/°C to 80° C. For multiple channel conduction, total package dissipation can not exceed rated dissipation, at 40° C. Total package dissipation is the sum of each channel's dissipation, which is calculated by multipling the maximum forward voltage drop by the output current carried by each channel. See data sheet for additional information.*

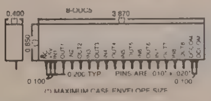


Mini-8 Modules


8-IACS (A)
0.400
3.870
0.850
0.100
0.200 TYP
PINS ARE .010" x .020"
(*) MAXIMUM CASE ENVELOPE SIZE


8-IDC5
0.400
3.870
0.850
0.100
0.200 TYP
PINS ARE .010" x .020"
(*) MAXIMUM CASE ENVELOPE SIZE


8 OACS (A)
0.400
3.870
0.850
0.100
0.200 TYP
PINS ARE .010" x .020"
(*) MAXIMUM CASE ENVELOPE SIZE


8-ODC5
0.400
3.870
0.850
0.100
0.200 TYP
PINS ARE .010" x .020"
(*) MAXIMUM CASE ENVELOPE SIZE

See Gordos Data Acquisition & Control Products in Section 2325 and Custom Hybrid Circuits in Section 3130.

Products and specifications subject to change without notice.

Consult factory for application assistance.

REED RELAYS

GORDOS

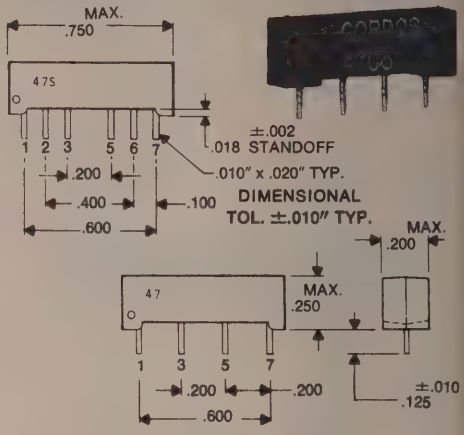
MOLDED REED RELAYS

All Gordos Reed Relays feature
- Molded in Semiconductor Grade Molding Compounds that meet UL 94-0 Flammability ratings
- Compatable with Automatic Insertion
- Logic Compatable
- 100% Computer Tested

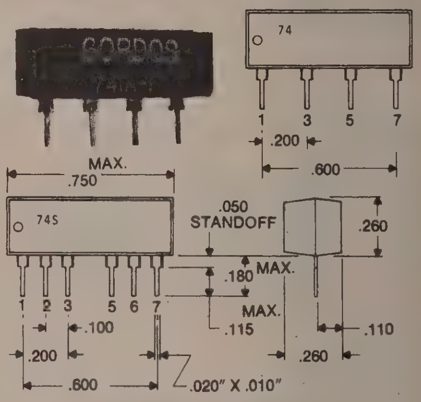
CONTACT SPECIFICATIONS

CONTACT ARRANGEMENT		FORM-A				FORM-B(3)		FORM-C			
MODEL	**TYPE**	**47**	**741A**	**831A**	**832A**	**741B**	**831B**	**741C**	**831C**	**835C**	**836C**
Maximum Switching DC(2)	Watts	10	10	10		10	10	3	3		
	Volts	200	200	200		200	200	30	30		
Maximum Current DC amps	Switch	0.5	0.5	0.5		0.5	0.5	0.2	0.2		
	Carry	1.5	1.5	1.5		1.5	1.5	0.5	0.5		
Maximum Initial Contact Resistance (1)		0.1	0.2	0.2		0.2	0.2	—	0.2		
Minimum Breakdown DC Voltage	Across Contracts	250	250	250		250	250	250	200		
	Contact to Coil	750	750	750		750	750	750	750		
Capacitance (typical) pF	Across Contracts	1.0	1.0	1.0		—	—	2.0	1.5		
	Contact to Coil	2.0	2.0	2.0		3.8	3.8	2.0	2.0		
Insolation Resistance (ohms)		10^{10}	10^{10}	10^{10}		10^{10}	10^{10}	10^{8}	10^{8}		
Operate Time (typical mSec) Including Bounce Except Form-B		0.5	0.5	0.5		0.5	0.5	1.0	1.0		
Release Time (typical mSec) Diode Suppressed		0.3	0.3	0.3		0.3	0.3	1.5	1.5		

Operating Temperature Range -20° C - 85° C, Storage Temperature Range -20° C - 100° C


MAX.
.750
47S
1 2 3 5 6 7
±.002
.018 STANDOFF
.200
.010" x .020" TYP.
.400
.100
.600
DIMENSIONAL TOL. ±.010" TYP.
MAX.
.200
47
MAX.
.250
1 3 5 7
.200
.200
±.010
.125
.600

47 Series Mini-SIP Dry Reed Relay


74
1 3 5 7
.200
.600
MAX.
.750
74S
.050
STANDOFF
.260
1 2 3 5 6 7
.180 MAX.
.100
MAX.
.115
.110
.200
.260
.600
.020" X .010"

74 Series SIP Dry Reed Relay

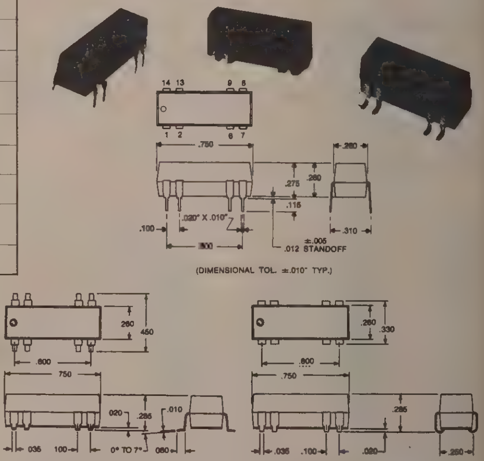
SERIES 846 HIGH VOLTAGE / 847 MERCURY WETTED
SERIES 848 HIGH VOLTAGE & HIGH ISOLATION

CONTACT ARRANGEMENT		FORM-A				FORM-C
Model Type		**846A**	**Mercury Wetted (4) 847A**	**848A**	**851A**	**Mercury Wetted (3) 847C**
Maximum Switching DC(2)	Watts	25	50	25	10	50
	Volts	1000	500	1000	200	500
Maximum Current DC (amps)	Switch	1.0	1.0	1.0	0.5	1.0
	Carry	2.0	2.0	2.0	1.5	2
Maximum Initial Contact Resistance (ohms) (1)		0.200	0.100	0.200	0.200	0.100
Minimum Breakdown Voltage DC	Across Contracts	1000	1000	1000	500	1000
	Contact to Coil	1500	1500	2500	2000	1000
Capacitance (typical) pF	Across Contracts	1	1.1	1	1	1.3
	Contact to Coil	2	2	2	2	6
Insulation Resistance (typical ohms)		10^{10}	10^{12}	10^{10}	10^{10}	10^{8}
Operate Time (typical mSec) Including Bounce Except Form-B		0.5	2.5	0.5	0.5	2.5
Release Time (typical mSec) Diode Suppressed		0.3	2.0	0.3	0.3	2.0

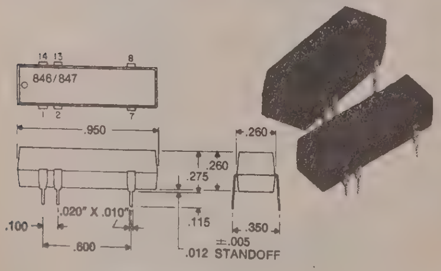
Nominal Coil Volt DC	5	12	24
Most Operate Voltage DC	3.8	9.0	18
Maximum Voltage DC	0.5	1.2	2.4
Maximum Voltage DC (3)	10	20	35

Notes: All specifications are based on a 25° C ambient emperature.

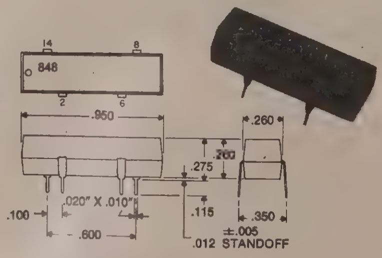
1. *Measured with nominal coil voltage applied (except Form B).*
2. *Higher voltage and/or current may be switched with life expectancy reduced.*
3. *Excessive voltage (maximum of 6.5 VDC for 5VDC model, 15 VDC for 12 VDC model, and 28VDC for 24 model), may cause contact reclosure on Form B models.*


14 13 9 8
1 2 6 7
.750
.260
.275
.260
.115
.020" X .010"
.100
.600
.310
±.005
.012 STANDOFF
(DIMENSIONAL TOL. ±.010" TYP.)
.260
.450
.600
.750
.020
.285
.010
.036
.100
0° TO 7°
.060
.260
.330
.600
.750
.285
.036
.100
.020
.260

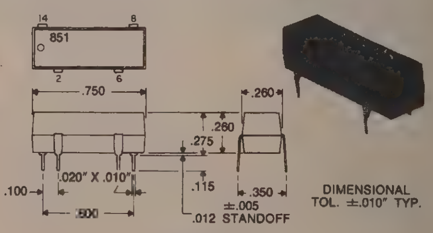
83 Series Molded Dip Thru-hole and Surface Mount


14 13 8
846/847
1 2 7
.950
.260
.260
.275
.020" X .010"
.115
.350
.100
.600
±.005
.012 STANDOFF

846/847 Series


14 8
848
2 6
.950
.260
.260
.275
.020" X .010"
.115
.350
.100
.600
±.005
.012 STANDOFF

848 Series


14 8
851
2 6
.750
.260
.260
.275
.020" X .010"
.115
.350
.100
.500
±.005
.012 STANDOFF
DIMENSIONAL TOL. ±.010" TYP.

851 Series

See Gordos Data Acquisition & Control Products in Section 2325 and Custom Hybrid Circuits in Section 3130.

Products and specifications subject to change without notice.

Consult factory for application assistance.

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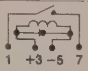
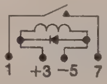
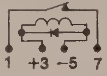
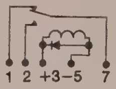
REED RELAYS

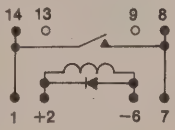
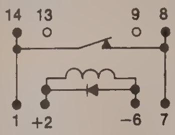
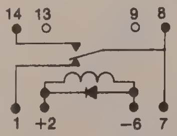
GORDOS

MOLDED REED RELAYS SELECTION CHART

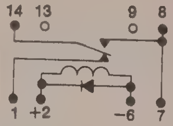
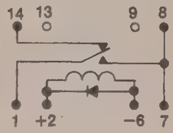
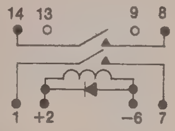
Series 47 Mini-Sip Dry Reed Relays
Series 74 Sip Dry Reed Relays

MODEL	NOMINAL COIL VDC	COIL RES OHMS	DIODE SUSPENSION	SCHEMATIC (TOP VIEW)
4705	5	500	NO	
4705D	5	500	YES	
4712	12	1200	NO	
4712D	12	1200	YES	
741A-1	5	380	NO	
741A-2	5	380	YES	
741A-9	5	500	NO	
741A-10	5	500	YES	
741A-3	12	1000	NO	
741A-4	12	1000	YES	
741A-7	24	1750	NO	
741A-8	24	1750	YES	
741B-9	5	500	NO	
741B-10	5	500	YES	
741B-5	12	500	NO	
741B-6	12	500	YES	
741B-7	24	1750	NO	
741B-8	24	1750	YES	
741C-1	5	200	NO	
741C-2	5	200	YES	
741C-3	12	500	NO	
741C-4	12	500	YES	
741C-5	24	1750	NO	
741C-6	24	1750	YES	

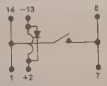
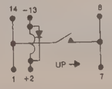
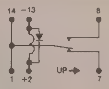
Series 83 Molded DIP Thru-Hole and Surface Mount Dry Reed Relay

831A-1	5	380	No	
831A-1G	5	380	No	
831A-1J	5	380	No	
831A-2	5	380	Yes	
831A-2G	5	380	Yes	
831A-2J	5	380	Yes	
831A-3	5	500	No	
831A-3G	5	500	No	
831A-3J	5	500	No	
831A-4	5	500	Yes	
831A-4G	5	500	Yes	
831A-4J	5	500	Yes	
831A-5	12	1000	No	
831A-5G	12	1000	No	
831A-5J	12	1000	No	
831A-6	12	1000	Yes	
831A-6G	12	1000	Yes	
831A-6J	12	1000	Yes	
831A-7	24	1750	No	
831A-7G	24	1750	No	
831A-7J	24	1750	No	
831A-8	24	1750	Yes	
831A-8G	24	1750	Yes	
831A-8J	24	1750	Yes	
831B-3	5	500	No	
831B-3G	5	500	No	
831B-3J	5	500	No	
831B-4	5	500	Yes	
831B-4G	5	500	Yes	
831B-4J	5	500	Yes	
831B-5	12	500	No	
831B-5G	12	500	No	
831B-5J	12	500	No	
831B-6	12	500	Yes	
831B-6G	12	500	Yes	
831B-6J	12	500	Yes	
831B-7	24	1750	No	
831B-7G	24	1750	No	
831B-7J	24	1750	No	
831B-8	24	1750	Yes	
831B-8G	24	1750	Yes	
831B-8J	24	1750	Yes	
831C-1	5	200	No	
831C-1G	5	200	No	
831C-1J	5	200	No	
831C-2	5	200	Yes	
831C-2G	5	200	Yes	
831C-2J	5	200	Yes	
831C-3	12	500	No	
831C-3G	12	500	No	
831C-3J	12	500	No	
831C-4	12	500	Yes	
831C-4G	12	500	Yes	
831C-4J	12	500	Yes	
831C-5	24	1750	No	
831C-5G	24	1750	No	
831C-5J	24	1750	No	
831C-6	24	1750	Yes	
831C-6G	24	1750	Yes	
831C-6J	24	1750	Yes	

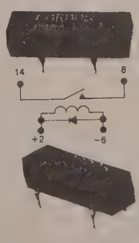
Series 83
(Continued)

MODELS	NOMINAL COIL VOC	COIL RES OHMS	DIODE SUSPENSION	SCHEMATIC (TOP VIEW)
835C-1	5	200	No	
835C-1G	5	200	No	
835C-1J	5	200	No	
835C-2	5	200	Yes	
835C-2G	5	200	Yes	
835C-2J	5	200	Yes	
835C-3	12	500	No	
835C-3G	12	500	No	
835C-3J	12	500	No	
835C-4	12	500	Yes	
835C-4G	12	500	Yes	
835C-4J	12	500	Yes	
835C-5	24	1750	No	
835C-5G	24	1750	No	
835C-5J	24	1750	No	
835C-6	24	1750	Yes	
835C-6G	24	1750	Yes	
835C-6J	24	1750	Yes	
836C-1	5	200	No	
836C-1G	5	200	No	
836C-1J	5	200	No	
836C-2	5	200	Yes	
836C-2G	5	200	Yes	
836C-2J	5	200	Yes	
836C-3	12	500	No	
836C-3G	12	500	No	
836C-3J	12	500	No	
836C-4	12	500	Yes	
836C-4G	12	500	Yes	
836C-4J	12	500	Yes	
836C-5	24	1750	No	
836C-5G	24	1750	No	
836C-5J	24	1750	No	
836C-6	24	1750	Yes	
836C-6G	24	1750	Yes	
836C-6J	24	1750	Yes	
832A-1	5	200	No	
832A-1G	5	200	No	
832A-1J	5	200	No	
832A-2	5	200	Yes	
832A-2G	5	200	Yes	
832A-2J	5	200	Yes	
832A-3	12	500	No	
832A-3G	12	500	No	
832A-3J	12	500	No	
832A-4	12	500	Yes	
832A-4G	12	500	Yes	
832A-4J	12	500	Yes	
832A-5	24	1750	No	
832A-5G	24	1750	No	
832A-5J	24	1750	No	
832A-6	24	1750	Yes	
832A-6G	24	1750	Yes	
832A-6J	24	1750	Yes	

6 PIN DIP RELAYS / 846 SERIES HIGH VOLTAGE / 847 SERIES MERCURY WETTED

CONTACT ARRANGE-MENT	NOM. COIL VOLT.	COIL RES. OHMS ± 10%	CLAMP DIODE	PART NUMBER		SCHEMATIC (TOP VIEW)
1A SPST N.O.	5	150	NO YES	846A-1 846A-2	HIGH VOLTAGE	
	12	500	NO YES	846A-3 846A-4		
	24	1750	NO YES	846A-5 846A-6		
	5	150	NO YES	847A-1 847A-2	MERCURY WETTED CONTACTS	
	12	500	NO YES	847A-3 847A-4		
	24	1750	NO YES	847A-5 847A-6		
1C SPDT	5	70	NO YES	847C-1 847C-2		
	12	320	NO YES	847C-3 847C-4		
	24	1600	NO YES	847C-5 847C-6		

4 PIN DIP RELAYS / 848 SERIES HIGH VOLTAGE / 851 SERIES MERCURY WETTED

1A SPST N.O.	5	150	NO YES	848A-1 848A-2	HIGH VOLTAGE HIGH ISOLATION	
	12	500	NO YES	848A-3 848A-4		
	24	1750	NO YES	848A-5 846A-6		
	5	150	NO YES	851A-1 851A-2		
	12	500	NO YES	851A-3 851A-4		
	24	1750	NO YES	851A-7 851A-8		

See Gordos Data Acquisition & Control Products in Section 2325 and Custom Hybrid Circuits in Section 3130.
Products and specifications subject to change without notice.
Consult factory for application assistance.

Crouzet Corporation 3237 Commander Dr., Carrollton, TX 75006-2506 • Tel: 214-250-1647 • 1-800-677-5311 • Fax: 214-250-3865

CRYDOM
COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES AO241

1-1.5 AMP AC MINI-SIP
DC CONTROL, AC OUTPUT
TRIAC OR SCR OUTPUT

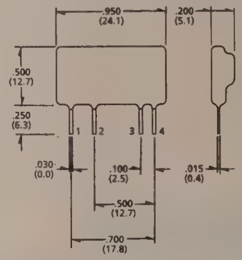
Models AO241/R and the new ASO241/R are 1.0A/1.5A rated SPST-NO miniature SIP solid state relays. All models are available in zero-cross and random turn-on ("R") versions. With an SCR AC switch on the output, the ASO241/R although designed for switching highly inductive, low current loads such as solenoids is also suitable for all loads up to 1.5A.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
AO241	24-280	.02-1.0	4-10	4.0	1.0	40
AO241R	24-280	.02-1.0	4-10	4.0	1.0	40
AS0241	12-280	.01-1.5	4-10	4.0	1.0	10
ASO241R	12-280	.01-1.5	4-10	4.0	1.0	10

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 2500 Vrms

Approvals
UL: E116950(AO Only) CSA: LR81689 (AO Only)

Mechanical
All Dimensions are in inches (millimeters)



Pin 1: AC Load
Pin 2: AC Load
Pin 3: +DC Control
Pin 4: -DC Control

SERIES DO061

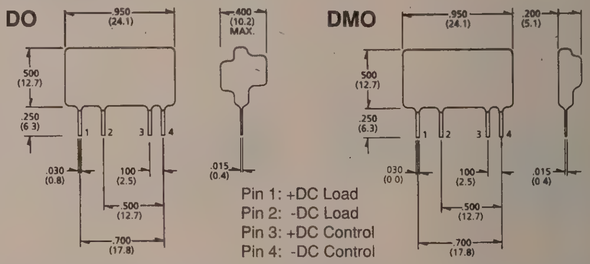
1-5 AMP DC MINI-SIP
DC CONTROL
BIPOLAR OR MOSFET OUTPUT

SPST-NO DC output relays in epoxy-coated packages utilize the popular .10" grid lead spacing. They are available with either bipolar transistor output(DO), or the new DMO Series with MOSFET output rated at 3A/100VDC, or 5A/60 VDC.

Crydom Model Number	Line Voltage Range (Vdc)	Load Current Range (Adc)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
DO061A	3-60	.02-1.0	3-9	3.0	1.0	5.0
DO061B	3-60	.02-1.0	1.7-9	1.7	0.8	5.0
DMO065	0-60	0-5.0	3-10	3.0	1.0	20
DMO103	0-100	0-3.0	3-10	3.0	1.0	12

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage:4000Vrms(DO Models) 2500Vrms(DMO Models)

Mechanical
All Dimensions are in inches (millimeters)



Pin 1: +DC Load
Pin 2: -DC Load
Pin 3: +DC Control
Pin 4: -DC Control

SERIES CX

5 AMP AC SIP
SCR OUTPUT/ ULTRA HIGH SURGE RATING
NORMALLY CLOSED OPTION (-B) AVAILABLE

Crydom's family of SPST-NO relays achieves the highest power switching capability in a PC-mounted aircooled package. Advanced features include exceptional steady state current, plus ultra-high surge ratings. Models are available to switch up to 660 Vrms with AC or DC control, and either zero-cross or random turn-on("R") switching versions. Pinout is compatible with Series 6 and OAC type I/O modules.

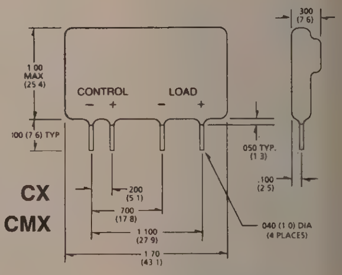
AC INPUT MODELS

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Must Operate Voltage (Vac)	Must Release Voltage (Vac)	Surge Current 1-Cycle (Apk)
CX240A5	12-280	.06-5.0	90-140	90.0	10.0	250
CX240A5R	12-280	.06-5.0	90-140	90.0	10.0	250
CXE240A5	12-280	.06-5.0	18-36	18.0	2.0	250
CXE240A5R	12-280	.06-5.0	18-36	18.0	2.0	250

General Specifications
Operating Temperature range:
-30°C to 80°C
Isolation Voltage: 4000Vrms

Approvals
UL: E116949 CSA: LR81689
VDE: 70938(240 & 380V,
DC Input Only)

Mechanical
All Dimensions are
in inches (millimeters)



DC INPUT MODELS

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
CX240D5	12-280	.06-5.0	3-15	3.0	1.0	250
CX240D5R	12-280	.06-5.0	3-15	3.0	1.0	250
CXE240D5	12-280	.06-5.0	15-32	15.0	1.0	250
CXE240D5R	12-280	.06-5.0	15-32	15.0	1.0	250
CX380D5	48-530	.06-5.0	4-13	4.0	1.0	250
CXE380D5	48-530	.06-5.0	15-32	15.0	1.0	250
CX480D5	48-660	.06-5.0	4-13	4.0	1.0	250
CXE480D5	48-660	.06-5.0	15-32	15.0	1.0	250

CRYDOM COMPANY : 6015 OBISPO AVE., LONG BEACH, CA 90805 TELEPHONE:(310) 865-3536 FAX: (310) 865-3318 TELEX: 910-250-5756

CRYDOM
COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES CMX

6-10 AMP DC SIP MOSFET OUTPUT/ EXTRA LOW ON-STATE RESISTANCE/ PRINTED CIRCUIT BOARD MOUNTING

New DC output SPST-NO solid state relays use MOSFET output for high switching capabilities in a PC-mount air-cooled package. Pinouts are compatible with Series 6 and ODC type I/O modules.

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 2500 Vrms

Approvals
UL: E116950

Crydom Model Number	Line Voltage Range (Vdc)	Load Current Range (Adc)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 10ms (Apk)
CMX100D6	0-100	0-6	3-10	3.0	1.0	100
CMX60D10	0-60	0-10	3-10	3.0	1.0	100

SERIES 3

3 AMP 120/240 VOLT AC OUTPUT SMALL FOOTPRINT/PRINTED CIRCUIT BOARD MOUNTING/ HIGH PACKAGING DENSITY

These solid state relays combine small size and high ratings in a PC-board-mounted SPST-NO design.Available with (S30 types) or without snubber network (S3 types), Series 3 is an ideal replacement for power reed relays in microprocessor or computer-based logic level system. Designed for long, reliable service in demanding industrial environments.

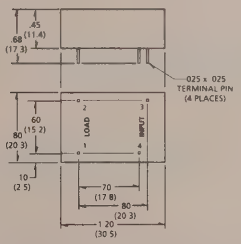
Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
S312	20-140	.01-3.0	3.5-8	3.5	1.0	55
S3012A	20-140	.02-3.0	3.5-8	3.5	1.0	55
S322	40-280	.01-3.0	3.5-8	3.5	1.0	55
S3022A	40-280	.02-3.0	3.5-8	3.5	1.0	55

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

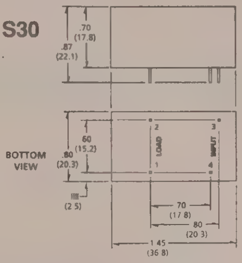
Approvals
UL: E116949 CSA: LR81689

Mechanical
All Dimensions are in inches (millimeters)

S3


.45 (11.4)
.68 (17 3)
025 x 025 TERMINAL PIN (4 PLACES)
60 (15 2)
80 (20 3)
LOAD
INPUT
1
2
3
4
10 (2 5)
70 (17 8)
80 (20 3)
1 20 (30 5)

S30


.70 (17.8)
.87 (22.1)
BOTTOM VIEW
60 (15.2)
.80 (20.3)
LOAD
INPUT
1
2
3
4
(2 5)
70 (17 8)
80 (20 3)
1 45 (36 8)

SERIES 1

2.5-90 AMP 120/240 VOLT AC OUTPUT ZERO VOLTAGE AND RANDOM TURN-ON SWITCHING/ PANEL MOUNT

Featuring state-of-the-art Surface Mount Technology, these SPST-NO relays deliver proven reliability in the most demanding applications. Output consists of an SCR-AC switch and is available in zero-cross, random turn-on(phase controllable) and normally closed (Form B) versions with either AC or DC input (coil) control.

DC CONTROL

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
D1202	24-140	.04-2.5	3-32	3.0	1.0	25
D1210	24-140	.04-10	3-32	3.0	1.0	120
D1225	24-140	.04-25	3-32	3.0	1.0	250
D1240	24-140	.04-40	3-32	3.0	1.0	625
D2410	48-280	.04-10	3-32	3.0	1.0	120
D2425	48-280	.04-25	3-32	3.0	1.0	250
D2450	48-280	.04-50	3-32	3.0	1.0	625
D2475	48-280	.04-75	3-32	3.0	1.0	1000
D2490	48-280	.04-90	3-32	3.0	1.0	1200

AC CONTROL

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
A1202	24-140	.04-2.5	90-280	90.0	10.0	25
A1210	24-140	.04-10	90-280	90.0	10.0	120
A1225	24-140	.04-25	90-280	90.0	10.0	250
A1240	24-140	.04-40	90-280	90.0	10.0	625
A2410	48-280	.04-2.5	90-280	90.0	10.0	120
A2425	48-280	.04-25	90-280	90.0	10.0	250
A2450	48-280	.04-50	90-280	90.0	10.0	625
A2475	48-280	.04-75	90-280	90.0	10.0	1000
A2490	48-280	.04-90	90-280	90.0	10.0	1200

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms
Minimum Off-State dv/dt:500V/ µsec

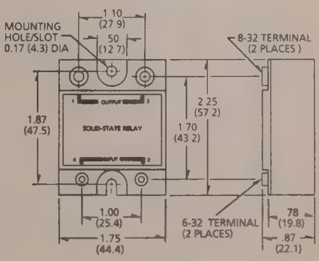
Approvals
UL: E116949 CSA: LR81689 VDE: 58729 (Not Applicable -B &4D)

Mechanical
All Dimensions are in inches (millimeters)

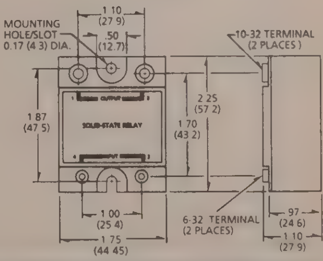
AVAILABLE OPTIONS

-10	Non-Zero Cross, Phase Controllable 10-90 Amp Models Only Example: **D2450-10**
-B	Normally Closed (Form B) 10-90 Amp Models Only, DC Control Models Only Example: **D2450-B**
4D	400 Hz Operation 2.5-50 Amp Models Only, Zero Cross Switching Only Example: **4D2450**
E	24 VAC Input (18-36 Vac) Example: **A2450E**

2.5-50A


MOUNTING HOLE/SLOT 0.17 (4.3) DIA
1 10 (27 9)
50 (12 7)
8-32 TERMINAL (2 PLACES)
OUTPUT
SOLID-STATE RELAY
INPUT
1.87 (47.5)
2 25 (57 2)
1 70 (43 2)
1.00 (25.4)
1.75 (44.4)
6-32 TERMINAL (2 PLACES)
78 (19.8)
.87 (22.1)

75-90A


MOUNTING HOLE/SLOT 0.17 (4 3) DIA.
1 10 (27 9)
.50 (12.7)
10-32 TERMINAL (2 PLACES)
OUTPUT
SOLID-STATE RELAY
INPUT
1 87 (47 5)
2 25 (57 2)
1 70 (43 2)
1 00 (25 4)
1 75 (44 45)
6-32 TERMINAL (2 PLACES)
97 (24 6)
1 10 (27 9)

CRYDOM COMPANY : 6015 OBISPO AVE., LONG BEACH, CA 90805 TELEPHONE:(310) 865-3536 FAX: (310) 865-3318 TELEX: 910-250-5756

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 2

8 AMP 120/240 VOLT AC OUTPUT ZERO VOLTAGE /2500 VOLT ISOLATION PANEL MOUNT

Relays combine small size and high ratings in a package designed for easy heat sink or panel mounting. Standard .187 push-on terminals assure quick connection and are arranged to provide maximum isolation between signal and power circuits. Model S228C is a snubberless design for applications that require low off-state leakage.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
S218	20-140	.02-8.0	3.5-8	3.5	1.0	120
S228	40-280	.02-8.0	3.5-8	3.5	1.0	120
S228C	40-280	.02-8.0	3.5-8	3.5	1.0	120

General Specifications

Operating Temperature range: -30°C to 80°C

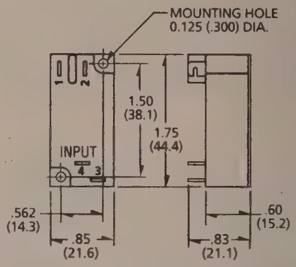
Isolation Voltage: 2500 Vrms

Approvals

UL: E116949 CSA: LR81689

Mechanical

All Dimensions are in inches (millimeters)


MOUNTING HOLE 0.125 (.300) DIA.
1.50 (38.1)
1.75 (44.4)
INPUT
4
3
.562 (14.3)
.85 (21.6)
.83 (21.1)
.60 (15.2)

SERIES H12

50-90 AMP HIGH VOLTAGE AC OUTPUT 1200 VOLT BLOCKING/ UP TO 660 VAC PANEL MOUNT

High voltage relays use IC driven circuits for switching loads up to 660 VAC. All models come with 1200 Volts blocking standard and are available with either AC or DC input (coil) control. Types CA and WD are Snubberless

DC CONTROL - SCR OUTPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
H12WD4850	48-660	.04-50	4-32	4.0	1.0	625
H12WD4890	48-660	.04-90	4-32	4.0	1.0	1200
H12D4850	48-530	.04-50	4-32	4.0	1.0	625
H12D4890	48-530	.04-90	4-32	4.0	1.0	1200

General Specifications

Operating Temperature range: -30°C to 80°C

Isolation Voltage: 4000 Vrms

Minimum Off-State dv/dt: 500V/µsec

Approvals

UL: E116949 CSA: LR81689

Mechanical

See drawing below

AC CONTROL - SCR OUTPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Must Operate Voltage (Vac)	Must Release Voltage (Vac)	Surge Current 1-Cycle (Apk)
H12CA4850	48-660	.04-50	90-140	90.0	10.0	625
H12CA4890	48-660	.04-90	90-140	90.0	10.0	1200

SERIES HA/HD

12-90 AMP 480 VOLT AC OUTPUT/ZERO VOLTAGE AND RANDOM TURN-ON SWITCHING/1200 VOLT BLOCKING /PANEL MOUNT

Crydom's new HA(Ac control) and HD (DC control) relays incorporate the same proven technologies as our Series 1. All models come with 1200 V blocking as standard and are available in either zero-cross or random turn-on(phase controllable) versions.

DC CONTROL - SCR OUTPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
HD4812	80-530	.04-12	3-32	3.0	1.0	140
HD4825	80-530	.04-25	3-32	3.0	1.0	250
HD4850	80-530	.04-50	3-32	3.0	1.0	625
HD4875	80-530	.04-75	3-32	3.0	1.0	1000
HD4890	80-530	.04-90	3-32	3.0	1.0	1200

AC CONTROL - SCR OUTPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Must Operate Voltage (Vac)	Must Release Voltage (Vac)	Surge Current 1-Cycle (Apk)
HA4812	80-530	.04-12	90-280	90.0	10.0	140
HA4825	80-530	.04-25	90-280	90.0	10.0	250
HA4850	80-530	.04-50	90-280	90.0	10.0	625
HA4875	80 530	.04-75	90-280	90.0	10.0	1000
HA4890	80-530	.04-90	90-280	90.0	10.0	1200

General Specifications

Operating Temperature range: -30°C to 80°C

Isolation Voltage: 4000 Vrms

Minimum Off-State dv/dt:500V/ µsec

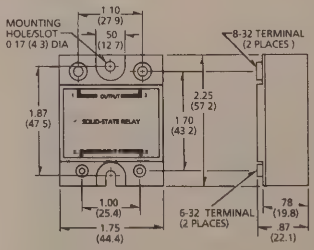
Approvals

UL: E116949 CSA: LR81689 VDE: 10104

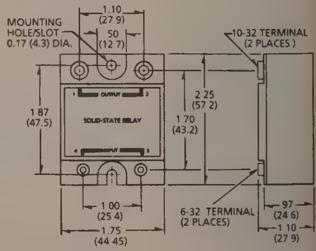
Mechanical

All Dimensions are in inches (millimeters)

12-50A


MOUNTING HOLE/SLOT 0 17 (4 3) DIA
1 10 (27 9)
50 (12 7)
8-32 TERMINAL (2 PLACES)
OUTPUT
1
2
SOLID-STATE RELAY
1.87 (47 5)
2.25 (57 2)
1 70 (43 2)
1.00 (25.4)
1.75 (44.4)
6-32 TERMINAL (2 PLACES)
78 (19.8)
.87 (22.1)

75-90A


MOUNTING HOLE/SLOT 0.17 (4.3) DIA.
1.10 (27 9)
50 (12 7)
10-32 TERMINAL (2 PLACES)
OUTPUT
1
2
SOLID-STATE RELAY
INPUT
4
3
1 87 (47.5)
2 25 (57 2)
1 70 (43.2)
1 00 (25 4)
1.75 (44 45)
6-32 TERMINAL (2 PLACES)
97 (24 6)
1 10 (27 9)

CRYDOM
COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES CS/CT

10-90 AMP 120/240 VOLT AC OUTPUT LOW LEAKAGE/ SCR OR TRIAC OUTPUT PANEL MOUNT

Available with an SCR AC switch output(Series CS) or triac output (CT), all models feature low off-state leakage (snubberless), zero-voltage switching and have a broadened operating range (24-280 Vac). This wide range permits optimum performance at both 120Vac and 240Vac line voltages.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
CSD2410	24-280	.1-10	3.5-15	3.5	1.0	120
CSD2425	24-280	.1-25	3.5-15	3.5	1.0	250
CSD2450	24-280	.1-50	3.5-15	3.5	1.0	500
CSD2475	24-280	.1-75	3.5-15	3.5	1.0	1000
CSD2490	24-280	.1-90	3.5-15	3.5	1.0	1200
CSE2410	24-280	.1-10	15-32	15.0	1.0	120
CSE2425	24-280	.1-25	15-32	15.0	1.0	250
CSE2450	24-280	.1-50	15-32	15.0	1.0	500
CSE2475	24-280	.1-75	15-32	15.0	1.0	1000
CSE2490	24-280	.1-90	15-32	15.0	1.0	1200
CTD2410	24-280	.1-10	3.5-15	3.5	1.0	120
CTD2425	24-280	.1-25	3.5-15	3.5	1.0	225

General Specifications

Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms
Minimum Off-State dv/dt: 200V/ µsec

Approvals

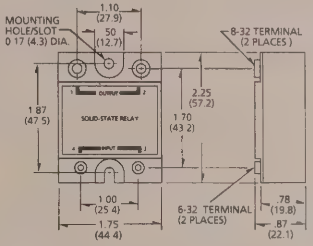
UL: E116949 CSA: LR81689

CS = SCR Output CT= Triac Output

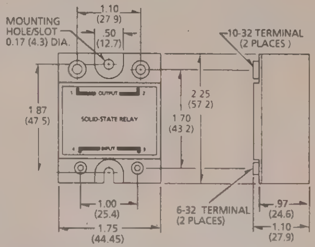
Mechanical

All dimensions are in inches (millimeters)

10-50A


1.10
(27.9)
MOUNTING
HOLE/SLOT
0 17 (4.3) DIA.
50
(12.7)
8-32 TERMINAL
(2 PLACES)
OUTPUT
SOLID-STATE RELAY
INPUT
1 87
(47 5)
2.25
(57.2)
1 70
(43 2)
1 00
(25 4)
1.75
(44 4)
6-32 TERMINAL
(2 PLACES)
.78
(19.8)
.87
(22.1)

75-90A


1.10
(27 9)
MOUNTING
HOLE/SLOT
0.17 (4.3) DIA.
.50
(12.7)
10-32 TERMINAL
(2 PLACES)
OUTPUT
SOLID-STATE RELAY
INPUT
1 87
(47 5)
2 25
(57 2)
1 70
(43 2)
1.00
(25.4)
1.75
(44.45)
6-32 TERMINAL
(2 PLACES)
.97
(24.6)
1.10
(27.9)

SERIES EZ

12-18 AMP AC OUTPUT LOW LEAKAGE/ QUICK CONNECT TERMINALS SCR OUTPUT

The Series EZ SPST-NO AC output relays offer a low profile package with the convenience of quick connect terminals. 4000 Vrms opto-isolation and low off-state leakage are standard. The Series EZ is the preferred choice for replacement of 120V and 240V Electro-mechanical relays.Series EZ is also available in AC control models.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
EZ240D12	24-280	.06-12	3-15	3.0	1.0	150
EZ240D18	24-280	.06-18	3-15	3.0	1.0	200
EZE240D12	24-280	.06-12	15-32	15.0	1.0	150
EZE240D18	24-280	.06-18	15-32	15.0	1.0	200

General Specifications

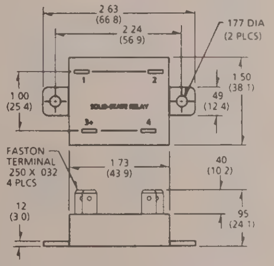
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

Approvals

UL: E116949
CSA: LR81689

Mechanical

All dimensions are in inches (millimeters)


2 63
(66 8)
2 24
(56 9)
177 DIA
(2 PLCS)
1
2
1 50
(38 1)
1 00
(25 4)
SOLID-STATE RELAY
49
(12 4)
3+
4
FASTON
TERMINAL
250 X 032
4 PLCS
1 73
(43 9)
40
(10 2)
12
(3 0)
95
(24 1)

SERIES T

10-25 AMP AC OUTPUT TRIAC OUTPUT/ INDUSTRY STANDARD PACKAGE

The high reliability of surface mount assembled circuitry combines with cost-effective triac output. Snubbers are included for high DV/DT applications and inductive loads, together with zero-voltage switching to reduce inrush currents and electrical noise.

DC INPUT MODELS

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
TD1210	24-140	.05-10	3-32	3.0	1.0	100
TD1225	24-140	.05-25	3-32	3.0	1.0	250
TD2410	48-280	.05-10	3-32	3.0	1.0	100
TD2425	48-280	.05-25	3-32	3.0	1.0	250

AC INPUT MODELS

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
TA1210	24-140	.05-10	90-280	90.0	10.0	100
TA1225	24-140	.05-25	90-280	90.0	10.0	250
TA2410	48-280	.05-10	90-280	90.0	10.0	100
TA2425	48-280	.05-25	90-280	90.0	10.0	250

General Specifications

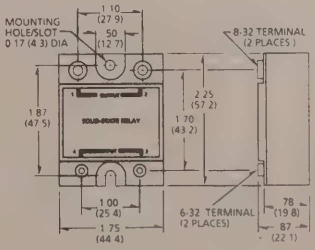
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

Approvals

UL: E116949
CSA: LR81689
VDE: 58731

Mechanical

All dimensions are in inches (millimeters)


1 10
(27 9)
MOUNTING
HOLE/SLOT
0 17 (4 3) DIA
50
(12 7)
8-32 TERMINAL
(2 PLACES)
SOLID-STATE RELAY
1 87
(47 5)
2 25
(57 2)
1 70
(43 2)
1 00
(25 4)
1 75
(44 4)
6-32 TERMINAL
(2 PLACES)
78
(19 8)
87
(22 1)

CRYDOM COMPANY : 6015 OBISPO AVE., LONG BEACH, CA 90805 TELEPHONE:(310) 865-3536 FAX: (310) 865-3318 TELEX: 910-250-5756

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SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES D2W

2-3.5 AMP AC SIP TRIAC OUTPUT PRINTED CIRCUIT BOARD MOUNTING

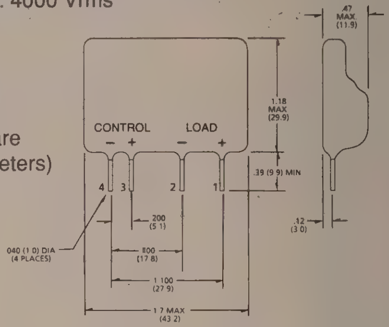
The D2W Series features an epoxy coated package for exceptional environmental protection. Pinouts are compatible with Series 6 and OAC type I/O modules.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
D2W202F	24-280	.06-2.0	3-32	3.0	1.0	28
D2W203F	24-280	.06-3.0	3-32	3.0	1.0	70
D2W203-11	24-280	.06-3.5	3-32	3.0	1.0	80

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

Approvals
UL: E116950
CSA: LR81689

Mechanical
All dimensions are in inches (millimeters)


.47 MAX (11.9)
1.18 MAX (29.9)
CONTROL
– +
LOAD
– +
4 3 2 1
.39 (9 9) MIN
200 (5 1)
.12 (3 0)
040 (1 0) DIA (4 PLACES)
800 (17 8)
1 100 (27 9)
1 7 MAX (43 2)

DUAL RELAYS / QUAD RELAYS

120/240 VOLT AC OUTPUT INDUSTRY STANDARD PACKAGE/ ZERO VOLTAGE AND RANDOM TURN-ON SWITCHING

Two (dual) or four (Quad) totally independent AC output relays come in a single standard panel-mount package. Utilizing an AC switch output with internal snubber, relays provide greater protection against false triggering. Model choices include zero-voltage or random turn-on (phase controllable) switching.

DUAL-SCR OUTPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
D2425D	24-280	.05-25	4-15	4.0	1.0	250
D2440D	24-280	.05-40	4-15	4.0	1.0	625

QUAD-TRIAC OUTPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
TD2420Q	24-280	.05-20	4-15	4.0	1.0	250

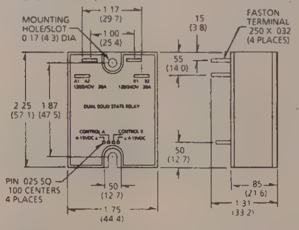
General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 2500 Vrms

Approvals:
UL : E116949 CSA: LR56256M9 (Dual Only)

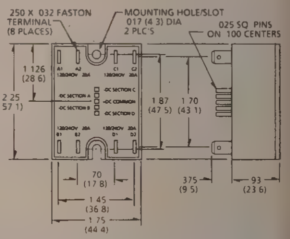
Available Options:
-10: Random Turn-on, Phase Controllable Example: D2440D-10, TD2420Q-10

Mechanical
All dimensions are in inches (millimeters)

Dual


MOUNTING HOLE/SLOT 0 17 (4 3) DIA
1 17 (29 7)
1 00 (25 4)
15 (3 8)
FASTON TERMINAL 250 X 032 (4 PLACES)
55 (14 0)
A1 A2 120/240V 25A
B1 B2 120/240V 25A
DUAL SOLID STATE RELAY
CONTROL A
CONTROL B
2 25 (57 1)
1 87 (47 5)
50 (12 7)
PIN 025 SQ 100 CENTERS 4 PLACES
50 (12 7)
1 75 (44 4)
85 (21 6)
1 31 (33 2)

Quad


250 X 032 FASTON TERMINAL (8 PLACES)
MOUNTING HOLE/SLOT 017 (4 3) DIA 2 PLC'S
025 SQ PINS ON 100 CENTERS
1 126 (28 6)
2 25 57 1)
A1 A2 120/240V 20A
C1 C2 120/240V 20A
-DC SECTION A
-DC SECTION B
-DC SECTION C
+DC COMMON
-DC SECTION D
120/240V 20A B1 B2
120/240V 20A D1 D2
1 87 (47 5)
1 70 (43 1)
70 (17 8)
1 45 (36 8)
1 75 (44 4)
375 (9 5)
93 (23 6)

SERIES 53 TP

25-50 AMP 3 PHASE SCR OUTPUT/ AC OR DC CONTROL/ LED STATUS INDICATOR

Three-phase solid state relays switch up to 530 Vrms directly to loads such as motors, transformers, heating elements, etc. Models are available with either AC or DC input (coil) control in zero-voltage or random turn-on switching versions.

DC INPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
D53TP25D	48-530	.05-25	3-32	3.0	1.0	250
D53TP50D	48-530	.05-50	3-32	3.0	1.0	625

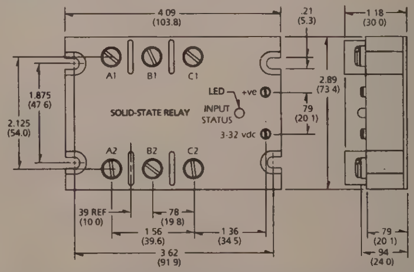
AC INPUT

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Must Operate Voltage (Vac)	Must Release Voltage (Vac)	Surge Current 1-Cycle (Apk)
A53TP25D	48-530	.05-25	90-280	90.0	10.0	250
A53TP50D	48-530	.05-50	90-280	90.0	10.0	625

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

Available Options:
-10: Non-Zero Cross, Instantaneous Turn-On
Example: D53TP50D-10
DP: 2 Controlled, 1 Linked Example: D53DP50D

Mechanical
All dimensions are in inches (millimeters)


4 09 (103.8)
.21 (5.3)
1 18 (30 0)
A1
B1
C1
LED
+ve
INPUT STATUS
3-32 vdc
SOLID-STATE RELAY
A2
B2
C2
1.875 (47 6)
2.125 (54.0)
2.89 (73 4)
79 (20 1)
39 REF (10 0)
78 (19 8)
1 56 (39.6)
1 36 (34 5)
3 62 (91 9)
79 (20 1)
94 (24 0)

CRYDOM COMPANY : 6015 OBISPO AVE., LONG BEACH, CA 90805 TELEPHONE:(310) 865-3536 FAX: (310) 865-3318 TELEX: 910-250-5756

CRYDOM
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SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES DC60

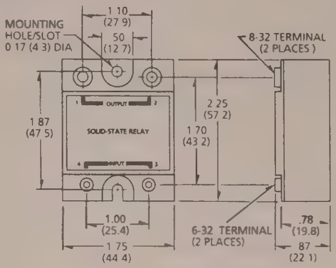
3-7 AMP DC OUTPUT 60 VDC
INDUSTRY STANDARD PACKAGE
COST EFFECTIVE

Bipolar transistor outputs are available in 3,5 and 7 amp ratings. Cost-effective relays offer 4000 Volt isolation and come in crydom's standard panel-mount package.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
DC60S3	3-60	.02-3	3-32	3.0	1.0	6.0
DC60S5	3-60	.02-5	3-32	3.0	1.0	10
DC60S7	3-60	.02-7	3-32	3.0	1.0	14

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

Mechanical
All dimensions are in inches (millimeters)


MOUNTING HOLE/SLOT 0 17 (4 3) DIA
1 10 (27 9)
50 (12 7)
8-32 TERMINAL (2 PLACES)
OUTPUT
SOLID-STATE RELAY
INPUT
1 87 (47 5)
2 25 (57 2)
1 70 (43 2)
1.00 (25.4)
1 75 (44 4)
6-32 TERMINAL (2 PLACES)
.78 (19.8)
87 (22 1)

SERIES DSD/DLD

TIME DELAY RELAY 10-50 AMP AC OUTPUT
INDUSTRY STANDARD PACKAGE
EXTERNALLY ADJUSTABLE

These time-delay solid state relays are housed in a single industry standard package. AC output is controlled by a DC input and has an externally adjustable time delays. Choices include models with two-time delay ranges.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
DSD2410	48-280	.04-10	3.5-15	3.5	1.0	120
DSD2425	48-280	.04-25	3.5-15	3.5	1.0	250
DSD2450	48-280	.04-50	3.5-15	3.5	1.0	625
DLD2410	48-280	.04-10	3.5-15	3.5	1.0	120
DLD2425	48-280	.04-25	3.5-15	3.5	1.0	250
DLD2450	48-280	.04-50	3.5-15	3.5	1.0	625

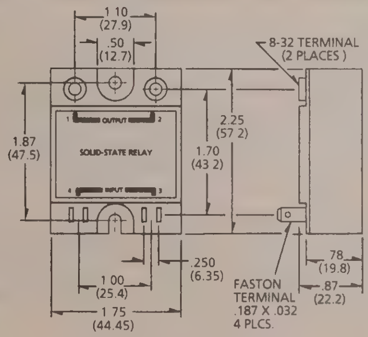
TYPICAL TURN-ON DELAY

For Various Timing Resistances

Resistor	Time(DSD)	Time(DLD)
0(Short)	0.10s	1.6s
10KΩ	0.19s	3.1s
100KΩ	0.94s	15s
470KΩ	4.0s	64s
1.0MΩ	8.3s	133s

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

Mechanical
All dimensions are in inches (millimeters)


1 10 (27.9)
.50 (12.7)
8-32 TERMINAL (2 PLACES)
OUTPUT
SOLID-STATE RELAY
INPUT
1.87 (47.5)
2.25 (57 2)
1.70 (43 2)
.250 (6.35)
1 00 (25.4)
1 75 (44.45)
FASTON TERMINAL .187 X .032 4 PLCS.
.78 (19.8)
.87 (22.2)

SERIES SST

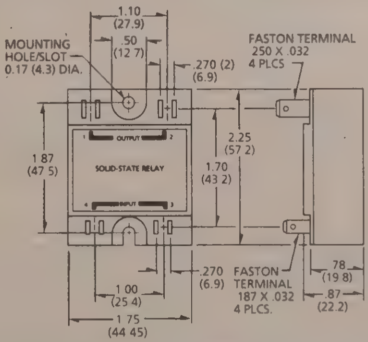
SOFT-START MODULES 10-90 AMP AC OUTPUT
120 AND 240 VAC MODELS

Models SST120 and SST240 auxiliary function modules gradually apply power to the load when energized by the control voltage. They must be used with Crydom Series 1 random turn-on solid state-relays. Consult factory about use with 480 Vac loads. For a complete set (control module and solid state relay) order 10SST120. 25SST120, etc.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
SST120*	90-140	*	3.5-10	3.5	1.0	*
10SST120	90-140	.04-10	3.5-10	3.5	1.0	120
25SST120	90-140	.04-25	3.5-10	3.5	1.0	250
40SST120	90-140	.04-40	3.5-10	3.5	1.0	625
SST240*	180-280	*	3.5-10	3.5	1.0	*
10SST240	180-280	.04-10	3.5-10	3.5	1.0	120
25SST240	180-280	.04-25	3.5-10	3.5	1.0	250
50SST240	180-280	.04-50	3.5-10	3.5	1.0	625
75SST240	180-280	.04-75	3.5-10	3.5	1.0	1000
90SST240	180-280	.04-90	3.5-10	3.5	1.0	1200

General Specifications
Operating Temperature range: -30°C to 80°C
Isolation Voltage: 4000 Vrms

Mechanical
All dimensions are in inches (millimeters)


MOUNTING HOLE/SLOT 0.17 (4.3) DIA.
1.10 (27.9)
.50 (12 7)
.270 (2) (6.9)
FASTON TERMINAL 250 X .032 4 PLCS
OUTPUT
SOLID-STATE RELAY
INPUT
1 87 (47 5)
2.25 (57 2)
1.70 (43 2)
.270 (6.9)
1 00 (25 4)
1 75 (44 45)
FASTON TERMINAL 187 X .032 4 PLCS.
78 (19 8)
.87 (22.2)

* Control Module only, must be used with -10 (Series 1) DC input relay.

CRYDOM
COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES CPV

PHASE CONTROL MODULES / 120 & 240 VAC MODELS / 0-5 VDC PHASE CONTROL

Models CPV120 and CPV240 auxiliary function modules provide control of the phased turn-on of a solid state relay, in response to the application of a 0-5 Vdc control signal. They must be used with the Crydom Series 1 random turn-on solid state relays. Consult factory about use with 480 Vac loads. For a complete set (control module and solid state relay) order 10CPV120, 25CPV120, etc.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Signal Range (Vdc)	Logic Supply Voltage (Vdc)	Surge Current 1-Cycle (Apk)
CPV120*	90-140	*	0-5	3.5-10	*
10CPV120	90-140	.04-10	0-5	3.5-10	120
25CPV120	90-140	.04-25	0-5	3.5-10	250
40CPV120	90-140	.04-40	0-5	3.5-10	625
CPV240*	180-280	*	0-5	3.5-10	*
10CPV240	180-280	.04-10	0-5	3.5-10	120
25CPV240	180-280	.04-25	0-5	3.5-10	250
50CPV240	180-280	.04-50	0-5	3.5-10	625
75CPV240	180-280	.04-75	0-5	3.5-10	1000
90CPV240	180-280	.04-90	0-5	3.5-10	1200

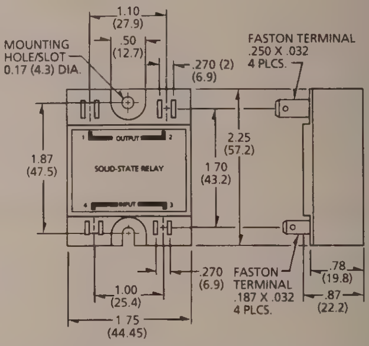
General Specifications

Operating Temperature range: -30°C to 80°C

Isolation Voltage: 4000 Vrms

Mechanical

All dimensions are in inches (millimeters)


1.10
(27.9)
.50
(12.7)
MOUNTING
HOLE/SLOT
0.17 (4.3) DIA.
.270 (2)
(6.9)
FASTON TERMINAL
.250 X .032
4 PLCS.
OUTPUT
SOLID-STATE RELAY
INPUT
1.87
(47.5)
2.25
(57.2)
1.70
(43.2)
.270
(6.9)
FASTON
TERMINAL
.187 X .032
4 PLCS.
1.00
(25.4)
1.75
(44.45)
.78
(19.8)
.87
(22.2)

* Control Module only, must be used with -10 (Series 1) DC input relay.

SERIES 1-DC

7-40 AMP DC OUTPUT / 100-500 VDC / MOSFET OUTPUT / LOW ON-STATE RESISTANCE / PARALLELING CAPABILITY FOR HIGHER CURRENTS

DC output relays feature MOSFET technology for low on-state resistance, assuring easy paralleling and switching capabilities to 40 amps at 100 Vdc. Lower current models are also available to 500 Vdc. All models come in Crydom's standard panel-mount package.

Crydom Model Number	Line Voltage Range (Vdc)	Load Current Range (Adc)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 10 ms (Apk)
D1D07	0-100	0-7	3.5-32	3.5	1.0	15
D1D12	0-100	0-12	3.5-32	3.5	1.0	28
D1D20	0-100	0-20	3.5-32	3.5	1.0	42
D1D40	0-100	0-40	3.5-32	3.5	1.0	106
D2D07	0-200	0-7	3.5-32	3.5	1.0	22
D2D12	0-200	0-12	3.5-32	3.5	1.0	27
D4D07	0-400	0-7	3.5-32	3.5	1.0	17
D4D12	0-400	0-12	3.5-32	3.5	1.0	36
D5D07	0-500	0-7	3.5-32	3.5	1.0	19
D5D10	0-500	0-10	3.5-32	3.5	1.0	29

General Specifications

Operating Temperature range: -30°C to 80°C

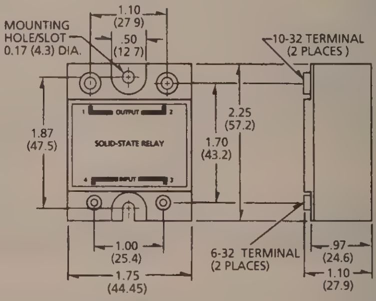
Isolation Voltage: 2500 Vrms

Approvals

UL : E116950 (100 Volt Models)

Mechanical

All dimensions are in inches (millimeters)


MOUNTING
HOLE/SLOT
0.17 (4.3) DIA.
1.10
(27.9)
.50
(12.7)
10-32 TERMINAL
(2 PLACES)
OUTPUT
SOLID-STATE RELAY
INPUT
1.87
(47.5)
2.25
(57.2)
1.70
(43.2)
1.00
(25.4)
1.75
(44.45)
6-32 TERMINAL
(2 PLACES)
.97
(24.6)
1.10
(27.9)

SERIES MP

3-4 AMP AC OUTPUT, SIP HIGH PACKAGING DENSITY/ COMPATIBLE WITH 5 & 15 VOLT LOGIC SYSTEMS

Available in 3Arms and 4Arms ratings, all are SPST-NO, PCB mount relays that provide greater packaging density and compatibility with pinout of Series 6 and OAC output modules. Models include internal snubber for high dv/dt applications, together with zero-voltage switching to reduce high inrush currents and electrical noise.

Crydom Model Number	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Surge Current 1-Cycle (Apk)
MP120D3	12-140	.02-3.0	3.5-18	3.5	1.0	80
MP240D3	24-280	.02-3.0	3.5-18	3.5	1.0	80
MP240D4	24-280	.02-4.0	3.5-18	3.5	1.0	80

General Specifications

Operating Temperature range: -30°C to 80°C

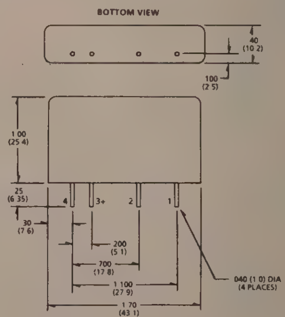
Isolation Voltage: 2500 Vrms

Approvals

UL : E116950

Mechanical

All dimensions are in inches (millimeters)


BOTTOM VIEW
40
(10 2)
100
(2 5)
1 00
(25 4)
25
(6 35)
4
3+
2
1
30
(7 6)
200
(5 1)
700
(17 8)
1 100
(27 9)
1 70
(43 1)
040 (1 0) DIA
(4 PLACES)

CRYDOM
COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 6

AC & DC BUFFERED OUTPUT MODULES
INVERTING & NON-INVERTING INPUTS
PRINTED CIRCUIT BOARD MOUNTING

Series 6 buffered output modules contain additional internal amplification to reduce drive requirements to a level suitable for the Mos devices used in many microprocessor systems. Models are available with either inverting or non-inverting inputs, for 5 and 15 volt logic.

INPUT SPECIFICATIONS-5 VOLT

	6311*	6231**	6411*	6412*	6421*	6422**
Input on Voltage	0.0-0.8Vdc	2.4-6.0Vdc	0.0-0.8Vdc	0.0-0.8Vdc	2.4-6.0Vdc	2.4-6.0Vdc
Maximum Current @ Rated Voltage	100µA@ 0.0Vdc	250µ A@ 6.0Vdc	100µ A@ 0.0Vdc	100µ A@ 0.0Vdc	250µ A@ 6.0Vdc	250µ A@ 6.0Vdc

INPUT SPECIFICATIONS-15 VOLT

	6341*	6351**	6441*	6442**	6451*	6452**
Input on Voltage	0.0-2.0Vdc	8.0-18Vdc	0.0-2.0Vdc	0.0-2.0Vdc	8.0-18Vdc	8.0-18Vdc
Maximum Current @ Rated Voltage	250µA@ 0.0Vdc	200µ A@ 18.0Vdc	250µ A@ 0.0Vdc	250µ A@ 0.0Vdc	200µ A@ 18.0Vdc	200µ A 18.0Vdc

OUTPUT SPECIFICATIONS- 5 AND 15 VOLT

Load Current Over	.02-3.5A@	.02-3.5A@	.02-3.5A@	.02-3.5A@	.02-3.5A@	.02-3.5A@
Load Voltage Range	3-60Vdc	3-60Vdc	12-140Vac	24-280Vac	12-0140Vac	24-280Vac
Maximum Turn-On Time	100ms	100ms	½ cycle	½ cycle	½cycle	½ cycle
Maximum Turn-off Time	100ms	100ms	½ cycle	½cycle	½ cycle	½cycle

General Specifications

Operating Temperature range: -30°C to 80°C

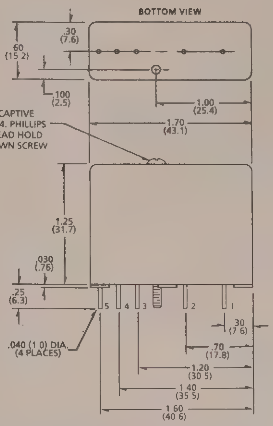
Isolation Voltage: 4000 Vrms

Approvals

UL : E116949 CSA: LR81689

Mechanical

All dimensions are in inches (millimeters)



* Sink current (non-inverting)
** Source current (inverting)

RELAY ACCESSORIES

HEATSINKS
PROTECTIVE COVERS
RELAY HANDBOOK

Over 200 informative pages of reference to the use and applications of Solid State Relays (SSRs). The book includes a detailed and comprehensive tutorial on SSRs and their usage in various industrial applications.

HEATSINK SPECIFICATIONS

	HS-1	HS-2	HE-54	HE-90
Usage Rating	Up to 10A	Up to 25A	Up to 50A	Up to 90A

Note: Contact factory for heatsink dimensions and thermal information.

PROTECTIVE COVERS

KS100: Cover for Series1 Solid State Relays
KS300: Cover for 53TP Series Solid State Relays

SOLID STATE RELAY HANDBOOK

HDBK899: A comprehensive and informative book written by Anthony Bishop.

SERIES PB

I/O MODULES MOUNTING BOARDS

These mounting boards accept I/O modules in any combination of input or output types. Modules are easily and quickly inserted without disturbing field wiring. Features include; LED status indicator, plug-in 5 amp fuse and 3.3K ohm pull-up resistor for each module.

Model Number	PB-4	PB-4H	PB-4R	PB-8	PB-16A	PB-16T	PB-24
Module Positions	4	4	4	8	16	16	24
Input/Output Channels	4	4	4	8	16	16	24
Designed to Operate with Negative True Logic Systems and One Logic Voltage	Yes	Yes	No	Yes	Yes	Yes	Yes
Designed to Operate with Negative or Positive True Logic Systems and Different Logic Voltage	No	No	Yes	No	No	No	No
CONNECTIONS, FUSES APPROVALS							
Barrier Strip Screw Terminals for Field Connections	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Logic Connection Type	Screw Terminal	26,50 Pin Card Edge	Screw Terminal	26,50 Pin Card Edge	50 Pin Card Edge	Screw Terminal	50 Pin Card Edge
Connector Part Number			Note1,2	Note 2		Note 2	
5 Amp Fuse: Bussman GFAI or Littlefuse 275-005, or Littlefuse 255005	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1 Amp Fuse: Bussman GFAI, or Littlefuse 275-001, or Littlefuse 255001	No	No	No	No	No	No	Yes
UL Recognized	Yes	Pending	Yes	Yes	Yes	Yes	Yes
CSA certified*	Yes	Pending	Yes	Yes	Yes	Yes	Yes

* Recognized/Certified for 125V max. with 5 amp fuses, for 250V max. use#22 solid copper jumper wire instead of 5 amp fuses.

CRYDOM COMPANY : 6015 OBISPO AVE., LONG BEACH, CA 90805 TELEPHONE:(310) 865-3536 FAX: (310) 865-3318 TELEX: 910-250-5756

CRYDOM
COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES IAC/IDC/OAC/ODC

SOLID STATE OPTO-ISOLATED I/O MODULES

Solid state I/O switching modules deliver an electrically clean, photo-isolated, noise-free "output" interface from logic level control systems to external loads such as motors, valves, solenoids, etc. - or an "input" interface from the load or sensors to microprocessor or computer-based logic level systems. Designed for long, reliable service demanding industrial environments.

SYSTEM VOLTAGE 5 VDC

Model Number	IAC5	IAC5A	IDC5	IDC5B	IDC5D	OAC5	OAC5A	ODC5	ODC5A
Voltage Type	AC or DC Input	AC or DC Input	DC Input	DC Input	DC Input	AC Output	AC Output	DC Output	DC Output
Color Code	Yellow	Yellow	White	White	White	Black	Black	Red	Red
Input Specifications									
Voltage Range	90-140Vac	180-280Vac	10-36Vdc	4-16Vdc	3-32Vdc	3-6Vdc	3-6Vdc	3-6Vdc	3-6Vdc
Typical Current @ Rated Voltage	7mA	5mA	8mA	20mA	13mA	19mA	19mA	14mA	14mA
Typical Current @ Max. Voltage	8mA	5.5mA	10mA	23mA	15mA	22mA	22mA	18mA	18mA
Output specifications									
Load Current Over	.1-100mA@	.1-100mA@	.1-100mA@	.1-100mA@	.1-100mA@	.02-3A@	.02-3A@	.02-3A@	.02-1A@
Load Voltage Range	.4-30Vdc	.4-30Vdc	.4-30Vdc	.4-30Vdc	.4-30Vdc	12-140 Vac	24-480Vac	5-60Vdc	10-200Vdc
Maximum Turn-On Time	20ms	20ms	5ms	0.02ms	5ms	½ cycle	½ cycle	0.3ms	0.5ms
Maximum Turn-off Time	20ms	20ms	5ms	1ms	5ms	½ cycle	½ cycle	0.3ms	0.5ms
Switching Type	Random	Random	Random	Random	Random	Zero	Zero	Random	Random
Notes	1,2,4,6	1,2,4,6	1,2,4	1,2,4	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3

SYSTEM VOLTAGE 15 VDC

Model Number	IAC15	IAC15A	IDC15	IDC15B	IDC15D	OAC15	OAC15A	ODC15	ODC15A
Voltage Type	AC or DC Input	AC or DC Input	DC Input	DC Input	DC Input	AC Output	AC Output	DC Output	DC Output
Color Code	Yellow	Yellow	White	White	White	Black	Black	Red	Red
Input Specifications									
Voltage Range	90-140Vac	180-280Vac	10-36Vdc	4-16Vdc	3-32Vdc	9-18Vdc	9-18Vdc	9-18Vdc	9-18Vdc
Typical Current @ Rated Voltage	7mA	5mA	8mA	20mA	13mA	20mA	20mA	14mA	14mA
Typical Current @ Max. Voltage	8mA	5.5mA	10mA	23mA	15mA	25mA	25mA	17mA	17mA
Output specifications									
Load Current Over	.1-100mA@	.1-100mA@	.1-100mA@	.1-100mA@	.1-100mA@	.02-3A@	.02-3A@	.02-3A@	.02-1A@
Load Voltage Range	.4-30Vdc	.4-30Vdc	.4-30Vdc	.4-30Vdc	.4-30Vdc	12-140 Vac	24-480Vac	5-60Vdc	10-200Vdc
Maximum Turn-On Time	20ms	20ms	5ms	0.02ms	5ms	½ cycle	½ cycle	0.3ms	0.5ms
Maximum Turn-off Time	20ms	20ms	5ms	1ms	5ms	½ cycle	½ cycle	0.3ms	0.5ms
Switching Type	Random	Random	Random	Random	Random	Zero	Zero	Random	Random
Notes	1,2,4,6	1,2,4,6	1,2,4	1,2,4	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3

SYSTEM VOLTAGE 24 VDC

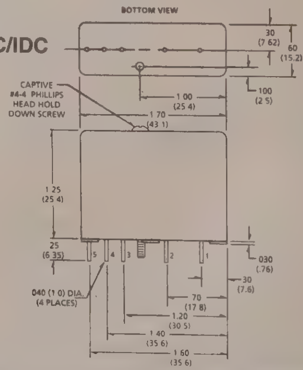
Model Number	IAC24	IAC24A	IDC24	IDC24B	IDC24D	OAC24	OAC24A	ODC24	ODC24A
Voltage Type	AC or DC Input	AC or DC Input	DC Input	DC Input	DC Input	AC Output	AC Output	DC Output	DC Output
Color Code	Yellow	Yellow	White	White	White	Black	Black	Red	Red
Input Specifications									
Voltage Range	90-140Vac	180-280Vac	10-36Vdc	4-16Vdc	3-32Vdc	18-28Vdc	18-28Vdc	18-28Vdc	18-28Vdc
Typical Current @ Rated Voltage	7mA	5mA	8mA	20mA	13mA	15mA	15mA	10mA	10mA
Typical Current @ Max. Voltage	8mA	5.5mA	10mA	23mA	15mA	18mA	18mA	12mA	12mA
Output specifications									
Load Current Over	.1-100mA@	.1-100mA@	.1-100mA@	.1-100mA@	.1-100mA@	.02-3A@	.02-3A@	.02-3A@	.02-1A@
Load Voltage Range	.4-30Vdc	.4-30Vdc	.4-30Vdc	.4-30Vdc	.4-30Vdc	12-140 Vac	24-480Vac	5-60Vdc	10-200Vdc
Maximum Turn-On Time	20ms	20ms	5ms	0.02ms	5ms	½ cycle	½ cycle	0.3ms	0.5ms
Maximum Turn-off Time	20ms	20ms	5ms	1ms	5ms	½ cycle	½ cycle	0.3ms	0.5ms
Switching Type	Random	Random	Random	Random	Random	Zero	Zero	Random	Random
Notes	1,2,4,6	1,2,4,6	1,2,4	1,2,4	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3

Notes:
1. UL recognized
2. CSA certified
3. The output of the AC output module is compatible with the input of the AC input module is compatible with the input of the DC input module.
4. Input modules provide an output that is active low.
5. Output modules can be controlled from active or active high logic.
6. Input will operate on AC or DC voltage.

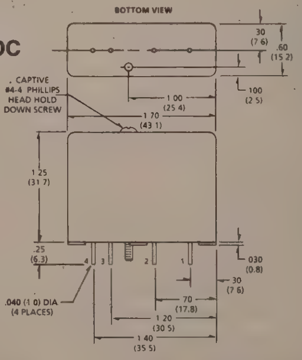
MECHANICAL

All dimensions are in inches (millimeters)

IAC/IDC

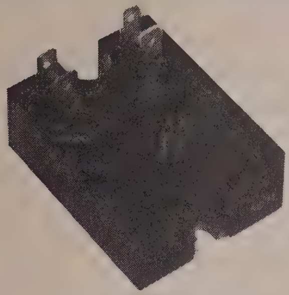


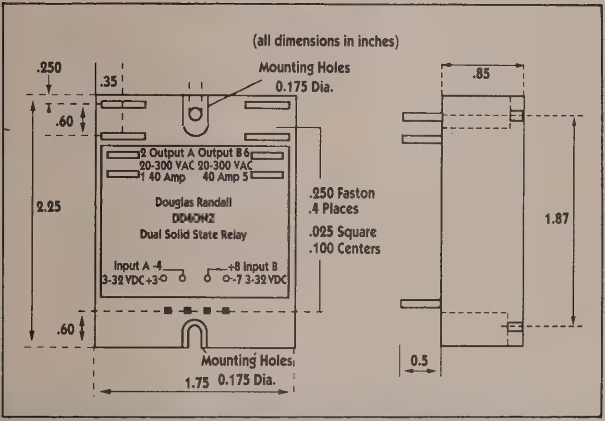
OAC/ODC



DOUGLAS RANDALL, INC

Dual Solid State Relays *(25 and 40 Amp)*




(all dimensions in inches)
.250
.35
Mounting Holes
0.175 Dia.
.60
2.25
.60
2 Output A Output B 6
20-300 VAC 20-300 VAC
1 40 Amp 40 Amp 5
Douglas Randall
DD40H2
Dual Solid State Relay
Input A -4
3-32 VDC +3
+8 Input B
-7 3-32 VDC
.250 Faston
.4 Places
.025 Square
.100 Centers
Mounting Holes
1.75 0.175 Dia.
.85
1.87
0.5

Features & General Specifications

- Two Independent 25 or 40 Amp Solid State Relays in one standard case.
- UL Approved.
- Non-Zero Crossing for Lamp Dimming or Heater Control Applications.
- Zero Crossing for Motor Control Applications. ZC Units switch on in 1/2 cycle.
- Advanced MOS Technology offers a significant increase in both static and commutating dv/dt, improving immunity to false triggering.
- Ambient Temperature for all models:
  - -30°C to +80°C operating
  - -40°C to +120°C storage
- 2500 VRMS Isolation
  - Input to Output
  - Input to Base
  - Output to Base
  - Output Switch "A" to Output Switch "B"
- Aluminium Base Plates. High Temperature Black Plastic Case.
- Base Plate slotted on bottom for easy installation.
- Input reverse polarity protected.
- Inverse Parallel (back to back) SCR Output Device.

		DD 25B 25 Amp 120/240VAC	DD 40B 40 Amp 120/240VAC
Input Signal Data	Range	3.0-32 VDC	3.0-32 VDC
	Must Turn On	3.0 VDC	3.0 VDC
	Must Turn Off	1.0 VDC	1.0 VDC
	Input Impedance	1000 Ohms Typ.	1000 Ohms Typ.
	Isolation-Signal to Load	2500 VRMS	2500 VRMS
	Isolation-Signal to Base	2500 VRMS	2500 VRMS
	Temperature Range		
	Operating	-30°C to +80°C	-30°C to +80°C
	Storage	-40°C to +120°C	-40°C to +120°C
Output Data	Range	20-300 VRMS	20-300 VRMS
	Voltage Drop at Rated Load	1.6 VPK	1.6 VPK
	Typical Turn On Voltage	7 VRMS	7 VRMS
	Response Time	0.5 Cycle Max.	0.5 Cycle Max.
	Off State DV/DT	200V/uS	200V/uS
	Off State Leakage Current	15 MA	20 MA
	Max. Non Repetitive Single Cycle Surge Current	400 Amp	600 Amp
	I^2T For Fusing (T=8.3 MS)	1000A² Sec	1500A² Sec
	Peak Inverse Voltage	600 Volts	600 Volts
	Minimum Holding Current	.150 Amps	.150 Amps
	Operating Frequency	50/60 Hz	50/60 Hz
	Power Factor	.5	.5

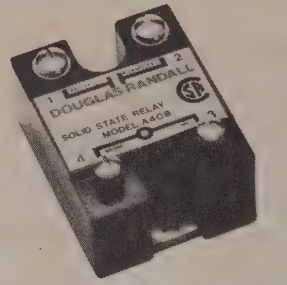
100 Mechanics Street, P.O. Box 506, Pawcatuck, CT 06379 • **(800) 447-6799** • in Connecticut 599-2075 • Fax (203) 599-1754

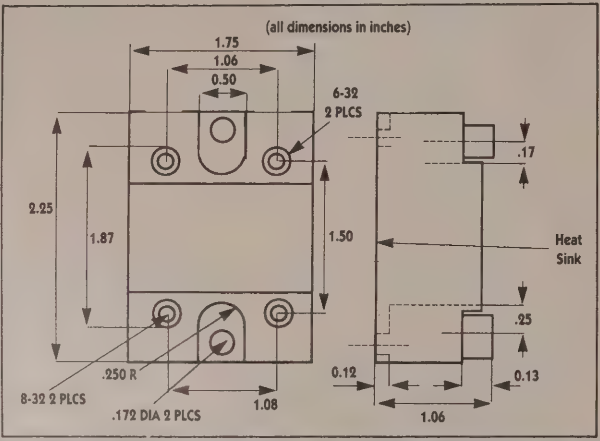
See our additional data pages in sections 2200 D•1154 and 4800 A•2144

DOUGLAS RANDALL, INC

Solid State Relays - AC Output (up to 40 Amps/240 volts)

A & D SERIES





Features & General Specifications

- Output configuration (Back to Back) SCR's)
  Normally Open, Form A (SPST-NO)
  Normally Closed, Form B (SPST--NC)
- Most models UL and CSA approved.
- Zero Crossover switching standard.
- Non-Zero Crossover switching optional.
- 10 to 25 VAC outputs available.
- Internal Snubber standard.
- Wide range outputs available.
- 2500 & 3750 Vrms Input to Output isolation can be supplied on request.
- Rapid switching under load.
- Arc-free switching for use in hazardous atmospheres.
- Opto-isolated Input circuits.
- DC input: 3 to 32 Volts.
  Compatible with DTL and TTL logic.
  Reverse polarity protected.
- AC input: 90 to 260 Volts.
- Optional NOISE IMMUNE INPUTS available to prevent false triggering on sinusodial tone bursts up to 5Vp-p 20HZ.

NOTES:
(1) Add suffix (-NC) to designate Form B configuration.
(2) Add suffix (-NZ) to Designate Non-Zero crossing

		DC Input D25B and D40B (1)(2)	AC Input A25B and A40B (1)(2)
Input Data	V Range/Impedance (Standard)	3-32 V/1000 _ Min.	90-260 V/40K _ Min.
	V Range/Impedance (Optional)	1-5 V/500 _ Min.	90-260 V/40K _ Min.
	Must Turn On	3 VDC	90 VAC
	Must Turn Off	1 VDC	10VAC
	Isolation-Signal to Load	1500 Vrms	1500 Vrms
	Isolation-Signal to Base	1500 Vrms	1500 Vrms
	Capacitance-Signal to Load	15 pF	15 pF
	Temperature Range (Deg. C)		
	Operating	-30 to +80	-30 to +80
	Storage	-40 to +120	-40 to +120
Output Data	Range (VAC)	80-260 VAC	80-260 VAC
	Off State Leakage Current	5.5mA Typ.	5.5mA Typ.
	Voltage Drop at Rated Load	1.6 V max.	1.6 V max.
	Typical Turn On Voltage	5V	5V
	Response Time	1/2 Cycle Max.	1/2 Cycle Max.
	DV/DT: Off State	100V/uSec.	100V/uSec.
	Commutating	5V/uSec.	5V/uSec.
	Minimum Holding Current	50mA Typ.	50mA Typ.
	Operating Frequency	50/60 Hz	50/60 Hz
	Isolation Output to Base	1500 Vrms 10^{10}Ohms DC	1500 Vrms 10^{10}Ohms DC
	I^2T for Fusing (T=8.3 ms)	1500 A^2S @60 Hz	1500 A^2S @60 Hz
	Single Cycle Surge	800 1000	800 1000

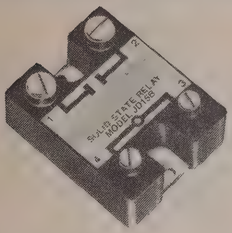
100 Mechanics Street, P.O. Box 506, Pawcatuck, CT 06379 • **(800) 447-6799** • in Connecticut 599-2075 • Fax (203) 599-1754

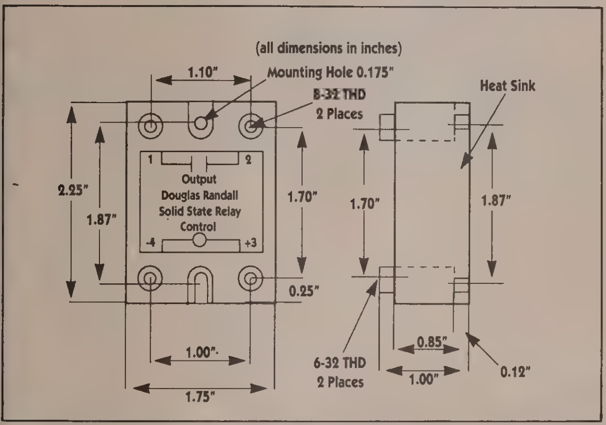
See our additional data pages in sections 2200 D•1154 and 4800 A•2144

DOUGLAS RANDALL, INC

Solid State Relays - AC Output (to 150 Amps/260 volts)

J SERIES





Features & General Specifications

- Output configuration, ack-Back SCR.
  Normally Open, Form A (SPST-NO)
- Zero Crossover switching standard, switch on in 1/2 cycle max.
- Non-Zero Crossover switching optional.
  Internal snubbers standard.
- Wide range outputs available.
- Rapid switching under load.
- Arc-free switching for use in hazardous atmospheres.
- Opto-isolated Input circuits.
- DC input: 3 to 32 Volts.
  Compatible with DTL and TTL logic.
  Reverse polarity protected.
- AC input: 90 to 260 Volts.
- Low profile hockey puck design.
- Epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.
- Screw terminals standard.

NOTES:

(1) Substitute 25 for 40 for (**) to designate applicable load current rating of 25 or 40 amps.

(2) Substitute the letter 'A' or 'D' for (x) to designate AC or DC input.

(3) Add the suffix (-NZ) to designate Non-Zero crossing devices

Input Data	JD(**)B	JD(**)D	JA(**)B	JA(**)D
Voltage	3-32 VDC	4-32 VDC	90-260 Vrms.	90-260 Vrms.
Impedance	1000 Ohms Min.	1000 Ohms Min.	13K Ohms Min.	13K Ohms Min.
Must Turn On	3.0 Vdc	4.0 Vdc	90 Vrms.	90 Vrms.
Must Turn Off	1.0 Vdc	1.0 Vdc	10Vrms	10Vrms
Isolation-Signal to Load	4000 Vrms	4000 Vrms	4000 Vrms	4000 Vrms
Isolation-Signal to Base	2500 Vrms	2500 Vrms	2500 Vrms	2500 Vrms
Capacitance-Signal to Load	15 pF	15 pF	15 pF	15 pF
Temperature Range (Deg. C)				
Operating	-30 to +80	-30 to +80	-30 to +80	-30 to +80
Storage	-40 to +120	-40 to +120	-40 to +120	-40 to +120

Output Data	J(x)25B	J(x)40B	J(x)25D	J(x)40D
Rated Current (Amps)	25	40	25	40
Voltage	20-300 Vrms.	20-300 Vrms.	100-525 Vrms.	100-525 Vrms.
Voltage Drop at Rated Load	1.6 Vpk	1.6 Vpk	1.6 Vpk	1.6 Vpk
Typical Turn On Voltage	5Vrms	5Vrms	5Vrms	5Vrms
Response Time	.5 Cycle Max.	.5 Cycle Max.	.5 Cycle Max.	.5 Cycle Max.
Off State DV/DT (V/u Sec.)	200	200	120	200
Off State Leakage Current	15mA	20mA	15mA	20mA
Maximum Non-repetitive Single Cycle Surge Current(Amps.)	400	600	400	600
I T for Fusing (T=8.3mS) (A S)	400	1500	400	1500
Peak Inverse Voltage	600 Vpk	600 Vpk	1200 Vpk	1200 Vpk

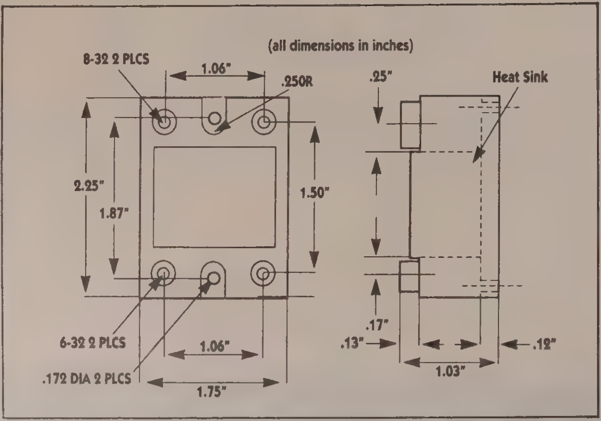
100 Mechanics Street, P.O. Box 506, Pawcatuck, CT 06379 • **(800) 447-6799** • in Connecticut 599-2075 • Fax (203) 599-1754

See our additional data pages in sections 2200 D•1154 and 4800 A•2144

DOUGLAS RANDALL, INC

Solid State Relays - DC Output (12 Amps, 2 to 250 volts)

K SERIES



Features & General Specifications

- Output configuration (BIPOLAR)
  - Normally Open, Form A (SPST-NO)
  - Normally Closed, Form B (SPST-NC)
- Shunt Diodes internally connected across the output.
- Rapid switching under load.
- Arc-free switching for use in hazardous atmospheres.
- Input circuit features:
  - Opto-isolated
  - Compatible with DTL and TTL logic
  - Reverse polarity protected
- Epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.
- Screw terminals standard.

Notes:

(1) Add suffix (-NC) to designate Form B configuration

		K12B(1) 12 Amps/2 to 55 VDC	K06D(1) 6 Amps/2 to 250 VDC
Input Signal Data	Range	3 to 32 VDC	3 to 32 VDC
	Input Impedance	1000 Ohms min.	1000 Ohms min.
	Must Turn On	3 VDC	3 VDC
	Must Turn Off	1 VDC	1 VDC
	Isolation-Signal to Load	1500 Vrms	1500 Vrms
	Isolation-Signal to Base	1500 Vrms	1500 Vrms
	Temperature Range		
	Operating	-30 to +80	-30 to +80
	Storage	-40 to +120	-40 to +120
Output Data	Range	2 to 52 VDC	2 to 250 VDC
	Voltage Drop at Rated Load	1.5 VDC	1.5 VDC
	Turn On Time	50 micro Secs.	50 micro Secs.
	Turn Off Time	500 micro Secs.	500 micro Secs.
	Off State Leakage Current	2 mADC	2 mADC
	Surge Current (Max.)		
	10 mSec. @ 10% duty cycle	24 ADC	12 ADC
	Minimum Holding Current	5 mADC	5 mADC
	Isolation - Load to Base	1500 Vrms	1500 Vrms
	Maximum Cycling Frequency	100 HZ	100 HZ

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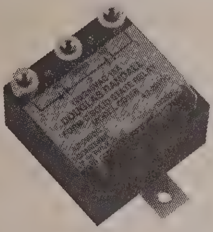
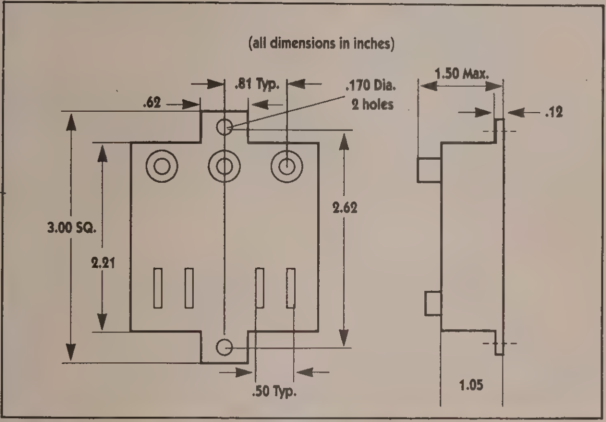
See our additional data pages in sections 2200 D•1154 and 4800 A•2144

DOUGLAS RANDALL, INC

Form 'C' Solid State Relays - AC Output (up to 40 Amps/300 Volts)

CA CD SERIES





Features & General Specifications

- Output configuration,
  Triac or Back-Back SCR's.
  Form C (SPDT), Break -Before-Make
- LED indicators provide visual indication of active output.
- Internal snubber network standard.
- Wide range outputs.
- Rapid switching under load.
- Arc-free switching for use in hazardous atmospheres.
- Opto-isolated Input circuits.
- DC voltage or Dry Switch inputs.
- Additional power requirements;
  An independent DC or AC constant power supply must be provided.
- Epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.

		DC Input		Dry Switch Input	
		CD15B	CD40B	CA15B	CA40B
Input Data	Range	4.7-29 VDC		N/A (Dry Closure)	
	Impedance	2.7 K Ohms		N/A	
	Must Operate	4.7 VDC		N/A	
	Must Release	1.0 VDC		N/A	
	Isolation-Signal to Load	2500 Vrms		2500 Vrms	
	Isolation-Signal to Base	2500 Vrms		2500 Vrms	
	Temperature Range (Deg. C)	-20 to +80		-20 to +80	
	Constant Supply:				
	Voltage	4.7-29 VDC		90-140 VAC	
	Inp. Z	2.7 K Ohms		5.5 K Ohms	
Output Data	Voltage Range	90/300 VAC @47-63Hz			
	Load Current (max.)	15 A	40 A	15 A	40 A
	Off State Leakage Current (typ.)	5 mA	10 mA	5 mA	10 mA
	Voltage Drop at Rated Load	1.6 V Max.	1.6 V Max.	1.6 V Max.	1.6 V Max.
	Typical Turn On Voltage	6 V	6 V	6 V	6 V
	Transfer Time Minimum	8 mSecs.	8 mSecs.	8 mSecs.	8 mSecs.
	Transfer Time Maximum	16 mSecs.	16 mSecs.	16 mSecs.	16 mSecs.
	Minimum Holding Current (typ.)	100 mA	200 mA	100 mA	200 mA
	Isolation Output to Base	2500 Vrms	2500 Vrms	2500 Vrms	2500 Vrms
	I^2T for Fusing (T=8.3mS)	60 A^2S	1500 A^2S	60 A^2S	1500 A^2S
	Single Cycle Surge Current (Max.)	150 A	600 A	150 A	600 A

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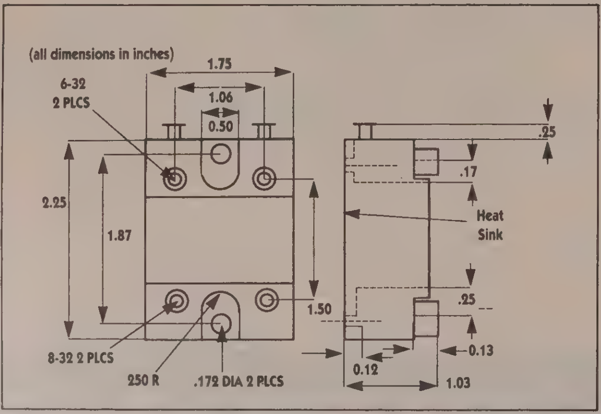
See our additional data pages in sections 2200 D•1154 and 4800 A•2144

DOUGLAS RANDALL, INC

Solid State Relays - DC Output (8 Amps, 25 to 500 volts)

F SERIES

1
LOAD
2+
DOUGLAS RANDALL
SOLID STATE RELAY
MODEL FO8E
INPUT
VDC
3-32
3+
4


(all dimensions in inches)
1.75
6-32
2 PLCS
1.06
0.50
2.25
1.87
1.50
8-32 2 PLCS
250 R
.172 DIA 2 PLCS
.25
.17
Heat
Sink
.25
0.13
0.12
1.03

Features & General Specifications

- Output configuration (FET)
  - Normally Open, Form A (SPST-NO)
  - Normally Closed, Form B (SPST-NC)
- Shunt Diodes internally connected across the output.
- Rapid switching under load.
- Arc-free switching for use in hazardous atmospheres.
- Input circuit features:
  - Opto-isolated
  - Compatible with DTL and TTL logic
  - Reverse polarity protected
- Epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.
- Screw terminals standard.

NOTE:
(1) Voltage drop proportional to load current
(2) Add suffix (-NC) to designate Form B configuration

		FO8E - 8 Amps/25 to 500 volts
Input Data	Range	3 to 32 VDC
	Must Turn On	3 VDC
	Must Turn Off	1 VDC
	Input Impedance	1000 Ohms min
	Isolation-Signal to Load	1500 Vrms
	Isolation-Signal to Base	1500 Vrms
	Temperature Range	
	Operating	-30 to +80
	Storage	-40 to +120
Output Data	Range	25 to 500 VDC
	Voltage Drop at Rated Load	5 VDC typ. (note 1)
	Turn On Time	50 micro Secs.
	Turn Off Time	500 micro Secs.
	On State Resistance Rds (on)	.43 Ohms at 25°C
	Off State Leakage Current	1 mADC
	Surge Current	
	Maximums Duration @ 2% Duty Cycle	1000 micro Secs.
	Rate	60 Amps
	Bias Voltage	8 to 15 VDC
	Bias Current	.3 mADC
	Maximum Cycling Frequency	100 Hz

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See our additional data pages in sections 2200 D•1154 and 4800 A•2144

Signal Switch Company

1791 Capital Street, Suite F, Corona, CA 91720 • Tel: (909) 736-5404 • Fax: (909) 736-5406

SWITCHES ◆◆◆ MATRICES ◆◆◆ SYSTEMS

Signal Switch Company has been an integral part of this ever-changing field of electronics since 1978. It has been a major goal of **Signal Switch Company** to assist every customer on an individual basis, with the focus placed on satisfying their unique switching requirements. This service is extended to all of our customers, whether they are interested in one or one thousand switches, matrices or systems.

Switches, Matrices and Systems are a key element in directing computer data and video signals which are generated daily in the vast network of electronic communications.

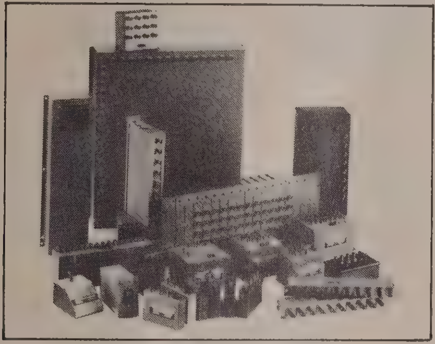
Signal Switch Company manufacturers complete turnkey systems, which include interconnect cabling and control interfaces. Switches and matrices are adaptable for rack mounting within a system and can be manufactured in an unlimitedd variety of configurations.

TYPES:

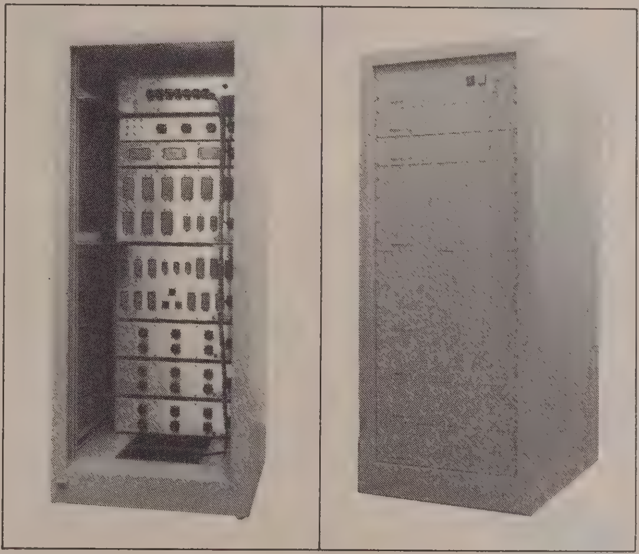
- AUDIO
- DATA
- VIDEO
- R.F.
- MULTI-WIRE
- BALANCED LINE
- COAX
- TWINAX

OPTIONS:

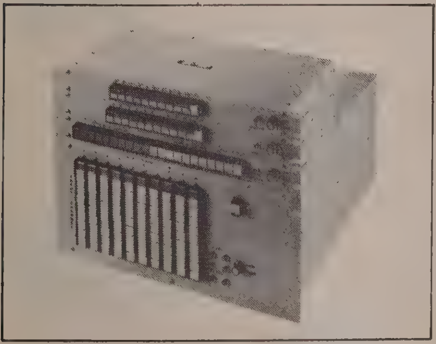
- PROGRAMMABLE
- COMPUTER INTERFACE
- ELECTRO-MECHANICAL
- SOLID STATE
- DESK TOP
- RACK MOUNT
- MODULAR
- COMPLETE SYSTEMS



MODULAR SWITCHES AND MATRICES



1000 WIRE A-B SWITCHING SYSTEM



MULTI SWITCH MATRIX SYSTEMS

TYPICAL SPECIFICATIONS:

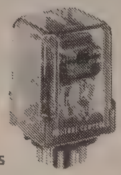
Switches:	1 to N poles, 1 to N throws
Matrices:	2 to N inputs, 2 to N outputs
Frequency Range:	DC to 1.2 GHz
Switching Speed:	100 ms. down to 1 ns.
Swtiching Types:	Solid State, Reed, Relay
Switch Life:	Greater than 100 million operations
Isolation (open contact):	To −110 db
Insertion Loss (RF):	Less than 0.5 db, typically 0.2 db
Xtalk Between Channels:	To −180 db
VSWR:	1.5 to 1
Shock:	200 G max., 11±1 msec.
Vibration:	20 G max. @ 0 to 600 Hz
Temperature Range:	−50° to +150°F

Let us show you how WE can satisfy your switching requirements.
Call or write for complete specifications and our new catalog.

TEL: (909) 736-5404 **FAX: (909) 736-5406**

DELTROL RELAYS

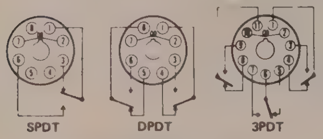
SEE SECTION 4550 FOR SOLENOIDS



105 Series

L = 1-3/8
W = 1-3/8
H = 2

General purpose plug-in relay for continuous duty operation. Plastic cover. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



BASE DIAGRAMS FOR 105 SERIES

B-3 HOLD DOWN SPRING
S/N 20171-00

L = 1-13/32
W = 1-1/2
H = 2-3/16

165/166 Series

Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA Recognized.

L = 1-13/32
W = 1-1/2
H = 2-3/16

Latching relays especially suited for AC power supplies. Units have moisture and fungus-resistant nylon encapsulated coil. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

L = 1-7/8
W = 1-5/8
H = 1-1/4

177 Series

High current relays for industrial control applications. Molded nylon encapsulated coil is resistant to fungus and moisture. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

L = 1-13/32
W = 1-1/2
H = 2-29/32
Mounting Center = 2-1/2

267F Series

General purpose relay with plastic cover. Molded nylon coil insures reliable continuous-duty performance. .250 quick connect terminals. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

105 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20106-82	105	SPDT	10A	24VAC	82	2.0VA
20106-84	105	SPDT	10A	120VAC	2,250	2.0VA
20107-84	105	DPDT	5A	120VAC	1,800	2.2VA
20108-81	105	DPDT	10A	12VAC	19	2.0VA
20108-82	105	DPDT	10A	24VAC	74	2.0VA
20108-84	105	DPDT	10A	120VAC	1,800	2.0VA
20108-85	105	DPDT	10A	240VAC	6,800	2.0VA
20110-82	105	3PDT	10A	24VAC	74	2.2VA
20110-84	105	3PDT	10A	120VAC	1,800	2.2VA
20110-85	105	3PDT	10A	240VAC	6,800	2.2VA
20114-80	105	DPDT	10A	6VDC	30	1.2W
20114-81	105	DPDT	10A	12VDC	120	1.2W
20114-82	105	DPDT	10A	24VDC	472	1.2W
20114-83	105	DPDT	10A	48VDC	1,800	1.2W
20114-84	105	DPDT	10A	110VDC	10,000	1.2W
20116-81	105	3PDT	10A	12VDC	120	1.2W
20116-82	105	3PDT	10A	24VDC	472	1.2W

165/166 SERIES

Flange-Mount Versions are Also Available.

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20307-82	166	DPDT	13A	24VAC	74	2.2VA
20307-84	166	DPDT	13A	120VAC	1,800	2.2VA
20307-85	166	DPDT	13A	240VAC	6,800	2.2VA
20308-82	166	3PDT	13A	24VAC	74	2.2VA
20308-84	166	3PDT	13A	120VAC	1,800	2.2VA
20308-85	166	3PDT	13A	240VAC	6,800	2.2VA
20310-80	166	DPDT	13A	6VDC	30	1.2W
20310-81	166	DPDT	13A	12VDC	120	1.2W
20310-82	166	DPDT	13A	24VDC	472	1.2W
20325-84	165	3PDT	5A	120VAC	1,800	2.2VA
20311-81	166	3PDT	13A	12VDC	120	1.2W
20311-82	166	3PDT	13A	24VDC	472	1.2W
20311-84	166	3PDT	13A	110VDC	9,500	1.2W
20381-82	166A	3PDT	13A	24VAC	74	2.2VA
20381-83	166A	3PDT	13A	120VAC	1,800	2.2VA

166ML SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20525-84	166ML	DPDT	10A	120VAC	1,800	4VA

177 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20935-82	177	SPST-NO-DM	30A	24VAC	44	4.7VA
20935-83	177		30A	120VAC	1,100	4.7VA
20936-81	177	SPST-NO-DM	30A	12VDC	72	2W
20936-82	177		30A	24VDC	288	2W

267F SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20601-84	267F	DPDT	15A	120VAC	1,800	2.2VA
20606-82	267F	SPDT	15A	24VDC	360	1.2W
20607-81	267F	DPDT	15A	12VDC	96	1.2W
20607-82	267F	DPDT	15A	24VDC	360	1.2W

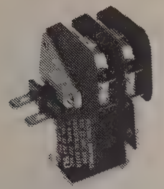
DELTROL RELAYS MADE IN U.S.A. SEE SECTION 4550 FOR SOLENOIDS

General purpose relays with plastic dust cover with flange mounting, barrier-type .250" quick-connect terminals and molded-nylon coil. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA Recognized.

275F SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20844-82	275F	DPDT	25A	24VAC	55	2.4VA
20844-84	275F	DPDT	25A	120VAC	1,500	2.4VA
20848-82	275F	SPST-NO-DM	35A	24VDC	320	1.8W
20852-82	275F	DPDT	25A	24VDC	320	1.8W

20-AMP POWER RELAYS

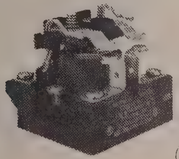


L = 2.07 Max.
W = .940 Max.
H = 2.42 Max.

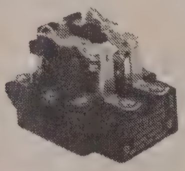
20-Amp Power Relays with molded nylon coils. 0.187 or 0.250 quick-connect terminals. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA Certified (File No. 20690).

871 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20886-84	871	SPDT	20A	120VAC	800	5.0VA
20887-84	871	DPDT	20A	120VAC	800	5.0VA
20888-82	871	SPDT	20A	24VDC	200	2.9W
20889-82	871	DPDT	20A	24VDC	128	4.5W



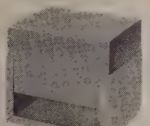
Single Pole
L = 2-1/2
W = 2-1/2
H = 2-3/16



Double Pole
L = 3-11/32
W = 2-1/2
H = 2-3/8

Heavy duty power relay for industrial control applications. Particularly suited for motor controls, heater loads, welder loads, and other power switching applications. Molded nylon coil resists fungus and moisture. Long life, rugged construction. Rating: 30 amps, 1-1/2 hp, 120/240 VAC. Heavy duty screw-type terminals. Mounting: two 3/16" holes on 1-7/8" centers. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).

B-5 DUST COVER



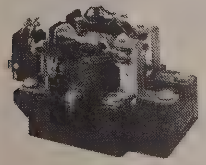
L = 5
W = 4
H = 3

S/N 20257-80

Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates relay series 900.

900 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20237-82	900	SPST-NO	30A	24VAC	12	9.5VA
20237-83	900	SPST-NO	30A	120VAC	290	9.5VA
20238-82	900	SPST	30A	24VAC	12	9.5VA
20238-83	900	NO-DM	30A	120VAC	290	9.5VA
20239-82	900	SPDT	30A	24VAC	12	9.5VA
20239-83	900	SPDT	30A	120VAC	290	9.5VA
20240-82	900	DPST-NO	30A	24VAC	12	9.5VA
20240-83	900	DPST-NO	30A	120VAC	290	9.5VA
20240-84	900	DPST-NO	30A	240VAC	1,200	9.5VA
20241-82	900	DPDT	30A	24VAC	12	9.5VA
20241-83	900	DPDT	30A	120VAC	290	9.5VA
20241-84	900	DPDT	30A	240VAC	1,200	9.5VA
20243-81	900	SPDT	30A	12VDC	72	2W
20243-82	900	SPDT	30A	24VDC	290	2W
20244-81	900	DPST-NO	30A	12VDC	72	2W
20244-82	900	DPST-NO	30A	24VDC	290	2W
20245-81	900	DPDT	30A	12VDC	72	2W
20245-82	900	DPDT	30A	24VDC	290	2W
20245-84	900	DPDT	30A	110VDC	6,050	2W



L = 4-1/4
W = 2-1/2
H = 2-3/8

900 Series heavy duty power relay with snap-action, 10 amp, 1/4" hp, SPDT auxiliary switch. Molded nylon coil resists fungus and moisture. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA File No. 20690.

900-1C SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20246-83	900-1C	DPDT	30A	120VAC	290	9.5VA
20249-82	900-1C	DPST-NO	30A	24VDC	290	2W

DELTROL
controls | DIVISION OF DELTROL CORP

2745 S. 19th St., Milwaukee, WI 53215, Phone (414) 671-6800, Telex 2-6871, Fax (414) 671-6809

All Dimensions are Nominal.

EI&S
ELECTRONIC INSTRUMENTS & SPECIALTY DIVISION

Reed Relays and Solid State Relays

A PRIME TECHNOLOGY COMPANY

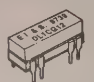
EI&S produces a range of catalog and custom reed relays for switching applications that are not market dependent.

Today's reed relays offer many technical advantages over mechanical relay types, including speed, long life, dry switching and low power input.

Vibration: Reed switch contacts, with only two or three moving parts, offer better response to vibration than mechanical types (e.g. MIL STD 202, Method 204: 20g's @ 10 to 2000 Hz).

Shock: Dry reed relays withstand relatively high levels of shock (e.g. MIL STD 202, Method 213B, Condition A: 50g's for 11mSec @ 1/2 sine wave).

DL/DH **14 Pin Molded DIP (.275 in. high)**



Popular industry standard low cost designs.
Epoxy-molded for minimum package size.
DH Series mercury-wet designs for 50W/2Amp switching.

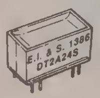
D/DM **14 Pin Encapsulated DIP (.250 in. high)**

Similar to DL Series with added capability.
Epoxy-coated metal case for magnetic shielding.

DA **14 Pin Encapsulated DIP (.420 in. high)**

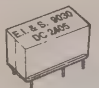
Redesigned low power replacements for D Series.
Optimum coil designs (33mW/5V coil).

DT **Encapsulated DIP (.250 or .430 in. high)**



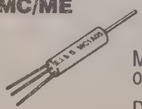
Meets MIL-R-83516A environmental requirements.
Ruthenium-plated contacts for low stable contact resistance.

DC **16 Pin Encapsulated DIP (.420 in. high)**



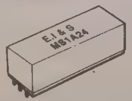
New! Low power coil designs (33mW/5V).
Form-fit sub for DS type EMR relays.
10W/0.5A DPST switching.

MC/ME **Micro-miniature Axial (replacement for 2000 Series)**



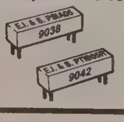
Magnetic shielding standard, electrostatic optional.
Designed for high density applications.

MS/MH **Encapsulated In-line Pinouts**



New! Low-power coil designs (<25mW/5V).
MS Series—to 10W/0.5A dry switching.
MH Series—50W/2A mercury switching.

PS/PT **Pico-Molded/Pico-Encapsulated Pinouts**



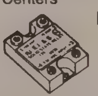
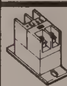
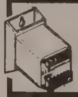
PS: Low profile in a standard molded package.
PT: Epoxy-coated metal case for magnetic shielding. Electrostatic shielding optional.

CONTACT FORM SPECIFICATIONS (@25°C)*

CONTACT FORM SPECIFICATIONS (@25°C)*		DRY REED SERIES D DA DL DC DT MC MS PS PT A & B	C	MERCURY WET SERIES DM DH ME MH MERCURY "A"
CONTACT: MAXIMUM RATINGS				
Switching Current	(Adc)	0.5	0.25	2
Switching Voltage	(Vdc)	200	100	500
Switching Power	(W)	10	3	50
Breakdown Voltage	(Vdc)	250	200	1000
Contact Resistance	(Ω)	0.150	0.200	0.100
Carry Current	(Adc)	1.0	0.5	3
RELAY: TYPICAL RATINGS				
Timing: Operate	(ms)	0.500	0.500	2.0
Release w/Diode Suppresion	(ms)	0.100	0.500	1.0
Bounce	(ms)	0.150	0.150	0
Breakdown (Coil-Contacts)	(Vdc)	1500	1500	1000
Insulation Resistance	(Ω)	10^{10}	10^9	10^{10}
Life Expectancy: @ Rated Load	(opns)	1 x 10^7		50 x 10^6
@ Low Level	(opns)	5 x 10^7		100 x 10^6
Temperature/Range: Operating	(°C)*	-30 to +65°		-30 to +65°
Storage	(°C)*	-55 to +85°		-55 to +85°

* Expanded limits available — contact factory

SOLID STATE RELAYS

MODEL		INPUT	OUTPUT	FEATURES
STANDARD "HOCKEY PUCK" 1.75" Mounting Centers DUAL SCR 	280RS10-04 280RS25-04 280RS45-04	3-32Vdc	10A 25A 45A } 40-280Vac	47-400Hz Low output leakage Optically-isolated Reduced EMI Better heat management Resistant to higher dv/dt
	280RS10-AC2 280RS25-AC2 280RS45-AC2	120Vac	10A 25A 45A } 40-280Vac	
TRIAC (surgeless™)	120SS10-04 120SS25-04	3-32Vdc	10A 25A } 40-140Vac	90° phase angle initial turn-on For heavy inductive loads
	240SS10-04 240SS25-04		10A 25A } 90-280Vac	
TRIAC	120EI10-04 120EI25-04	3-32Vdc	10A 25A } 40-140Vac	Optically-isolated Zero voltage turn-on RC Snubber
	240EI10-04 240EI25-04		10A 25A } 90-280Vac	
 TRIAC 2.50" Mounting Centers	902	3-32Vdc	5A 40-140Vac	Rated @ 80°C Ambient Ideal for process control Replaces Models 682,900,901
 MOSFET Ball or Chassis Mounted	9601 9602	120Vac 3-32Vdc	Dual 5 50Vdc 2X SPST	Fast switching Hi-Rel design for DC control or robotic systems Low output leakage

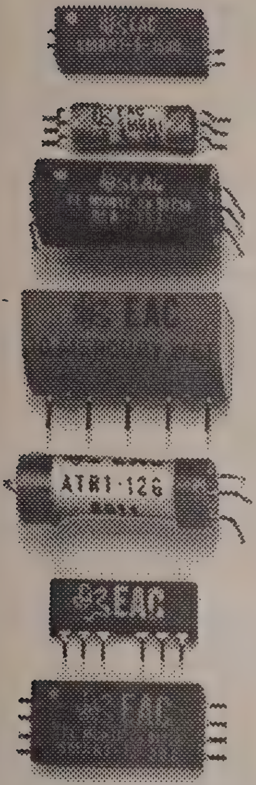
ELECTRONIC INSTRUMENTS & SPECIALTY DIVISION
P.O. Box 185, North Branford, Connecticut 06471
TWX: 710-452-[illegible] / FAX: (203) 481-8937

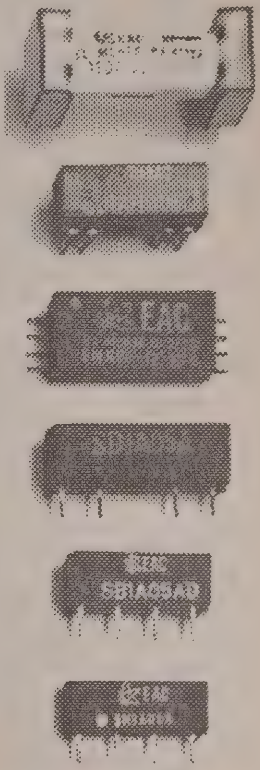
CALL 203 481-5721

EAC
4918 Santa Anita Avenue
El Monte, Ca. 91734
Telephone 818-442-3212 FAX 818-442-6873

This Could Be Important!

1-800-742-5361


ATR1-126
EAC


EAC
SBIA65AD

After you look at all of the fine print and tiny schematics and find what you need, make the call to the other guy and then call EAC's Sales Hotline.

We have direct industry standard cross referenced reed relays.

In a hurry? We ship in 24 hours.

If you need a custom relay, give us a week and we will make you a free sample.

Regular or custom, use the EAC Hotline telephone number. Call us, check out our prices and delivery.

I CAN SLEEP WELL TONIGHT BECAUSE I KNOW MY EAC REED RELAYS WILL BE HERE TOMMOROW! YAHOO !!
I'M SO EXCITED!
BIL

Electronic Specialty Corporation

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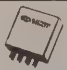
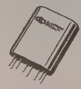
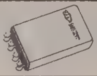
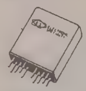
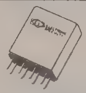
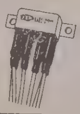
STANDARD HERMETIC SEALED RELAYS

SERIES	General Information	Contact Form	Contact Rating	D×W×H Size	Sensitivity	Coil Voltages
30	Digital time relay. Operate or release delay. Note: 4DPT available in delay on operate only.	1PDT 2PDT 3PDT 4PDT	2 Amp 28 VDC or 10 Amp 28 VDC	Various	N/A	12 to 48 VDC
35	Voltage Sensor	1.4PDT	10 Amp	Various	N/A	6 VDC to 115AC
50	Qualified to M39016/6. Non Latch	2PDT	D/C to 2A 28 VDC Resistive	.4×.800 ×.41	250 mw Pick Up	6 VDC to 115AC
55	Latching ½ size sensitive latching relay qualified to MIL-R-39016/45M.	2PDT	D/C to 2A 28 VDC Resistive	.4×.800 ×.41	90 mw Latch/Reset	6 VDC to 115AC
61 	Qualified to MS27401	2PDT	DC to 12A	.525× 1.025×1.010		6 VDC to 115AC
68 	Crystal can "Lazy S" header.	2PDT	D/C to 2A 28 VDC Resistive	.359×.797 ×.875	300 mw Pick Up	6 VDC to 115AC
71 	Sensitive crystal can relay.	2PDT	D/C to 2A 28 VDC Resistive	4×.8 ×1.280	40 mw Pick Up	6 VDC to 115AC
77 	Crystal can. Sensitive latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	4×.8 ×.875	90 mw Latch/Reset	6 VDC to 115AC
79 	Non Latch Crystal can. Non-latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.4×.8 ×.875	250 mw Pick Up	6 VDC to 115AC
90 92	Sensitive—non-latching. Sensitive—Latching.	4PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.601×1.032 ×1.278	80 mw Pick Up 80 mw Latch/Reset	6 VDC to 115AC
93 94	Non-latching Welded or solder sealed. Latching. Welded or solder sealed.	2PDT	10 Amps 28 VDC Resistive	.515×1.032 ×1.300	500 mw Pick Up 150 mw Latch/Reset	6 VDC to 115AC
100 102	Sensitive—non-latching. Sensitive—Latching.	6DPT	Dry Circuit to 3 Amps 28 VDC Resistive	.852×1.032 ×1.278	150 mw Pick Up 150 mw Latch/Reset	6 VDC to 115AC
103 104	Non-latching. Latching.	4PDT	10 Amps 28 VDC Resistive	.852×1.032 ×1.3	1000 mw Pick Up 300 mw Latch/Reset	6 VDC to 115AC
FHT 	Full or Half size crystal can coaxial relays with 8″ min. RG 178 B/U cables attached. T Series sensitive. Welded sealing.	1PDT with Auxiliary Contacts or 2 PDT Coax	RF to 1.5 Amps 50 Watt Max.	Frequency Range to 500 MHz VSWR-1:1.1 Typical. Characteristic Impedance–50 Ohm Typical. Cross Talk–50 dB Typical.		6 to 32 VDC
300	The ultimate in high current DC load switching. The load is switched with power semiconductors short term, and carried by the relay hard contacts long term, preventing the semiconductors from overheating. The Arcless™ uses a SPST heavy duty mechanical relay. In addition to switching 70 AMP loads, the Arcless will withstand a 180 AMP inrush current from motor or lamp load. Applications for arcless relays should include all high current DC switching where reliability and long life are important design criteria. No arc between contact points–No electro-magnetic interference. This non-arcing feature is useful for switching where EMI or RFI might cause damage to equipment, software, or quality of radio signals.					

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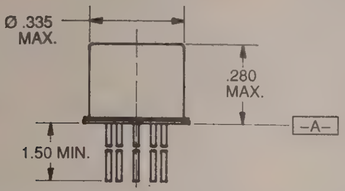
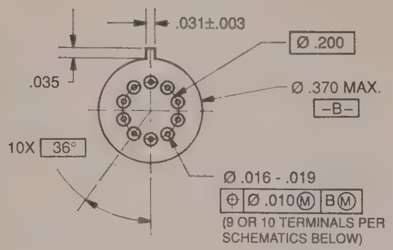
Mechanical Outlines

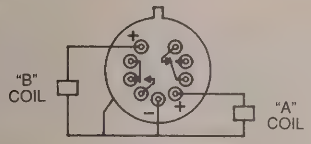
Side View



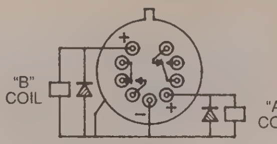
Terminal View



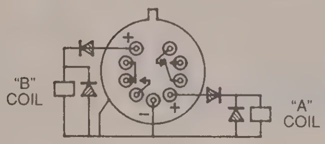
Schematic Diagrams: Terminal Views (shown with "A" coil last energized)



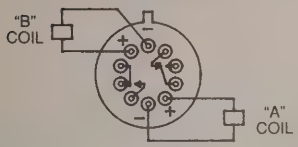
12L09-Series



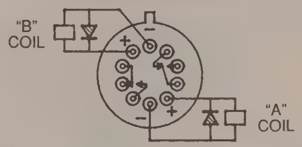
12DL09-Series



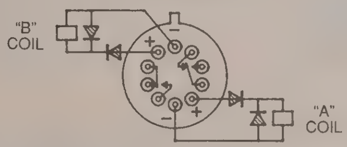
12DDL09-Series



12L10-Series



12DL10-Series



12DDL10-Series

Standard Adjustment Schedule

Coil Resistance (±10% at 25°C)	Rated Coil Voltage		Maximum Operate Voltage		Coil Resistance (±10% at 25°C)	Rated Coil Voltage		Maximum Operate Voltage	
(Relay Dash No.)	Nominal	Maximum	125°C	25°C	(Relay Dash No.)	Nominal	Maximum	125°C	25°C
2K	26.5	32.0	18.0	13.5	**280**	9.0	12.0	6.8	5.1
1.13K	18.0	24.0	13.5	10.1	**120**	6.0	8.0	4.5	3.3
500	12.0	16.0	9.0	6.7	**61**	5.0	6.0	3.5	2.6

NOTES

PHYSICAL CHARACTERISTICS:

1. **Case Finish:** Shell – None
   Header – Gold per MIL-G-45204, Type 1, Class 1.
2. **Terminal Finish:** Gold plate per MIL-G-45204 Type 1, Class 1 over Nickel underplate.
3. **Weight:** 2.84 Grams (0.10 oz.) maximum.
4. **Seal:** Hermetic, 10^{-8} ATM cc/sec.
5. Terminals shall be solderable per MIL-R-39016.
6. **Terminal Strength** (Method 211, MIL-STD-202):
   Pull Test: Test Condition A. 1 pound pull.
   Bend Test: Test Condition C. 1/2 pound load.
   Twist Test: Test Condition D.
7. **Electrical Characteristics** (Test methods per MIL-R-39016, where applicable): Contact Configuration: 2 form C (DPDT).
8. **Contact Material:** Noble Metal Alloy with Gold plating, intended for low-level to 1.0 AMP switching.
9. **Load Ratings:**
   A. High Level (Case grounded, except as noted):
      1.0 AMP at 28 VDC.
      500 Milliamp at 115 VAC 400 Hz (Case ungrounded).
      250 Milliamp at 115 VAC 60 Hz (Case ungrounded).
      100 Milliamp at 115 VAC 60 and 400 Hz.
      Inductive Load: 0.2 AMP at 28 VDC with 0.32 Henry inductance.
      Lamp Load: 0.10 AMP at 28 VDC.
   B. Low Level: 10 to 50μ AMP at 10 to 50 mV DC or Peak AC.
   C. Intermediate Current: 0.10 AMP at 28 VDC.
   D. Overload: 100 cycles at 2.0 AMPs 28 VDC.
10. **Contact Life:** 100,000 cycles at rated high level load, and intermediate current. 1,000,000 cycles at low level and mechanical.
11. **Contact Resistance or Voltage Drop:**
   A. Intitial: 0.100 Ω max. at low level.
   B. High Level: During life: 5% of open circuit voltage
      After life: 0.200 Ω max.
   C. Low Level: During life: 33 Ω max.
      After life: 0.15 Ω max.
   D. Intermediate Current:
      During Life: 1 Ω max.
      After Life: 0.20 Ω max.
12. **Inter-contact Capacitance:** 0.2 pF, typical.

OPERATING CHARACTERISTICS:

14. **Sensitivity:** Standard latch/reset power is 102 milliwatts maximum at 25°C.
15. **Operate Time:** 2.0 milliseconds maximum over the temperature range, with rated coil voltage. Recommended minimium coil operate voltage pulse: 3.0 milliseconds at rated voltage.
16. **Contact Bounce Time:** 2.0 milliseconds maximum.
17. **Contact Stabilization Time:** 2.5 milliseconds maximum.
18. **Dielectric Withstanding Voltage:**
    Sea Level: 500 VRMS, 60 Hz, all isolated combinations. Altitude (1.3 inches Hg): 125 VRMS 60 Hz, all terminals to case.
19. **Insulation Resistance:** 10,000 megohms minimum at 500 VDC, except the insulation resistance between coil and case at 125°C shall be 1,000 megohms minimum.
20. **Duty:** Continuous.

ENVIRONMENTAL CHARACTERISTICS:

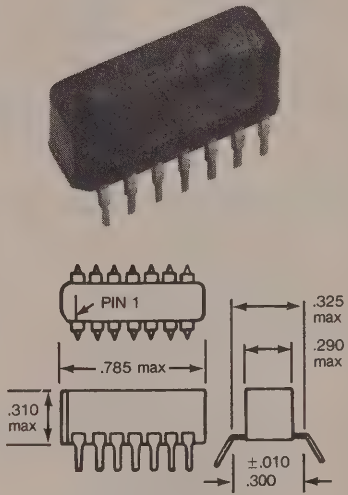
21. **Operating Ambient Temperature Range:** -65°C to 125°C.
22. **Vibration (Operational):** Per MIL-STD-202, method 204 condition D and the following:
    Minimum of 50 G's and 0.1 inch double amplitude from 10 to 3,000 to 10 Hz in each of 3 orthogonal axes, one of which is parallel to tab. 15 minutes per axis. No chatter exceeding 10 μ seconds: No transfer exceeding 1 μ second.
    Non-Operational: Same as operational with the following exceptions: Minimum of 100 G's and 0.2 inch double amplitude from 10 to 2,000 Hz. Monitoring not required.
23. **Shock (Operational):** Per method 213, MIL-STD-202, except 750 G's, 0.5 millisecond pulse. No chatter exceeding 10 μ seconds; No transfer exceeding 1 μ second.
    Non-Operational: Same as operational except 2,100 G's, 0.5 millisecond pulse. Contact chatter and transfer may occur.
24. **Acceleration:** 75 G's with axes and contact criteria same as for shock and vibration.
25. Single diode coil transient suppression.
26. Double diode suppression/polarity protection.

FIFTH
DIMENSION
INC.

Mercury Relays That

DIP Relays

- Position-insensitive, bounce-free LCI sealed capsule
- 100% run-in @ 10 VDC-100 mA for 2.5 x 10⁶ operations
- 5, 12 and 24 VDC-700 Mw coil drives
- Life expectancy over 50 x 10⁶ operations
- Latching or non-latching operation
- Molded diallyl phthalate case



- Operate Time (max.) — 2.5 ms
- Release Time (max.) — 3.0 ms
- Contact Resistance — 75 milliohms

7000 Series (DC to 10 MHz)

- Rated Contact Load — 1.0 amp 4 VDC to 0.3 amp @ 200 VDC

2000 Series (DC to 100 MHz)

(Specifications at 100 MHz)

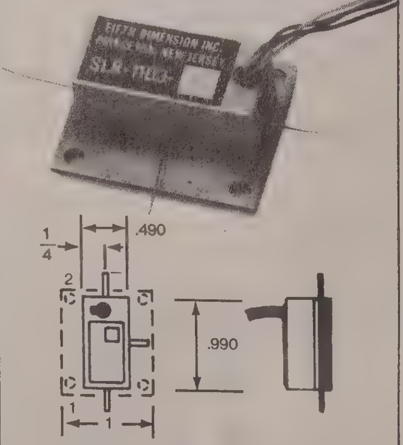
- Rated Contact Load — 10 watts CW
- Insertion Loss (Typical) — 0.2 dB
- Isolation (Typical) — 40 dB
- VSWR (Typical) — 1.5

Bistable (Latching Relays)			Monostable (Non-Latching Relays)		
Part No.	Form	Diode Protection	Part No.	Form	Diode Protection
7120-1A-V*	A	No	7210-1A-V*	A	No
7120-1C-V	C	No	7210-1C-V	C	No
7121-1A-V	A	Yes	7211-1A-V	A	Yes
7121-1C-V	C	Yes	7211-1C-V	C	Yes
2122-1A-V	A	No	2212-1A-V	A	No
2122-1C-V	C	No	2212-1C-V	C	No

*Specify Coil Voltage

50 Ohm Stripline and Coaxial Relays

Stripline RF Relay • SPDT Bistable
Part No. SLR 1103-(V)*

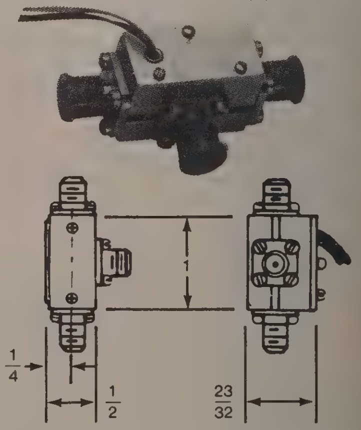


- Position-insensitive, bounce-free LCI sealed capsule
- Bistable operation
- 5, 12 and 24 VDC-700 Mw coil drives
- Operate Time (max.) — 4.0 ms
- Cycling rate — to 40 Hz
- Frequency Range — DC to 1 GHz
- Dielectric strength — 300 VDC
- Rated Load — 10 watts CW

	100 MHz	1.0 GHz
Typ. Insertion Loss (dB)	.07	.30
Typ. Isolation (dB)	56	36
Typ. VSWR	1.03	1.20

*Specify Coil Voltage

Coaxial RF Relay • SPDT Bistable
Part No. RF 1106-(V)*



FIFTH DIMENSION INC.
801 New York Avenue, Trenton, NJ 08638-3982 • Tel: (609) 393-8350 • FAX: (609) 599-9508

Operate in any Position

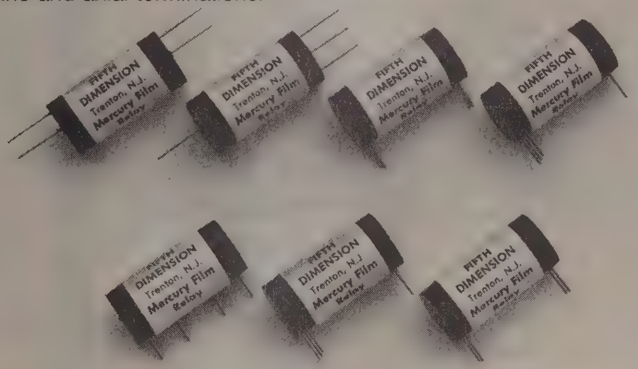
- **No Contact Bounce** — Produce clean square-wave pulses
- **Position Insensitive** — No pool of mercury
- **Self-Healing Contacts** — Always wetted with fresh mercury
- **Rugged Construction** — Welded steel switching capsule
- **Sealed Package** — High density polyethylene (WK Series)

Specifications

Meet Lightning Surge Standards — 2500 volts coil-to-contact breakdown meets FCC standards (WK Series only)
Contact Type: Form A (SPST) mercury film
Contact Bounce: None at 80% of rated voltage or higher
Load Current to 52 VDC: 0.24 amps
Load Current to 200 VDC: 0.10 amps
Contact Resistance: 150 milliohms (max.)
Contact Resistance Stability: ±15 milliohms
Contact Breakdown Voltage: 800 volts DC or AC (rms)
Coil-to-Contact Breakdown: 2500 VAC
Operate Time: 4.0 milliseconds (max.)
Release Time: 4.0 milliseconds (max.)

Molded-Case Magnetically Shielded Series WKS. Relays can be submerged in appropriate cleaning solvents during board assembly.

Series WKS Mercury Relays are available in a wide variety of footprints including 0.1, 0.15 and 0.2-inch PCB spacing as well as with in-line and axial terminations.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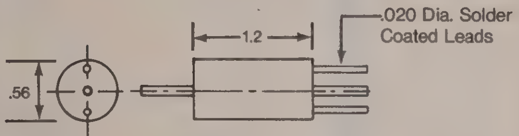
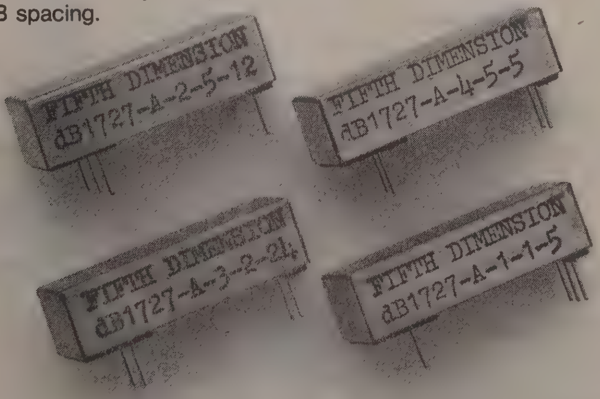
Flame Resistant Relays
Series FR relays meet the requirements of UL Standard 94VO. Available with 250, 375 and 500 mW coils.
Ask for details on these and special models.

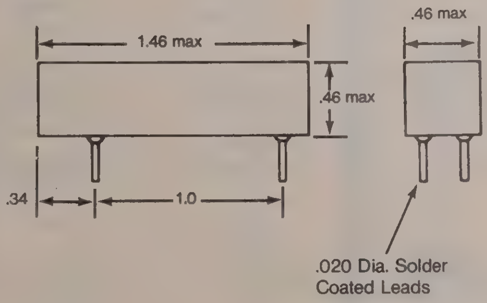

1.2
.020 Dia. Solder Coated Leads
.56

Nominal Coil Volts	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	250 MW	375 MW	500 MW		
5	100	67	50	4.0	0.5
12	575	384	288	9.6	1.2
24	2300	1536	1150	19.2	2.4

Open-Frame Magnetically Shielded Series dB. Open-frame magnetically shielded.

Series dB Mercury Relays are available with 0.1, 0.15 or 0.2-inch PCB spacing.


FIFTH DIMENSION dB1727-A-2-5-12
FIFTH DIMENSION dB1727-A-4-5-5
FIFTH DIMENSION dB1727-A-3-2-24
FIFTH DIMENSION dB1727-A-1-1-5


.46 max
1.46 max
.46 max
.34
1.0
.020 Dia. Solder Coated Leads

Nominal Coil Voltage	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	125 MW	250 MW	500 MW		
5	200	100	50	4.0	0.5
12	1150	575	288	9.6	1.2
24	4608	2300	1150	19.2	2.4

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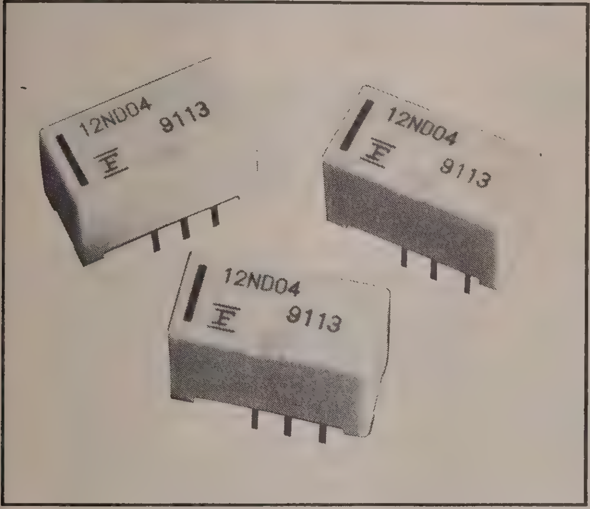
				■	■				■	■	■	Telecommunication

MICROMINIATURE RELAYS FOR P.C. BOARDS

FRR10 SERIES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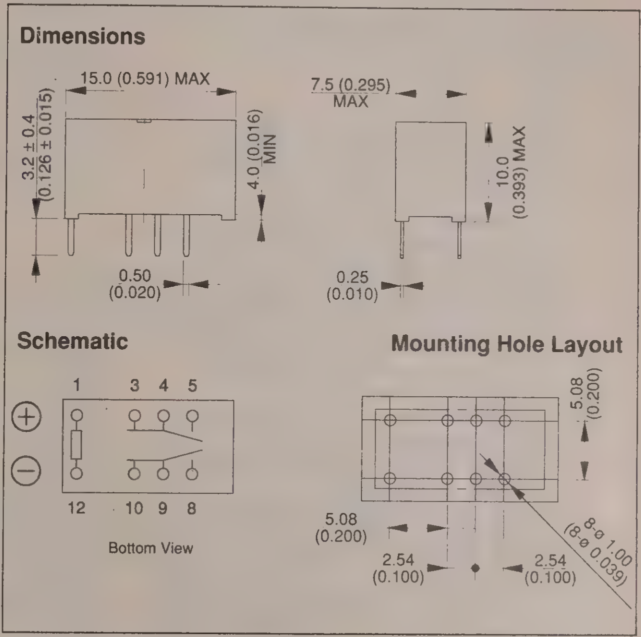
Dimensions
15.0 (0.591) MAX
3.2 ± 0.4 (0.126 ± 0.015)
4.0 (0.016) MIN
0.50 (0.020)
7.5 (0.295) MAX
10.0 (0.393) MAX
0.25 (0.010)
Schematic
1
3
4
5
12
10
9
8
Bottom View
Mounting Hole Layout
5.08 (0.200)
5.08 (0.200)
2.54 (0.100)
2.54 (0.100)
8-ø 1.00 (8-ø 0.039)

FEATURES

- Design based on worldwide telecommunications standards
- Other applications include instrumentation, data switching, security alarm
- 2.5 kV surge (per Bellcore TA-NWT-001089)
- 1.5 kV surge (per FCC part 68)
- Small size (0.2 in. x 0.1 in., 12 pin DIP)
- 140 mW coil power
- Stable contact resistance for signal switching
- 200 x 10^3 operations, 30 VDC, 1 A resistive
- 100 x 10^3 operations, 125 VAC, 0.5 A resistive

INITIAL DIELECTRIC STRENGTH

	VRMS, 1 min.	Surge*		
		Peak (V)	Rise Time (µs)	Decay Time (µs) (1/2 peak)
Between Open Contacts	1000	1500	10	160
Between Contact Size	1500	2500	2	10
Between Coil and Contacts	1500	2500	2	10

* Decay time measured from beginning of surge.

SELECTION TABLE

Nominal Voltage in VDC at 20° C	Nominal Coil Power Dissipation in W at 20° C	Coil Resistance in Ω ± 10% at 20° C	Pick-up Voltage in Vmax. at 20° C	Drop-out Voltage in Vmin. at 20° C	PART NO.
3	Approx. 0.14	64.3	2.25	0.3	FBR12N D03
4.5		145	3.38	0.45	FBR12N D04
5		178	3.75	0.5	FBR12N D05
6		257	4.5	0.6	FBR12N D06
9		579	6.75	0.9	FBR12N D09
12		1028	9.0	1.2	FBR12N D12
24	Approx. 0.20	2880	18.0	2.4	FBR12N D24

UL - File 63615
CSA - File
LR64026-27

UL & CSA Ratings:
0.5A, 125 VAC
2.0A, 30 VDC
0.3A, 110 VDC

MICROMINIATURE RELAYS FOR P.C. BOARDS
FBR20 Series

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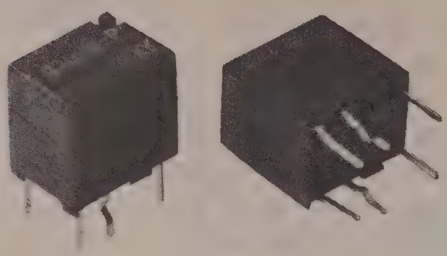
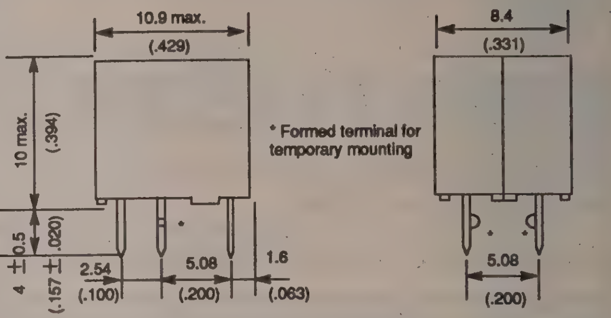


DIMENSIONS

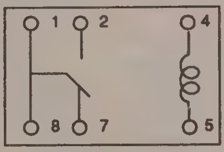


Fujitsu FBR20 series relays are designed for PC board mounting with 1A contact ratings – perfect for microminiature applications.

FEATURES

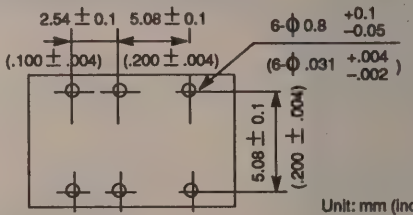
- **Microminiature size.** Two FBR20 series relays can be mounted in the space now required for a single FBR210 series relay.
- **1A contact rating.** Despite their microminiature size, FBR20 series relays have a contact rating of 1A at 24 VDC for convenient installation.
- **Gold overlay on silver-palladium contact.** Contact reliability is assured in low-level applications by contact shapes and materials especially designed for signal switching applications.
- **Low power consumption.** With a rated power consumption of only 0.3 W, today's expensive energy costs can be reduced significantly.
- **Wide range of drive voltages.** Drive voltages from 1.5 VDC to 24 VDC are available for a wide range of applications.
- **Strong shock resistance.** Even with a 50 G shock, FBR20 series relays never miss a switch.
- **Easy-to-pattern design.** Separate terminal connections with drive and output sections allow easy pattern design.
- **Formed terminal available for temporary lock.** The unique design of the forming terminal allows FBR20 series relays to be temporarily mounted for greater design flexibility.
- **Automatic soldering provision.** The terminal is sealed to prevent flux from entering during automatic soldering.
- **Immersion cleaning.** Sealed for immersion cleaning.

SCHEMATIC



(Bottom View)

MOUNTING HOLE LAYOUT



Unit: mm (inches)

ENGINEERING DATA

Item	Specification
Contact Arrangement Contact Shape Contact Material Contact Rating Initial Contact Resistance	SPDT (1 form C) Single contact Gold overlay silver-palladium alloy 24 VDC-1A, 120 VAC-0.5 A (resistive load) 100 megohm max. (measured at 6 V DC-0.1 A)
Maximum Carrying Current Maximum Switching Voltage Maximum Switching Power	2 A 125 VDC, 125 VAC 24 WDC, 60 VA AC (resistive load)
Coil Power Coil Temperature Rise	0.3 W 45 degrees C (at rated voltage, 20 degrees C)
Insulation Resistance Withstanding Voltage	1,000 megohm min. (at 500 VDC) Between contacts: 500 VAC for 1 minute Between contact and coil: 750 VAC for 1 minute
Vibration	20 G, 10 to 300 Hz (dual amplitude, maximum 3.0 mm) No contact chatter longer than 1.0 ms
Shock	Operation error: 50 G (sine half-wave of 11 ms) No contact chatter longer than 1.0 ms
Operate Time Release Time	5 ms max. (at rated voltage) 3 ms max. (after rated operation)
Life Expectancy Mechanical Electrical	 5 x 10^6 ops. min. 200 x 10^3 ops. min. (at rated contact load)
Maximum Switching Frequency Mechanical Electrical	 18,000 operations/hour 1,800 operations/hour (at contact rated load)
Ambient Temperature Range Ambient Humidity	−30 degrees C to +65 degrees C (at rated operation) 45 to 85% RH
Weight	1.7 g (approx.)

SELECTION TABLE

Type	Voltage Specifications	Coil Rated Voltage	Coil Resistance (± 10%)	Pick-up Voltage	Drop-out Voltage	Maximum Coil Voltage Allowance	Rated Power Consumption	Part No.
Standard Type	D01	1.5 VDC	7.5 ohm	Less than 80% of rated voltage	More than 5% of rated voltage	160% of rated voltage	Approx. 300 mW (at rated voltage)	FBR21ND01P
	D03	3 VDC	30 ohm					FBR21ND03P
	D05	5 VDC	83 ohm					FBR21ND05P
	D06	6 VDC	120 ohm					FBR21ND06P
	D09	9 VDC	270 ohm					FBR21ND09P
	D12	12 VDC	480 ohm					FBR21ND12P
	D18	18 VDC	1,080 ohm					FBR21ND18P
	D24	24 VDC	1,920 ohm					FBR21ND24P

Note: Measured at 20 degrees C

ULTRA-MINIATURE RELAYS FOR P.C. BOARDS
FBR40 Series

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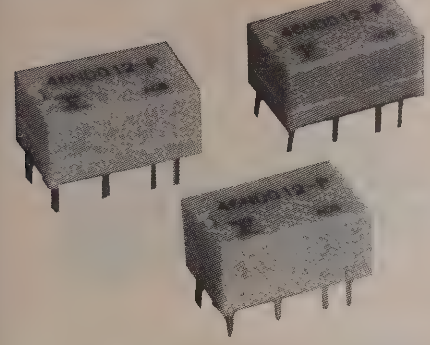
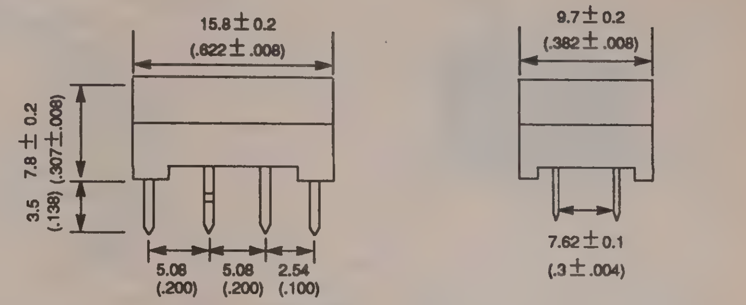


The Fujitsu FBR40 series relay with a pick-up power consumption reduced to 85 mW is an extremely small DPDT CONTACT relay designed for PC board mounting.

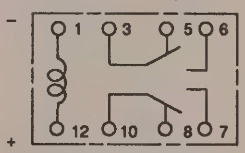
FEATURES

- **Ultra-miniature low-profile design.** At half the size of the conventional FBR240 relay and requiring only three quarters of the board area, a drastic reduction in size has been achieved in the design of the FBR40. 15.8 (L) x 9.7 (W) x 7.8 (H) mm.
- **High dielectric strength.** Dielectric withstanding voltage between contacts and coil is over 1,000 VAC and with the ability to withstand a surge voltage of over 1,500 V, it conforms to FCC 68.302 standard.
- **High-shock resistance**. Even a shock force of 30 G will not result in a malfunction.
- **Low power consumption**. With a high efficiency built-in permanent magnet, operating power consumption is only 85 mW. (Rated power consumption is 150 mW.)
- **Formed terminal for temporary lock.** The terminals of the FBR40 are specially formed so that they can be temporarily attached to the PC board.
- **Pattern design is easy.** The terminal connections are designed so that the drive portion (coil) and the output portion (contacts) are isolated, which simplifies pattern design.
- **Immersion cleaning.** Sealed for immersion cleaning.
- **UL and CSA approved.** UL File No. (E63615), CSA File No. (LR64026-17).
- Contact sales representative for availability of models meeting BELCOR 2500 V surge test.

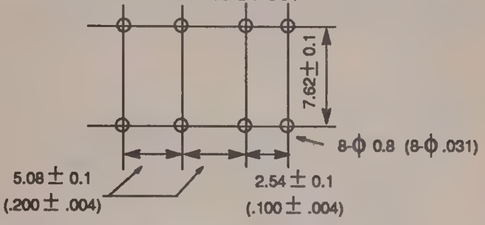
DIMENSIONS Unit: mm (inches)



SCHEMATIC

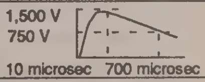


MOUNTING HOLE LAYOUT



Notes: [1]This relay is polarized. Please refer to the schematic when designing a circuit.
[2]An abbreviated designation is marked on the top surface of the dust cover as follows:
(ex.) Designation: FBR46D012-P Marking: 46D012-P
[3]Terminal numbers are not shown on the relay.

ENGINEERING DATA

Item	Specification
Contact Arrangement Contact Materials Initial Contact Resistance	DPDT (2 Form C) bifurcated contact Gold overlay silver-palladium alloy 100 megohm max. measured at 6 V DC, 0.1 A
Insulation Resistance Dielectric Withstanding Voltage	100 megohm min. at 500 VDC Between open contacts 500 VAC for 1 min. Between contact and coil and between adjacent contacts 1,000 VAC for 1 min.
Surge Voltage (FCC 68.302)	1,500 V/10 microsec/700 microsec Between coil and contact Between adjacent contacts 
Electrostatic Capacitance Between Contacts (Reference)	Between open contacts approx. 1 pF Between coil and contact approx. 2 pF
Vibration	Operation malfunction 10-55 Hz (Dual amplitude 1.5 mm) Durability 10-55 Hz (Dual amplitude 1.5 mm)
Shock	Operation malfunction 30 G (11 msec) Durability 100 G (11 msec)
Operate Time Release Time	5 msec max. (bounce time not included) 5 msec max. (bounce time not included)
Life Expectancy Mechanical Electrical	 10 x 10^3 ops. min. 100 x 10^3 ops. min. (at rated contact load)
Maximum Switching Frequency Mechanical Electrical	 18 x 10^3 times/hour 1,800 times/hour (at contact rated load)
Operating Temperature Range Operating Humidity Range	–30 degrees C to +70 degrees C 45-85% RH
Weight	3 g (approx.)

SELECTION TABLE

Type	Rated Coil Voltage (VDC)	Coil Resistance (±10%) in Ω	Pick-up Voltage	Drop-out Voltage	Rated Power Consumption	Pick-Up Power Consumption	Designation
Standard Type	3	60	Less than 75% of rated voltage	More than 5% of rated voltage	150 mW approx. (when voltage is applied)	Less than 85 mW	FBR46ND003P
	5	167					FBR46ND005P
	6	240					FBR46ND006P
	9	540					FBR46ND009P
	12	960					FBR46ND012P
	24	2,880			200 mW approx.	Approx. 112 mW max.	FBR46ND024P

Note: Measured at 20 degrees C

SMALL CONTROL RELAYS FOR P.C. BOARDS
FBR160 Series

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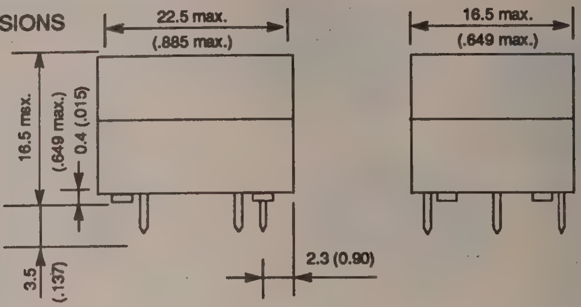
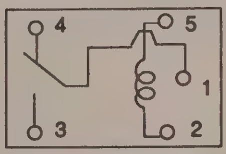
DIMENSIONS



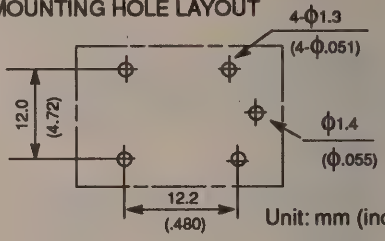
Fujitsu FBR160 series small control relays are PC board mounted and have contact ratings up to 10 A.

SCHEMATIC



(view from terminal side)

MOUNTING HOLE LAYOUT



Unit: mm (inches)

FEATURES

- **Same terminal array as FBR100.** These relays have the same foot print as Fujitsu's conventional FBR100 series.
- **Lower profile.** Since their profile is 7 mm lower than that of the FBR100 series relays, they can be used in smaller equipment.
- **Flux-prevention structure.** The contacts are located on the top of the relay to protect them from solder flux from the terminals.
- **Choices of contact materials.** Two different kinds of contact materials can be specified according to the load.
- **Immersion cleaning.** Sealed for immersion cleaning.
- **Meets major safety standards.** The relays are CSA certified (LR41893-56, LR50924-5, and LR64026-7). The relay structure is designed to meet the Japan Electric Appliance control law (150 V max.) and UL standards (File No. E63614 and E63615).

ENGINEERING DATA

Item	Specification
Contact Arrangement Contact Material	SPDT or SPST – No (Form A) No Suffix (silver) -H (Silver-Cadium-Oxide) -WB (special)
Contact Ratings	3 A at 28 VDC or 120 VAC (No Suffix) 5 A at 28 VDC or 120 VAC (H) 10 A at 28 VDC or 120 VAC (WB)
Initial Contact Resistance	100 megohm max. Silver contacts: Measured at 6 VDC, 0.5 V Other contacts: Measured at 6 VDC, 1.0 A
Insulation Resistance Withstanding Voltage	100 megohm min. (at 500 VDC) Between open contacts: 500 VAC for 1 minute Between contact and coil: 1,500 VAC for 1 minute
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	Operation malfunction: Less than 0.1 ms at 10 G (11 ms) Durability: 100 G (11 ms)
Operate Time Release Time	10 ms max. (at rated voltage, bounce time not included) 5 ms max. (after operation at rated voltage, bounce time not included)
Life Expectancy Mechanical Electrical	10 x 10^6 ops. min. (maximum switching frequency: 18 x 10^3/hour) 100 x 10^3 ops. min. (at rated contact load, maximum switching freqency: 18 x 10^2/hour)
Ambient Temperature Range Ambient Humidity	–30 degrees C to +60 degrees C 45 to 85% RH
Weight	11 g (approx.)

SELECTION TABLE

FBR161 Type	Contact Arrangement	Rated Voltage in VDC	Coil Resistance in Ω (± 10%) at 20 °C	Pick-up Voltage at 20 °C	Designation
Standard	SPDT	5	70	Less than 80% of rated voltage	FBR161NED005U-*
		6	100		FBR161NED006U-*
		9	225		FBR161NED009U-*
		12	400		FBR161NED012U-*
		24	1,600		FBR161NED024U-*

Note: *Insert contact material suffix.
Example Part No.: FBR161NED012U-H

ULTRA-MINIATURE RELAYS FOR P.C. BOARDS
FBR210 Series

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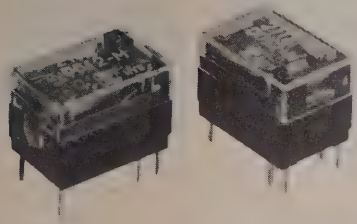
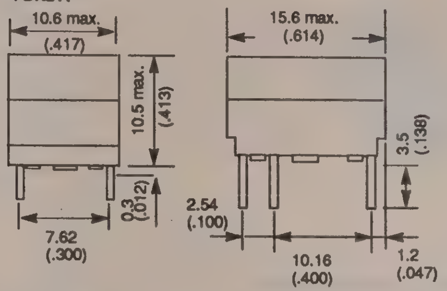


Fujitsu FBR210 series of ultra-miniature relays allow high component densities for savings in both equipment size and cost for the printed circuit board. The FBR211N series are suitable for immersion cleaning in freon and aqueous systems.

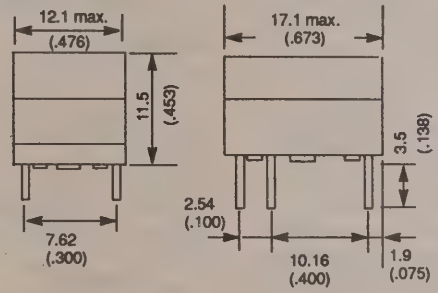
These highly sensitive relays with gold-clad SPDT contact arrangements are designed to offer load handling capabilities of 1 A at 28 VDC or 0.5 A at 120 VAC under a resistive load. The 0.1 inch grid spacing of terminals makes these relays ideally suited for printed circuit board applications requiring high-density mounting and for use in audio and wireless communications, office vending machines, automobiles and various control applications. Contact sales representative for availability of new 2 A models.

DIMENSIONS Unit: mm (inches)

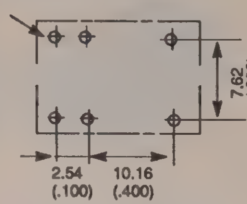
FBR211



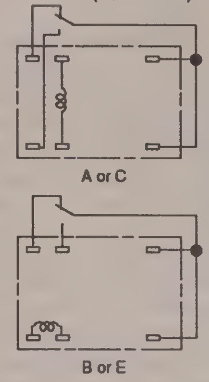
FBR211N



FBR211, FBR211N
MOUNTING HOLE LAYOUT



SCHEMATICS (Bottom View)



ENGINEERING DATA

Item	Specifications: Standard Model	Specifications: High-Sensitivity Model
Contact Arrangement	SPDT	
Contact Material	Gold overlay silver-palladium alloy or gold overlay silver	
Contact Rating	1 A at 28 VDC, 0.5 A at 120 VAC (resistive)	
Initial Contact Resistance	100 megohm max. at 6 VDC, 0.5 A	
Rated Coil Voltage	1.5, 3, 5, 6, 9, 12, 24 VDC	
Coil Power Dissipation	0.45 W at rated voltage	0.20 W at rated voltage
Coil Temperature Rise	45 degree C approx. at rated voltage	25 degree C at rated voltage
Insulation Resistance	100 megohm min. at 500 VDC (at 20 degree C 65% RH)	
Dielectric Withstanding Voltage	500 VAC for 1 minute	
Vibration	10 to 40 Hz (dual amplitude: 1.5 mm)	
Shock	10 G (11 ms)	6 G (11 ms)
Operate Time	5 ms approx. (at rated voltage, 20 degree C)	
Release Time	5 ms approx.	
Life Expectancy		
Mechanical	5 x 16^6 ops. min.	
Electrical	300 x 10^3 ops. min at 1 A 28 VDC, resistive 100 x 10^3 ops. min. at 0.5 A 120 VAC, resistive	
Temperature Range	-25 degree C to +55 degree C	-25 degree C to +75 degree C
Weight	4 g (approx.)	

SELECTION TABLE

Designation[*1,2]		Contacts		Schematics		Rated Voltage in VDC	Coil Resistance in ohms (± 10%) at 20 degree C		Pick-up Voltage at 20 $^\circ$C
Standard	High Sensitivity	Arrangement	Materials	Std.	High Sensitivity		Std.	High Sensitivity	
FBR211NAD001P	FBR211NCD001P	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)	A	C	1.5	5	12	Less than 70% of rated voltage
FBR211NAD003P	FBR211NCD003P					3	20	45	
FBR211NAD005P	FBR211NCD005P					5	56	120	
FBR211NAD006P	FBR211NCD006P					6	80	180	
FBR211NAD009P	FBR211NCD009P					9	180	400	
FBR211NAD012P	FBR211NCD012P					12	320	700	
FBR211NAD024P	FBR211NCD024P					24	1280	2800	
FBR211NBD001P	FBR211NED001P		Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)	B	E	1.5	5	12	Less than 70% of rated voltage
FBR211NBD003P	FBR211NED003P					3	20	45	
FBR211NBD005P	FBR211NED005P					5	56	120	
FBR211NBD006P	FBR211NED006P					6	80	180	
FBR211NBD009P	FBR211NED009P					9	180	400	
FBR211NBD012P	FBR211NED012P					12	320	700	
FBR211NBD024P	FBR211NED024P					24	1280	2800	

Notes:
[1] Each product bears its own designation on the top of the cover, but initial code "FBR" is omitted.
[2] Change P to M for gold overlay silver.

LOW PROFILE RELAYS FOR P.C. BOARDS
FBR240 Series

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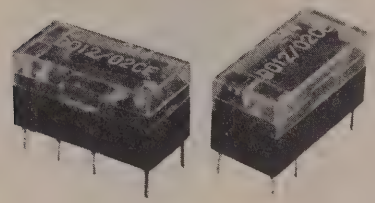
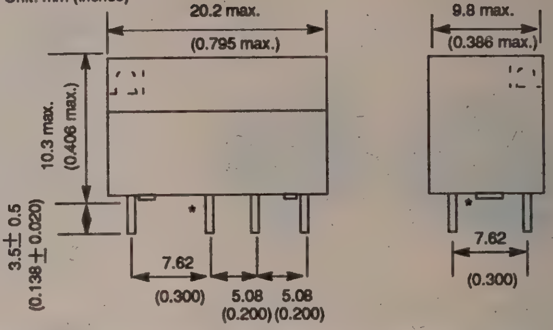


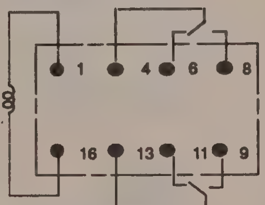
FBR244 and FBR244N series relays are low profile, P.C. board relays with 2 Form C (DPDT) contact arrangements in D.I.P.-compatible plastic housing and have a 2.54 mm pinout grid spacing to provide 16-pin-DIP socket compatibility. Sealed construction allows automatic wave soldering and board washing without relay damage. Single or bifurcated contacts switch 1 A at 28 VDC or 0.5 A at 120 VAC and have a rated-load life-time of 5 x 10^5 operations. These relays are suitable for telecommunication equipment, audio equipment and business machines. The relays are CSA certified (LR41893-35) and UL recognized (file #E63615).

DIMENSIONS Unit: mm (inches)



* The terminals marked with an asterisk are formed for temporary mounting on PC board.

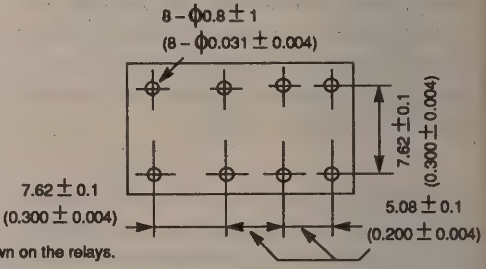
SCHEMATIC



(Bottom View)

Note: Terminal numbers are not shown on the relays.

PC BOARD MOUNTING HOLE LAYOUT



ENGINEERING DATA

Item	Specification
Contact Arrangement	2 Form C
Contact Material	Suffixes: S: Single Gold Overlay Silver P: Single Gold Overlay Silver-Palladium Alloy T: Bifurcated Gold Overlay Silver E: Bifurcated Gold Overlay Silver-Palladium Alloy
Contact Rating	1 A at 28 VDC (resistive), 2 A at 12 VDC (resistive) 0.5 A at 120 VAC (resistive)
Initial Contact Resistance	100 megohm max. at 6 VDC 0.1 A
Coil Power Dissipation	Typical 0.5 W at rated coil voltage
Coil Temperature Rise	50 degree C approx. at rated voltage 20 degree C
Insulation Resistance	100 megohm min. (at 500 VDC)
Dielectric Withstanding Voltage	500 VAC for 1 minute
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	10 G (11 ms)
Operate Time	10 ms max. at coil rated voltage
Release Time	5 ms max.
Life Expectancy	
Mechanical	10^7 ops. min.
Electrical	5 x 10^5 ops. min. at 1 A 28 VDC (resistive) – 0.3 A 120 VAC (resistive) 10^5 ops. min. at 0.5 A 120 VAC (resistive)
Ambient Temperature Range	–30 to +70 degrees C
Weight	4.5 g (approx.)

SELECTION TABLE

Rated Voltage in VDC	Coil Resistance in Ω (± 10%) at 20 degree C	Pick-up Voltage at 20 °C	Designation
3	18	Less than 75% of Rated Voltage	FBR244ND003/02C*-CSA
5	50		FBR244ND005/02C*-CSA
6	72		FBR244ND006/02C*-CSA
9	162		FBR244ND009/02C*-CSA
12	290		FBR244ND012/02C*-CSA
24	1150		FBR244ND024/02C*-CSA

Note: *Insert contact material suffix.

Example Part No: FBR244ND005/02CS

MINIATURE HIGH-POWER RELAYS
FBR600 Series

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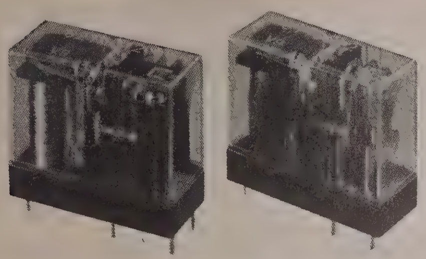
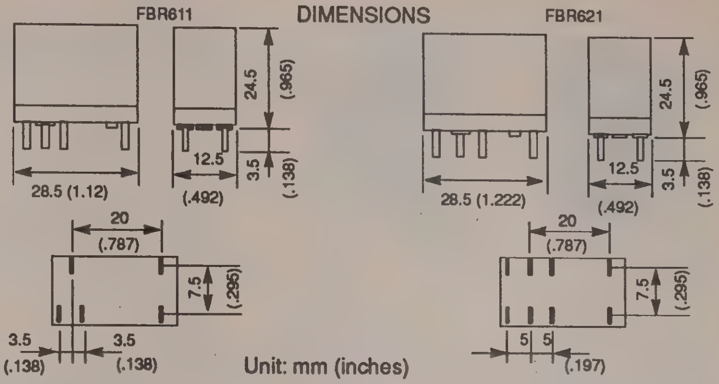


The FBR600 series are miniature high-power relays with a switching capability of 16 A, 30 VDC or 240 VAC for 1 Form C contact and 5 A, 30 VDC or 240 VAC for 2 Form C contacts. These relays are designed for mounting on printed circuit boards.

FEATURES

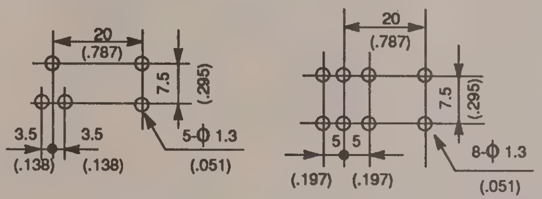
- **Applications.**
  Ideal for use in audio equipment, TV, vending machines, control machines, etc.
- **Conforms to various standards.**
  UL recognized (E63615) for industrial control equipment per UL508. CSA certified (LR41893-50, LR61319-4, and LR64026-10).
- **Immersion cleaning.**
  Sealed for immersion cleaning.

DIMENSIONS



Unit: mm (inches)

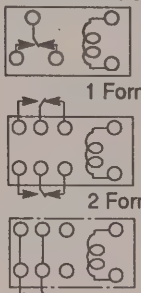
MOUNTING HOLE LAYOUT



1 Pole (Standard)

2 Pole and 1 Pole (K-type)

SCHEMATICS



1 Form C

2 Form C

1 Form A (K-type)

ENGINEERING DATA

Item	Specifications
Contact Arrangement	FBR611, FBR613-1 form C FBR621-2 form C
Contact Material	Silver alloy
Contact Rating	10 A at 30 VDC or 240 VAC for FBR611; 10 A at 30 VDC and 16 A at 240 VAC for FBR613; 5 A at 30 VDC or 240 VAC for FBR621
Carrying Current	FBR611 and FBR613, 16 A; FBR621, 5 A
Initial Contact Resistance	100 megohm max. at 6 VDC, 1 A
Rated Coil Voltage	5, 6, 9, 12, 18, 24, 48, 60 VDC
Coil Power Dissipation	FBR611/621, 0.5 W at 20 degree C
Coil Temperature Rise	FBR611/621, 35 degree C at rated voltage at 20 degree C
Insulation Resistance	1000 megohm min. at 500 VDC (initial) at 20 degree C 65% RH
Dielectric Withstanding Voltage	
Between coil and contact	5000 VAC for 1 minute at 20 degree C, 65% RH
Between open contacts	1000 VAC for 1 minute at 20 degree C, 65% RH
Between adjacent contacts	FBR621, 3000 VAC for 1 minute at 20 degree C, 65% RH
Lightening (1 x 40 microsec)	
Between coil and contact	10,000 V min.
Between adjacent contacts	FBR621, 6000 V min.
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	10 G (11 ms)
Operate Time	8 ms approx. (at rated voltage, 20 degree C)
Release Time	2.5 ms approx. at 20 degree C
Life Expectancy	
Mechanical	20 x 10^6 ops. min.
Electrical	100 x 10^3 ops. min at rated voltage
Temperature Range	-40 to +70 degree C
Weight	16 g (approx.)

SELECTION TABLE

Contact Material	Rated Voltage in VDC	Coil Resistance in Ω (± 10%) at 20 degree C	Pick-up Voltage at 20 °C	Release Voltage at 20 °C	1 pole (standard)	2 pole (standard)	1 pole (16 A)
Silver-Alloy	5	50	Less than 70% of rated Voltage	More than 10% of Rated Coltage (reference)	FBR611ND005-CSA	FBR621ND005-CSA	FBR613ND005-K-CSA
	6	72			FBR611ND006-CSA	FBR621ND006-CSA	FBR613ND006-K-CSA
	9	160			FBR611ND009-CSA	FBR621ND009-CSA	FBR613ND009-K-CSA
	12	285			FBR611ND012-CSA	FBR621ND012-CSA	FBR613ND012-K-CSA
	18	640			FBR611ND018-CSA	FBR621ND018-CSA	FBR613ND018-K-CSA
	24	1150			FBR611ND024-CSA	FBR621ND024-CSA	FBR613ND024-K-CSA
	48	4600			FBR611ND048-CSA	FBR621ND048-CSA	FBR613ND048-K-CSA

FUJITSU MICROELECTRONICS, INC. **3545 No. First St., San Jose, CA. 95134-1804** **1-800-642-7616**

GENERAL PURPOSE RELAYS
FRL260 Series

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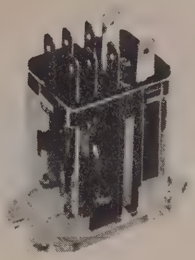


FLANGE MOUNT

The FRL260 series relays have been designed with emphasis on reliability, safety, cost performance, and applicability to a wide range of uses. These relays are top quality with proven performance.

These relays provide SPDT to 4PDT contacts, which are offered for contact ratings from 1 A to 15 A at 30 VDC or 240 VAC, resistive. Moreover, they are also available with four transfer bifurcated contacts that enable them to meet signal level or other light loads.

The FRL260 series relays are available in both DC- and AC-rated coils, and with a selection of mountings, such as solder, plug-in, P.C. boards and quick connect terminals.

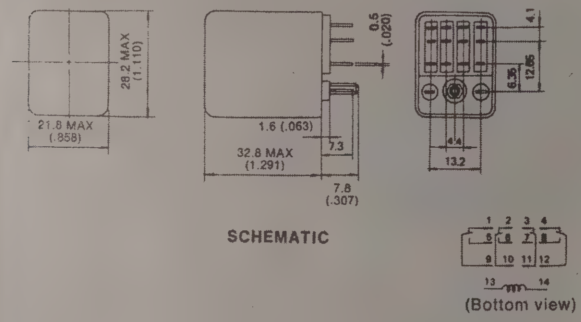
The FRL260 series are UL recognized (File No. E163614/E63615) and CSA certified (File No. LR41893).

ENGINEERING DATA

Item	Specification
Contact Ratings (resistive load) Initial Contact Resistance	As per Selection Table General (S, K V Contact): 100 megohm max. (at 6 VDC, 1 A) Low Level (T, L Contact): 50 megohm max. (at 6 VDC, 0.1 A)
Coil Power Dissipation	DC: 0.9 W (at rated coil voltage) AC: 1.2 VA (120 V max.) at rated coil voltage of 60 Hz 1.4 VA (200 V min.) at rated coil voltage of 60 Hz
Coil Temperature Rise	DC: 50 degree max. AC: 60 degree max.
Insulation Resistance Dielectric Withstanding Voltage	100 megohm min. (at 500 VDC) 1500 VAC (1000 VAC between open contacts) for 1 minute
Vibration	50 Hz (dual amplitude: 0.5 mm VDC)
Shock	10 G (11 ms)
Operate Time Release Time	25 ms max. (at rated coil voltage) 25 ms max.
Life Expectancy Mechanical Electrical	 50 x 10^6 ops. min. (at rated load) Medium Load SPDT: 500 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min. 3PDT: 500 x 10^3 ops. min. 4PDT: 200 x 10^3 ops. min. 4PST: 100 x 10^3 ops. min. Heavy Load SPDT: 200 x 10^3 ops. min. SPST: 200 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min.
Temperature Range	–30 to +55 degree C
Weight	35 g approx.

DIMENSIONS Unit: mm

04CL: DIMENSION AND CONSTRUCTION
04CS: DIMENSION AND CONSTRUCTION
04CT: DIMENSION AND CONSTRUCTION
04CV: DIMENSION AND CONSTRUCTION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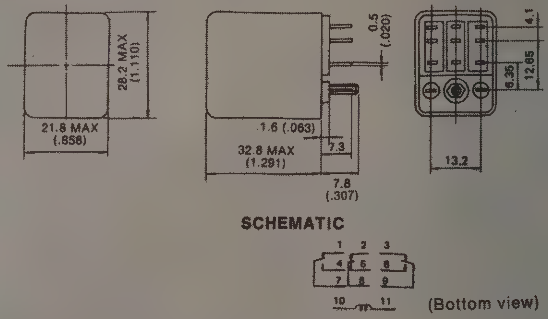
21.8 MAX (.858)
0.5 (.020)
1.6 (.063)
32.8 MAX (1.291)
7.3
7.8 (.307)
4.1
6.35
12.65
4.4
13.2
SCHEMATIC
1 2 3 4
5 6 7 8
9 10 11 12
13 14
(Bottom view)

03CS: DIMENSION AND CONSTRUCTION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21.8 MAX (.858)
0.5 (.020)
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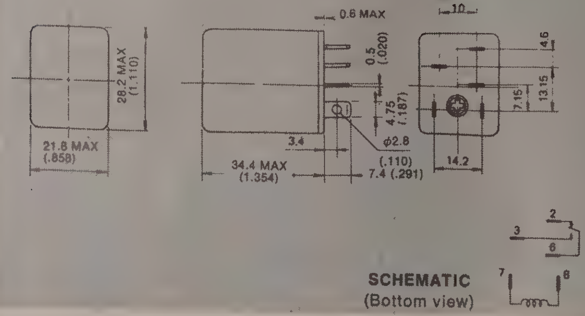
32.8 MAX (1.291)
7.3
7.8 (.307)
4.1
6.35
12.65
13.2
SCHEMATIC
1 2 3
4 5 6
7 8 9
10 11
(Bottom view)

01CK: DIMENSION AND CONSTRUCTION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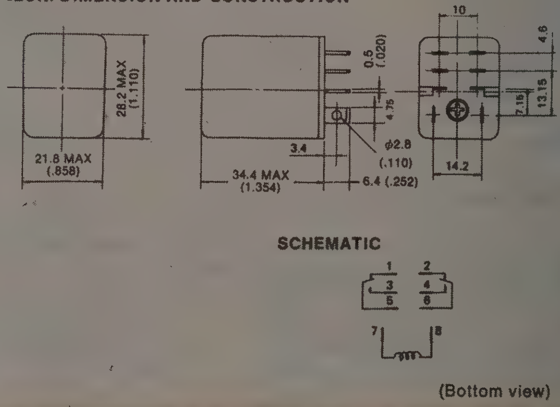
21.8 MAX (.858)
0.6 MAX
0.5 (.020)
4.75 (.187)
3.4
φ2.8 (.110)
34.4 MAX (1.354)
7.4 (.291)
10
4.6
7.15
13.15
14.2
SCHEMATIC (Bottom view)
2
3
6
7
8

02CK: DIMENSION AND CONSTRUCTION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21.8 MAX (.858)
0.5 (.020)
4.75
3.4
φ2.8 (.110)
34.4 MAX (1.354)
6.4 (.252)
10
4.6
7.15
13.15
14.2
SCHEMATIC
1 2
3 4
5 6
7 8
(Bottom view)

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GENERAL PURPOSE RELAYS
FRL260 Series

FRL260 SERIES RELAYS SELECTION TABLE – DC COIL

Contact Arrangement and Material	Contact Rating (Resistive)	Contact Rating (Horsepower)	Rated Voltage VDC 50/60 Hz	Coil Resistance ±15% Ω at 20 Degree C	Pick-Up Voltage at 20 °C	Fujitsu Part Number (Plug-In)*
SPDT AgCd0	15 A at 30 VDC or 150 VAC 10 A at 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6	40	4.5	FRL263D006/01CK-CSA
			12	160	9	FRL263D012/01CK-CSA
			24	650	18	FRL263D024/01CK-CSA
			48	2600	36	FRL263D048/01CK-CSA
			110	13300	82.5	FRL263D110/01CK-CSA
DPDT AgCd0	10 A at 30 VDC or 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6	40	4.5	FRL263D006/02CK-CSA
			12	160	9	FRL263D012/02CK-CSA
			24	650	18	FRL263D024/02CK-CSA
			48	2600	36	FRL263D048/02CK-CSA
			110	13300	82.5	FRL263D110/02CK-CSA
3PDT AgCd0	5 A at 30 VDC or 240 VAC	1/6 HP at 120 VAC	6	40	4.5	FRL263D006/03CS-CSA
			12	160	9	FRL263D012/03CS-CSA
			24	650	18	FRL263D024/03CS-CSA
			48	2600	36	FRL263D048/03CS-CSA
			110	13300	82.5	FRL263D110/03CS-CSA
4PDT Ag + Au Clad	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6	40	4.5	FRL263D006/04CL-CSA
			12	160	9	FRL263D012/04CL-CSA
			24	650	18	FRL263D024/04CL-CSA
			48	2600	36	FRL263D048/04CL-CSA
			110	13300	82.5	FRL263D110/04CL-CSA
4PDT Ag	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6	40	4.5	FRL263D006/04CS-CSA
			12	160	9	FRL263D012/04CS-CSA
			24	650	18	FRL263D024/04CS-CSA
			48	2600	36	FRL263D048/04CS-CSA
			110	13300	82.5	FRL263D110/04CS-CSA
4PDT (Bifurcated) Ag + Au Clad	1 A at 30 VAC or 120 V VAC	1/10 HP at 120 VAC	6	40	4.5	FRL263D006/04CT-CSA
			12	160	9	FRL263D012/04CT-CSA
			24	650	18	FRL263D024/04CT-CSA
			48	2600	36	FRL263D048/04CT-CSA
			110	13300	82.5	FRL263D110/04CT-CSA
4PDT AgCd0	5 A at 30 VAC or 240 VAC 5 A at 120 VAC General Purpose	1/6 HP at 120 VAC	6	40	4.5	FRL263D006/04CV-CSA
			12	160	9	FRL263D012/04CV-CSA
			24	650	18	FRL263D024/04CV-CSA
			48	2600	36	FRL263D048/04CV-CSA
			110	13300	82.5	FRL263D110/04CV-CSA

FRL260 SERIES RELAYS SELECTION TABLE – AC COIL

Contact Arrangement and Material	Contact Rating (Resistive)	Contact Rating (Horsepower)	Rated Voltage VAC 50/60 Hz	Coil Resistance ±15% Ω at 20 degree C	Pick-Up Voltage at 20 °C	Fujitsu Part Number (Plug-In)*
SPDT AgCd0	15 A at 30 VDC or 150 VAC 10 A at 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6	9.5	4.8	FRL263A006/01CK-CSA
			12	40	9.6	FRL263A012/01CK-CSA
			24	165	19.2	FRL263A024/01CK-CSA
			48	630	38.4	FRL263A048/01CK-CSA
			120	4400	96.0	FRL263A120/01CK-CSA
			240	13000	192.0	FRL263A240/01CK-CSA
DPDT AgCd0	10 A at 30 VDC or 240 VAC Flange mount available. See example part no. below.	1/3 HP at 120 VAC 1/2 HP at 240 VAC	6	9.5	4.8	FRL263A006/02CK-CSA
			12	40	9.6	FRL263A012/02CK-CSA
			24	165	19.2	FRL263A024/02CK-CSA
			48	630	38.4	FRL263A048/02CK-CSA
			120	4400	96.0	FRL263A120/02CK-CSA
			240	13000	192.0	FRL263A240/02CK-CSA
3PDT AgCd0	5 A at 30 VDC or 240 VAC	1/6 HP at 120 VAC	6	9.5	4.8	FRL263A006/03CS-CSA
			12	40	9.6	FRL263A012/03CS-CSA
			24	165	19.2	FRL263A024/03CS-CSA
			48	630	38.4	FRL263A048/03CS-CSA
			120	4400	96.0	FRL263A120/03CS-CSA
			240	13000	192.0	FRL263A240/03CS-CSA
4PDT Ag + Au Clad	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6	9.5	4.8	FRL263A006/04CL-CSA
			12	40	9.6	FRL263A012/04CL-CSA
			24	165	19.2	FRL263A024/04CL-CSA
			48	630	38.4	FRL263A048/04CL-CSA
			120	4400	96.0	FRL263A120/04CL-CSA
			240	13000	192.0	FRL263A240/04CL-CSA
4PDT Ag	3 A at 30 VAC or 120 VAC 3 A at 120 VAC General Purpose	1/10 HP at 120 VAC	6	9.5	4.8	FRL263A006/04CS-CSA
			12	40	9.6	FRL263A012/04CS-CSA
			24	165	19.2	FRL263A024/04CS-CSA
			48	630	38.4	FRL263A048/04CS-CSA
			120	4400	96.0	FRL263A120/04CS-CSA
			240	13000	192.0	FRL263A240/04CS-CSA
4PDT (Bifurcated) Ag + Au Clad	1 A at 30 VAC or 120 VAC	1/10 HP at 120 VAC	6	9.5	4.8	FRL263A006/04CT-CSA
			12	40	9.6	FRL263A012/04CT-CSA
			24	165	19.2	FRL263A024/04CT-CSA
			48	630	38.4	FRL263A048/04CT-CSA
			120	4400	96.0	FRL263A120/04CT-CSA
			240	13000	192.0	FRL263A240/04CT-CSA
4PDT AgCd0	5 A at 30 VAC or 240 VAC 5 A at 120 VAC General Purpose	1/6 HP at 120 VAC	6	9.5	4.8	FRL263D006/04CV-CSA
			12	40	9.6	FRL263A012/04CV-CSA
			24	165	19.2	FRL263A024/04CV-CSA
			48	630	38.4	FRL263A048/04CV-CSA
			120	4400	96.0	FRL263A120/04CV-CSA
			240	13000	192.0	FRL263A240/04CV-CSA

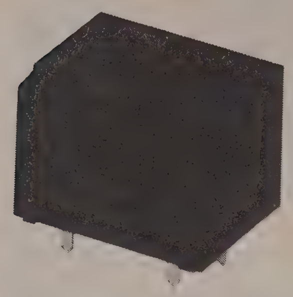
Note: *For PCB type terminals change prefix to FRL264.

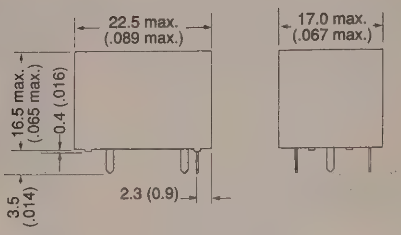
Example Part No. for flange mount: FRL263A024/02CK-0E-CSA

P.C. BOARD RELAYS FOR AUTOMOTIVE APPLICATIONS

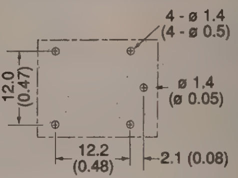
FBR175 Series

FUJITSU



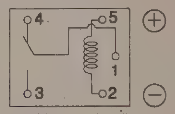

22.5 max.
(.089 max.)
17.0 max.
(.067 max.)
16.5 max.
(.065 max.)
0.4 (.016)
3.5
(.014)
2.3 (0.9)

MOUNTING HOLE LAYOUT


4 - ø 1.4
(4 - ø 0.5)
12.0
(0.47)
ø 1.4
(ø 0.05)
12.2
(0.48)
2.1 (0.08)

Note: Center-to-center terminal dimension tolerance is ± 0.1 (0.004)

SCHEMATICS (BOTTOM VIEW)



(Coil is polarized)

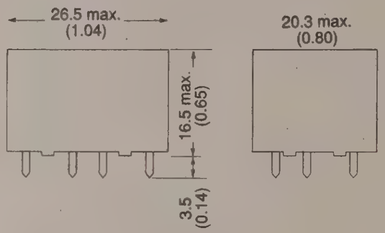
Unit: mm (inches)

- Low acoustic noise for passenger compartment applications (60 dBA MAX).
- 36 x 10^4 operations min., 25 amps inrush, 6 amps break motor load, 12 VDC.
- 50 x 10^4 operations minimum, 12 amps inrush, 2 amp break motor load, 12 VDC.
- Sealed/immersion cleanable.

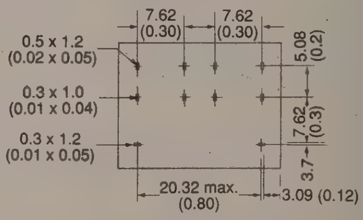
Selection Table

Part Number	Coil Resistance Ohms at 20°C	Must Operate Voltage
FBR175ND006-N	100	4
FBR175ND009-N	225	6
FBR175ND012-N	400	8
FBR175ND024-N	1,600	16

FBR562 Series

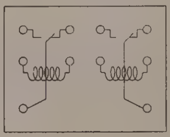

26.5 max.
(1.04)
20.3 max.
(0.80)
16.5 max.
(0.65)
3.5
(0.14)

TERMINAL DIMENSIONS AND PITCH


7.62
(0.30)
7.62
(0.30)
0.5 x 1.2
(0.02 x 0.05)
0.3 x 1.0
(0.01 x 0.04)
0.3 x 1.2
(0.01 x 0.05)
5.08
(0.2)
7.62
(0.3)
3.7
20.32 max.
(0.80)
3.09 (0.12)

Unit: mm (inches)

SCHEMATICS



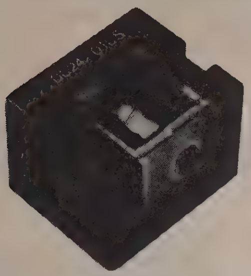
- Twin independent relays for automative motor reversing.
- 1 x 10^6 operations at 27 amps inrush, 4 amp break motor load, 16 VDC.
- 2 x 10^5 operations at 20 amps locked rotor, 14 VDC.
- Sealed/immersion cleanable.

Selection Table

Part Number	Coil Resistance Ohms at 20°C	Must Operate Voltage
FBR562ND06-N	42	3.6
FBR562ND09-N	95	5.4
FBR562ND12-N	170	7.3
FBR562ND24-N	677	14.4

P.C. BOARD RELAYS FOR AUTOMOTIVE APPLICATIONS
FRL270 Series

FUJITSU



Fujitsu FRL270 series power relays are for PC board mounting and are designed especially for automotive applications.

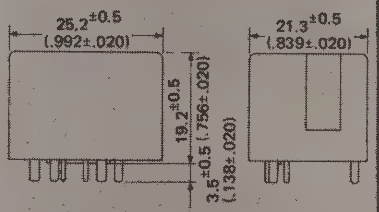
FEATURES

- **Maximum current: 30 A.** The relays are designed for high ambient and storage temperatures to ensure the contacts will endure continuous current of up to 30 A.
- **Rigid, shock-resistant construction.** (1-meter drop test.)
- **Welding resistant contact materials.** Three types of welding resistant contact materials are available as standard.
- Choice of wide terminal model (-01 suffix) for maximum heat/power transfer or standard terminal model (no suffix) for conventional hole/conductor sizes at no extra charge.
- **Immersion cleaning.** A sealed type is available for immersion cleaning.
- Alternate coil voltages 6 VDC and 9 VDC coils are available at no extra charge.

Typical Uses

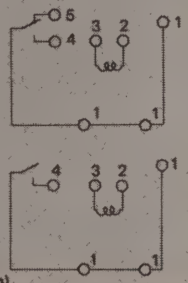
- **Engine Control.** Electronic fuel injection units.
- **Lamp control.** Flasher control units, headlight control units.
- **Motor, solenoid, and heater controls.** Windshield wiper control units for trucks, automatic door-lock control units, defogger control units, other various control units.

DIMENSIONS



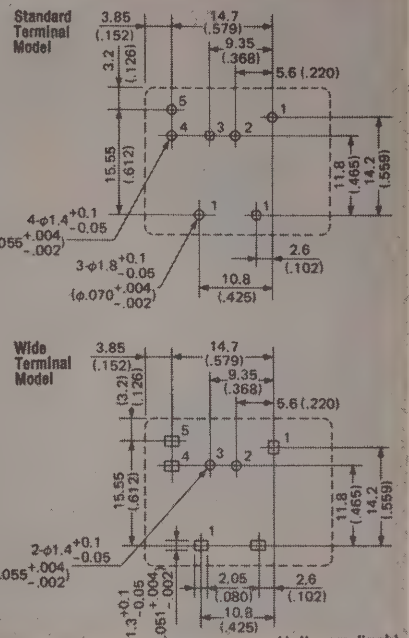
SCHEMATICS

(BOTTOM VIEWS)



Unit: mm (inch)

MOUNTING HOLE LAYOUT



Unit: mm (inch)

ENGINEERING DATA

Item	Specification
Contact Arrangement	SPDT (1 Form C) or SPST (1 Form A)
Contact Material Suffixes	-S (Silver-Copper Alloy) -K (Silver-Cadium Oxide) -Y (Silver-Tin Oxide) -D (Silver-Copper)
Contact Rating	
N.O. Contact	
Type "D" Contact:	12 VDC, 30 A
All Other Types:	12 VDC, 15 A or 24 VDC, 10 A
N.C. Contact	
All Contact Types:	12 VDC, 10 A or 24 VDC, 7A
Maximum Carry Current	30 A
Coil Power	Standard coil: 1.7 W approx. Low power coil: 0.6 W approx. (with rated voltage applied at 20 degree C)
Coil Temperature Rise	Standard coil: 75 deg. approx. Low-power coil: 35 deg approx. (with rated voltage applied at 20 degree C)
Insulation Resistance	100 megohm min. (at 500 VDC)
Withstanding Voltage	500 VAC for 1 minute
Vibration	Operation error: With 1.5 mm vibration applied at full amplitude at 10 to 55 Hz, contact chatter lasts less than 1 ms.
Shock	Operation error: 10 G (11 ms sine half-wave) Durability: 100 G (11 ms sine half-wave)
Operate Time	10 ms max. (Standard coil with 01-type contact gap)
Release Time	5 ms max. (01-type contact gap) 8 ms max. (51-type contact gap)
Life Expectancy	Mechanical: 100 x 10^4 operations or more Electrical: 250 x 10^3 operations or more (Silver-copper alloy under the rated contact load)

SELECTION TABLE

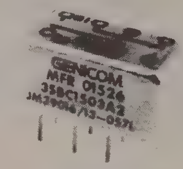
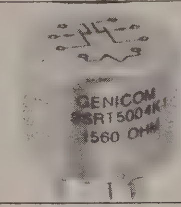
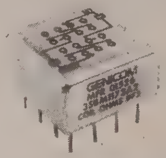
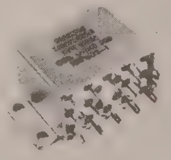
Type of Coil (Spec. Code)	Rated Voltage (Spec. Code)	Contact Gap (Spec. Code)	Coil Resistance (±10%)	Rated Power Consumption	Pick-up Voltage	Drop-out Voltage	Part No.
Standard (D)	12 VDC (012)	Standard (01)	85	1.7 W approx.	Less than 6.5 VDC	More than 1.0 VDC	FRL274ND012/01C^{1,2}-A
		1 mm (51)	85	1.7 W approx.	Less than 6.5 VDC	More than 1.0 VDC	FRL274ND012/51C^{1,2}-A
Low Power (H)		Standard (01)	240	0.6 W approx	Less than 8.4 VDC	More than 0.8 VDC	FRL274NH012/01C^{1,2}-A
Standard (D)	24 VDC (024)	Standard (01)	340	1.7 W approx.	Less than 13.0 VDC	More than 2.0 VDC	FRL274ND024/51C^{1,2}-A
		1 mm (51)	340	1.7 W approx.	Less than 13.0 VDC	More than 2.0 VDC	FRL274ND024/01C^{1,2}-A
Low Power (H)		Standard (01)	960	0.6 W approx.	Less than 16.8 VDC	More than 1.6 VDC	FRL274NH024/01C^{1,2}-A

Notes: [1] Insert contact material code [2] Insert 01 for wide terminals.

Example Part No.: FRL274ND012/01CD-01A

FUJITSU MICROELECTRONICS, INC. **3545 No. First St., San Jose, CA. 95134-1804** **1-800-642-7616**

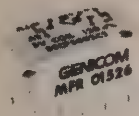
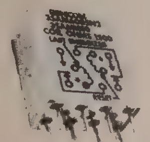
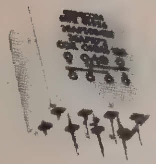
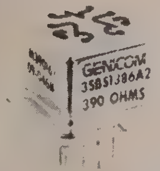
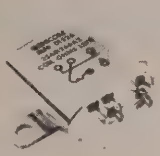
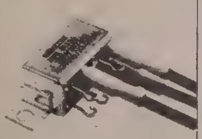
SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L"×W"×H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-39016	SHOCK	VIBRATION	TEMPERATURE RANGE	GENI 500 CATALOG PAGE
3SBC 1/5 Size Two Pole 150 Grid Hybrid		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 10^6	Size .61 × .31 × .32 Weight 0.13	135 mW	/13 /37 /38	100G @ 11 ms	30G 55- 3000 Hz	−65C +125C Special +200C	12 13
3SRT Round to 5 Relay		2PDT	1A-DC .2A-DC IND Low Level	10^5 10^6	Size .370 Dia. x.280 Weight .09 oz.	120 mW	/9 /15	100G @ 11 ms	30G 55- 3000 Hz	-65C +125C	
3SBH 1/5 Size Four Pole 150 Grid Hybrid		4PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 10^6	Size .61 × .61 × .32 Weight 0.24	250 mW	/14 /53 /54	100G @ 11 ms	30G 55- 3000 Hz	−65C +125C Special +200C	16 17
3SBM 1/2 Size 150 Grid Latching Hybrid		4PDT	2A DC Res .5A DC Ind .5A-DC Low Level	10^5 10^6	Size .61 × .61 × .32 Weight 0.28	100mW Single Coil or 180mW Dual Coil	/31 /35 /36	150G @ 11 ms	30G 55- 3000 Hz	−65C +125C Special +200C	20 21
3SAV Half-Size Sensitive R.F.		2PDT	2A DC Res .5A DC Ind .75 A-AC Low Level	10^5 10^6	Size .80 × .40 × .40 Weight 0.30	100mW to 260mW	/6 /22 /33 /44 /55	100G @ 11ms	20G 10- 2000 Hz **	−65C +125C Special +200C	23 24
3SAH Four Pole Grid		4PDT	2A DC Res .5A DC Ind 1A-AC Low Level	1×10^5 at 2A dc at 1A AC 1×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW	/39	50G @ 11ms	30G 55- 3000 Hz	−65C +125C Special +200C	27
3SCM DeciGrid® Mag- Latch 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	105 mW	/47	100G @ 6ms	30G 55- 3000 Hz	−65C +125C	6

**30G 55-3000 Hz Available

*Single-phase load, case not grounded

* ®GENICOM Corporation, Relays, 1 Genicom Drive
Waynesboro, VA 22980, 1-703-949-1471

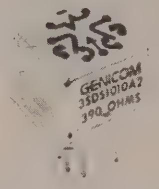
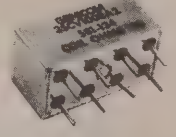
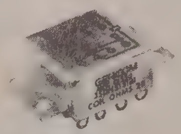
RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE OPERATIONS	SIZE NO MOUNT L × W × H & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-39016	SHOCK	VIBRATION	TEMPERATURE RANGE	GENI 500 CATALOG PAGE
3SCP DeciGrid* Mono-stable 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	68 mW	/48	100G @ 6ms	30G 55- 3000 Hz	−65C +125C	7
3SAM Mag-Latch Grid-Space		2PDT	2A DC Res .5A DC Ind 1A-AC Low Level	10^5 at 2A DC at 1A AC 10^6	Size .80 × .40 × .90 Weight 0.60	50mW Single Coil 75mW Dual Coil	/32	150G @ 11ms	30G 55- 3000 Hz	−65C +125C Special +200C	34
3SAF Grid Spaced Micro Crystal Can		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC 10^6	Size .80 × .40 × .90 Weight 0.50	300 mW		100G @ 11 ms	30G 55- 2000 Hz	−65C +125C	30
3SBS Transistor Size Relay		2PDT	1A DC Res .2A DC Ind Low Level	10^5 10^6	Size 37 × .37 × .275 Weight 0.09	120 mW	/9 /15 /20	100G @ 11ms	30G 55- 3000 Hz	−65C +125C Special +200C	9
3SAC Crystal Can "S" Header		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 2A DC at 1A AC 10^6	Size .797 × .359 × 1.187 Weight 0.90	200 mW		50G @ 11ms	10G 55- 2000 Hz	−65C +125C	38
3SAE Crystal Can "S" Header		2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × .875 Weight 0.45	330mW		100G @ 11ms	20G 55- 2000 Hz	−65C +125C	38
3SAV-RF with Co-ax Cables		2PDT 1PDT	25 Watts 10 Watts Low Level	10^5 10^6	Size .86 × .40 × .46 Weight .35 oz. max	260 mW 100 mW	/33	100G @ 11ms	20G 10– 2000Hz **	−65C +125C	44

*Single-phase load, case not grounded

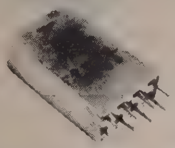
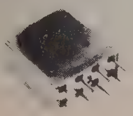
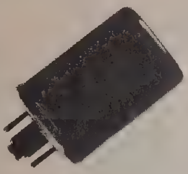
**30G 55-3000 Hz Available

Continued on next page.

SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE OPERATIONS	SIZE NO MOUNT L"×W"×H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)		SHOCK	VIBRATION	TEMPERATURE RANGE	GENI 500 CATALOG PAGE
3SDS Long Life		2PDT	1A DC .5A AC Low Level	10^5 50×10^6	Size .37 × .37 × .275 Weight 0.13	150mW		100G @ 11ms	30G 55-3000Hz	−40C +125C	10
3SCC Long Life		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 100×10^6	Size .61 × .31 × .32 Weight 0.13	170mW		100G @ 11ms	30G 55-3000Hz	−40C +125C	14
3SCV Long Life Half-Size		2PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 100×10^6	Size .80 × .40 × .40 Weight .30	340mW				−40C + 125C	26
3SCH Long Life		4PDT	2A Res .5A DC Ind 1A-AC Low Level	2 × 10 at 2A dc at 1A AC 75×10^6	Size 1.01 × .61 × .81 Weight 1.0	500mW		50G @ 11ms	30G 55-3000Hz	−40C +125C	28
3SDH Long Life		4PDT	2A DC .5A AC Low Level	10^5 100×10^6	Size .61 × .61 × .32 Weight 0.24	310mW		100G @ 11ms	55-3000Hz	−40C +125C	18

***Single-phase load, case not grounded**

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE		SIZE NO MOUNT L' × W' × H' & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)		SHOCK	VIBRATION	TEMPERATURE RANGE	GENI 500 CATALOG PAGE
			CURRENT LEVELS AT 28 VDC AT 115 VAC*	OPERATIONS							
3SAT Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	10^5 10^6	Size .80 × .400 × 1.125 Weight .95	40 mW & 25 mW		90G @ 11ms	20G 55-3000Hz	−65C +125C Special 200C	36
3SBF Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	10^5 10^6	Size .80 × .40 × .90 Weight .50	75 mW & 50 mW		90G @ 11ms	25G 55-2500Hz	−65C +125C Special 200C	31
3SAA Power Relay Mil Quality		1Pole to 6 Poles	Low Level to 10 Amps	Depends on Rating	Size 1.67 × 1.48 × 2.1 Weight 4.5	350 mW 600mW				−65C +125C	40
3SCA Miniature Industrial Relays		4PDT 6NO	5A DC Res 2A DC Ind 5A-AC Low Level	Depends on Contact Rating	1.67 × 1.48 × 2.1 Weight 4.5	600mW				0C +71C	42
3SDM Mag-Latch Grid-Spaced Pulsed Operation		2PDT	2A-DC 1A-AC Low Level	10^5 10^6	Size .800x .400x .545 Weight .4 oz.	285 mW		50G @ 11 ms	30G 55-2500 Hz		

Note: Long Life relays are rated at 50 μA, 50 mV open circuit DC or Peak AC for the number of operations indicated in selection guide with the contact resistance during life test not to exceed 50 ohms. Testing plan is available on request.

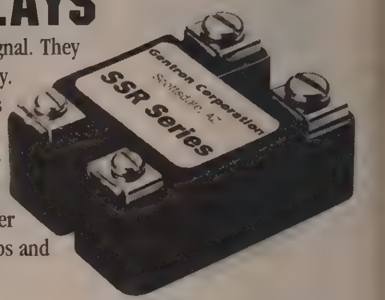
*Single-phase load, case not grounded

For additional publications and product information contact:
GENICOM Corporation, Relays, 1 Genicom Drive
Waynesboro, VA 22980, 1-703-949-1471

GENICOM®
Relays You Can Rely On.

GENTRON CORPORATION

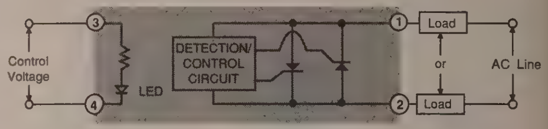
GENTRON CORPORATION SOLID STATE RELAYS



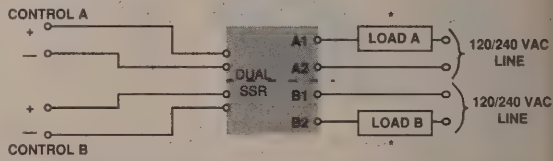
Gentron's Solid State Relay's are designed for controling large amounts of power with a low level input signal. They incorporate a dual SCR design to provide full wave control and high current capability with high dV/dt capability. Zero Crossing Drive Circuitry switches on at zero voltage, and off at zero current, thereby minimizing the effects of inductive loads. Non-Zero Crossing Drive Circuitry allows for phase control capability as well as on-off control. The opto-coupler provides the interface to the input signal and electrical input / output isolation. Superior performance, quality and reliability are insured by Gentron and the patented use of Gentron's Fused Copper™ Process. The nature of these devices, along with years of leadership and expertise in the production of power semiconductor modules allows Gentron to offer Solid State Relays to handle loads from 25 amps to 250 amps and voltage as high as 1200 volts in standard industry packages.

Model Number	Line Voltage Range	Amperage	Input Control Voltage	Maximum Transient Overvoltage	Nominal Line Voltage
AC INPUT / AC OUTPUT / ZERO-CROSS / 600 V PIV / SSRS					
SSR 600-240 A25	24-330 VAC	25A	90-280 VAC	600 V	120/240 VAC
SSR 600-240 A40	24-330 VAC	40A	90-280 VAC	600 V	120/240 VAC
SSR 600-240 A55	24-330 VAC	55A	90-280 VAC	600 V	120/240 VAC
SSR 600-240 A75	24-330 VAC	75A	90-280 VAC	600 V	120/240 VAC
SSR 600-240 A90	24-330 VAC	90A	90-280 VAC	600 V	120/240 VAC
SSR 600-240 A125	24-330 VAC	125A	90-280 VAC	600 V	120/240 VAC
DC INPUT / AC OUTPUT / ZERO-CROSS / 600 V PIV / SSRS					
SSR 600-240 D25	24-330 VAC	25A	3-32 VDC	600 V	120/240 VAC
SSR 600-240 D40	24-330 VAC	40A	3-32 VDC	600 V	120/240 VAC
SSR 600-240 D55	24-330 VAC	55A	3-32 VDC	600 V	120/240 VAC
SSR 600-240 D75	24-330 VAC	75A	3-32 VDC	600 V	120/240 VAC
SSR 600-240 D90	24-330 VAC	90A	3-32 VDC	600 V	120/240 VAC
SSR 600-240 D125	24-330 VAC	125A	3-32 VDC	600 V	120/240 VAC
DC INPUT / AC OUTPUT / RANDOM-CROSS / 600 V PIV / SSRS					
SSR 600-240 R25	24-330 VAC	25A	3.5-26 VDC	600 V	120/240 VAC
SSR 600-240 R40	24-330 VAC	40A	3.5-26 VDC	600 V	120/240 VAC
SSR 600-240 R55	24-330 VAC	55A	3.5-26 VDC	600 V	120/240 VAC
SSR 600-240 R75	24-330 VAC	75A	3.5-26 VDC	600 V	120/240 VAC
SSR 600-240 R90	24-330 VAC	90A	3.5-26 VDC	600 V	120/240 VAC
SSR 600-240 R125	24-330 VAC	125A	3.5-26 VDC	600 V	120/240 VAC
AC INPUT / AC OUTPUT / ZERO-CROSS / 1200 V PIV / SSRS					
SSR 1200-480 A25	48-660 VAC	25A	90-280 VAC	1200 V	480 VAC
SSR 1200-480 A40	48-660 VAC	40A	90-280 VAC	1200 V	480 VAC
SSR 1200-480 A55	48-660 VAC	55A	90-280 VAC	1200 V	480 VAC
SSR 1200-480 A75	48-660 VAC	75A	90-280 VAC	1200 V	480 VAC
SSR 1200-480 A90	48-660 VAC	90A	90-280 VAC	1200 V	480 VAC
SSR 1200-480 A125	48-660 VAC	125A	90-280 VAC	1200 V	480 VAC
DC INPUT / AC OUTPUT / ZERO-CROSS / 1200 V PIV / SSRS					
SSR 1200-480 D25	48-660 VAC	25A	3-32 VDC	1200 V	480 VAC
SSR 1200-480 D40	48-660 VAC	40A	3-32 VDC	1200 V	480 VAC
SSR 1200-480 D55	48-660 VAC	55A	3-32 VDC	1200 V	480 VAC
SSR 1200-480 D75	48-660 VAC	75A	3-32 VDC	1200 V	480 VAC
SSR 1200-480 D90	48-660 VAC	90A	3-32 VDC	1200 V	480 VAC
SSR 1200-480 D125	48-660 VAC	125A	3-32 VDC	1200 V	480 VAC
DC INPUT / AC OUTPUT / RANDOM-CROSS / 1200 V PIV / SSRS					
SSR 1200-480 R25	48-660 VAC	25A	3.5-26 VDC	1200 V	480 VAC
SSR 1200-480 R40	48-660 VAC	40A	3.5-26 VDC	1200 V	480 VAC
SSR 1200-480 R55	48-660 VAC	55A	3.5-26 VDC	1200 V	480 VAC
SSR 1200-480 R75	48-660 VAC	75A	3.5-26 VDC	1200 V	480 VAC
SSR 1200-480 R90	48-660 VAC	90A	3.5-26 VDC	1200 V	480 VAC
SSR 1200-480 R125	48-660 VAC	125A	3.5-26 VDC	1200 V	480 VAC
DC INPUT / DUAL AC OUTPUT / ZERO-CROSS / 600 V PIV / SSRS					
SSRD 600-240 D25	24-330 VAC	25A	3-32 VDC	600 V	120/240 VAC
SSRD 600-240 D40	24-330 VAC	40A	3-32 VDC	600 V	120/240 VAC
DC INPUT / DUAL AC OUTPUT / RANDOM-CROSS / 600 V PIV / SSRS					
SSRD 600-240 R25	24-330 VAC	25A	3.5-26 VDC	600 V	120/240 VAC
SSRD 600-240 R40	24-330 VAC	40A	3.5-26 VDC	600 V	120/240 VAC
AC INPUT / AC OUTPUT / ZERO—CROSS / 600 V PIV / EFR					
EFR 600-240 A150	24-330 VAC	150A	90-280 VAC	600V	240 VAC
EFR 600-240 A250	24-330 VAC	250A	90-280 VAC	600V	240 VAC
DC INPUT / AC OUTPUT / ZERO—CROSS / 600 V PIV / EFR					
EFR 600-240 D150	24-330 VAC	150A	3-32 VDC	600V	240 VAC
EFR 600-240 D250	24-330 VAC	250A	3-32 VDC	600V	240 VAC
DC INPUT / AC OUTPUT / RANDOM—CROSS / 600 V PIV / EFR					
EFR 600-240 R150	24-330 VAC	150A	3.5-26 VDC	600V	240 VAC
EFR 600-240 R250	24-330 VAC	250A	3.5-26 VDC	600V	240 VAC
AC INPUT / AC OUTPUT / ZERO-CROSS / 1200 V PIV / EFR					
EFR 1200-480 A150	48-660 VAC	150A	90-280 VAC	1200V	480 VAC
EFR 1200-480 A250	48-660 VAC	250A	90-280 VAC	1200V	480 VAC
DC INPUT / AC OUTPUT / ZERO-CROSS / 1200 V PIV / EFR					
EFR 1200-480 D150	48-660 VAC	150A	3-32 VDC	1200V	480 VAC
EFR 2100-480 D250	48-660 VAC	250A	3-32 VDC	1200V	480 VAC
DC INPUT / AC OUTPUT / RANDOM-CROSS / 1200 V PIV / EFR					
EFR 1200-480 R150	48-660 VAC	150A	3.5-26 VDC	1200V	480 VAC
EFR 1200-480 R250	48-660 VAC	250A	3.5-26 VDC	1200V	480 VAC

SSR Electrical Schematic

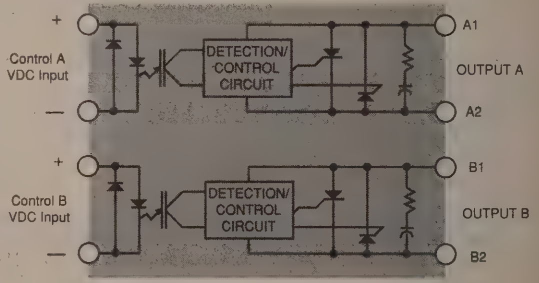


Hook Up Diagram for Dual



* Load can be placed in series with either terminal A1 or A2, B1 or B2.

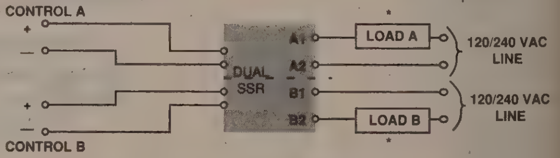
Dual SSR and EFR Relay



Hook Up Diagram for Dual SSR in EF Package

Control Hookup can be Parallel or Serial for 250A Operation

Output must be in Parallel for 250A Operation



* Load can be placed in series with either terminal A1 or A2, B1 or B2.

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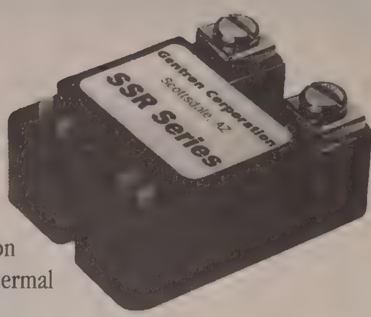
GENTRON CORPORATION SOLID STATE IGBT AND MOSFET RELAYS



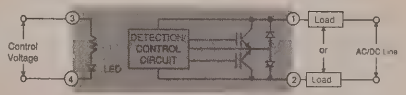
Many of the recent developments in semiconductor technology such as MOSFETS, IGBTs, and other types of newer devices, offer some interesting choices and performance advantages. Some of the vast advantages are: Selective On and Off control, Reduced RFI, Alterable Switching Slopes, Reduced Off State Leakage, Higher Immunity to False Triggering, Latch Free Operation, Absolute Zero Cross Firing (with options to switch on voltage or current for either on or off switching) and PWM availability. Available intelligence options are: Current Sense™, Thermal Shutdown, Load Fault and Current Limit.

From an overall perspective, these MOSFET and IGBT Relays offer significant advantages over the older technology SCR and TRIAC output Solid State Relays for many applications. Gentron other product lines: Power Supply Power Elements, Solid State Contactors, Motor Control Power Elements and Advanced Semiconductor Hermetic Products. Please call for more information.

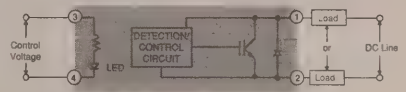
Model Number	Normal Line Voltage	Max. Input Current	Max. Electrical Isolation	Max. Line Voltage	Max. Single-Cycle Surge Current	Max. Load Current	.Max. Operating Frequency Hz
AC/DC OUTPUT / DC INPUT / RANDOM CONTROL							
IGTA 600-240 R25	240 VAC	17mA @ 5VDC	4000	330 VAC	80A	25A	75
IGTA 600-240 R50	240 VAC	17mA @ 5VDC	4000	330 VAC	100A	50A	75
IGTA 600-240 R75	240 VAC	17mA @ 5VDC	4000	330 VAC	150A	75A	75
IGTA 600-240 R100	240 VAC	17mA @ 5VDC	4000	330 VAC	200A	100A	75
IGTA 1200-480 R25	480 VAC	17mA @ 5VDC	4000	660 VAC	80A	25A	75
IGTA 1200-480 R50	480 VAC	17mA @ 5VDC	4000	660 VAC	100A	50A	75
IGTA 1200-480 R75	480 VAC	17mA @ 5VDC	4000	660 VAC	150A	75A	75
IGTA 1200-480 R100	480 VAC	17mA @ 5VDC	4000	660 VAC	200A	100	75
AC OUTPUT / AC INPUT							
IGTA 600-240 A 25	240 VAC	120mA @ 240 VAC	4000	330 VAC	80A	25A	75
IGTA 600-240 A 50	240 VAC	120mA @ 240 VAC	4000	330 VAC	100A	50A	75
IGTA 600-240 A 75	240 VAC	120mA @ 240 VAC	4000	330 VAC	150A	75A	75
IGTA 600-240 A 100	240 VAC	120mA @ 240 VAC	4000	330 VAC	200A	100A	75
IGTA 1200-480 A 25	480 VAC	120 mA @ 240 VAC	4000	660 VAC	80A	25A	75
IGTA 1200-480 A50	480 VAC	120mA @ 240 VAC	4000	660 VAC	100A	50A	75
IGTA 1200-480 A 75	480 VAC	120mA @ 240 VAC	4000	660 VAC	150A	75A	75
IGTA 1200-480 A 100	480 VAC	120mA @ 240 VAC	4000	660 VAC	200A	100A	75
DC OUTPUT / DC INPUT							
IGTD 600-240 R25	500 VDC	17mA @ 5VDC	4000	550 VDC	80A	25A	75
IGTD 600-240 R50	500 VDC	17mA @ 5VDC	4000	550 VDC	100A	50A	75
IGTD 600-240 R75	500 VDC	17mA @ 5VDC	4000	550 VDC	150A	75A	75
IGTD 600-240 R100	500 VDC	17mA @ 5VDC	4000	550 VDC	200A	100A	75
IGTD 1200-480 R25	1000 VDC	17mA @ 5VDC	4000	1100 VDC	80A	25A	75
IGTD 1200-480 R50	1000 VDC	17mA @ 5VDC	4000	1100 VDC	100A	50A	75
IGTD 1200-480 R75	1000 VDC	17mA @ 5VDC	4000	1100 VDC	150A	75A	75
IGTD 1200-480 R100	1000 VDC	17mA @ 5VDC	4000	1100 VDC	200A	100A	75
DC OUTPUT / AC INPUT							
IGTD 600-240 A25	500 VAC	120mA @ 240 VAC	4000	550 VDC	80A	25A	75
IGTD 600-240 A50	500 VAC	120mA @ 240 VAC	4000	550 VDC	100A	50A	75
IGTD 600-240 A75	500 VAC	120mA @ 240 VAC	4000	550 VDC	150A	75A	75
IGTD 600-240 A100	500 VAC	120mA @ 240 VAC	4000	550 VDC	200A	100A	75
IGTD 1200-480 A25	1000 VAC	120mA @ 240 VAC	4000	1100 VDC	80A	25A	75
IGTD 1200-480 A50	1000 VAC	120mA @ 240 VAC	4000	1100 VDC	100A	50A	75
IGTD 1200-480 A75	1000 VAC	120mA @ 240 VAC	4000	1100 VDC	150A	75A	75
IGTD 1200-480 A100	1000 VAC	120mA @ 240 VAC	4000	1100 VDC	200A	100A	75
DC OUTPUT / DC INPUT							
MOSD 50 50 R100	50 VDC	17mA @ 5VDC	4000	50 VDC	400A	100A	75
MOSD 100 100 R100	100 VDC	17mA @ 5VDC	4000	100 VDC	400A	100A	75
MOSD 200 200 R100	200 VDC	17mA @ 5VDC	4000	200 VDC	400A	100A	75
AC/DC OUTPUT / DC INPUT / RANDOM CONTROL							
IGFA 600-240 R25	240 VAC	10mA @ 5VDC	4000	330 VAC	80A	25A	20,000*
IGFA 600-240 R50	240 VAC	10mA @ 5VDC	4000	330 VAC	100A	50A	20,000*
IGFA 600-240 R75	240 VAC	10mA @ 5VDC	4000	330 VAC	150A	75A	20,000*
IGFA 600-240 R100	240 VAC	10mA @ 5VDC	4000	330 VAC	200A	100A	20,000*
IGFA 1200-480 R25	480 VAC	10mA @ 5VDC	4000	660 VAC	80A	25A	20,000*
IGFA 1200-480 R50	480 VAC	10mA @ 5VDC	4000	660 VAC	100A	50A	20,000*
IGFA 1200-480 R75	480 VAC	10mA @ 5VDC	4000	660 VAC	150A	75A	20,000*
IGFA 1200-480 R100	480 VAC	10mA @ 5VDC	4000	660 VAC	200A	100A	20,000*
DC OUTPUT / DC INPUT							
IGFD 600-240 R25	500 VDC	10mA @ 5VDC	4000	480 VDC	80A	25A	20,000*
IGFD 600-240 R50	500 VDC	10mA @ 5VDC	4000	480 VDC	100A	50A	20,000*
IGFD 600-240 R75	500 VDC	10mA @ 5VDC	4000	480 VDC	150A	75A	20,000*
IGFD 600-240 R100	500 VDC	10mA @ 5VDC	4000	480 VDC	200A	100A	20,000*
IGFD 1200-480 R25	1000 VDC	10mA @ 5VDC	4000	960 VDC	80A	25A	20,000*
IGFD 1200-480 R50	1000 VDC	10mA @ 5VDC	4000	960 VDC	100A	50A	20,000*
IGFD 1200-480 R75	1000 VDC	10mA @ 5VDC	4000	960 VDC	150A	75A	20,000*
IGFD 1200-480 R100	1000 VDC	10mA @ 5VDC	4000	960 VDC	200A	100A	20,000*
DC OUTPUT / DC INPUT							
MOSFD 50 50 R100*	50 VDC	10mA @ 5VDC	4000	50 VDC	400A	100A	100k
MOSFD 100 100 R100	100 VDC	10mA @ 5VDC	4000	100 VDC	400A	100A	100k
MOSFD 200 200 R100	200 VDC	10mA @ 5VDC	4000	200 VDC	400A	100A	100k

ELECTRICAL SCHEMATICS

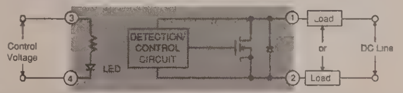
IGTA Series — AC/DC SSRs



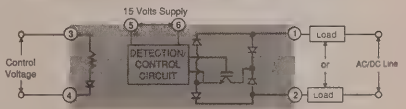
IGTD Series — DC SSRs



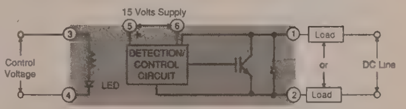
MOSD Series — DC SSRs



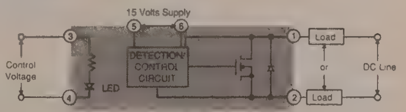
IGFA Series — AC/ DC SSRs



IGFD Series — DC SSRs



MOSFD Series — DC SSRs



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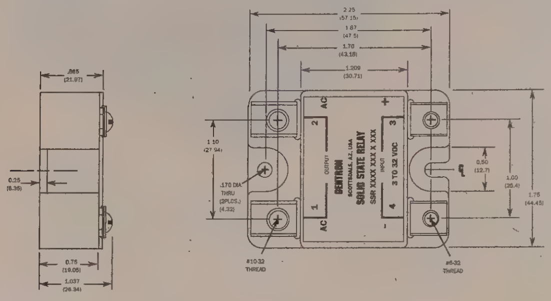
DIMENSIONAL DRAWINGS

SOLID STATE RELAYS SCR OUTPUT

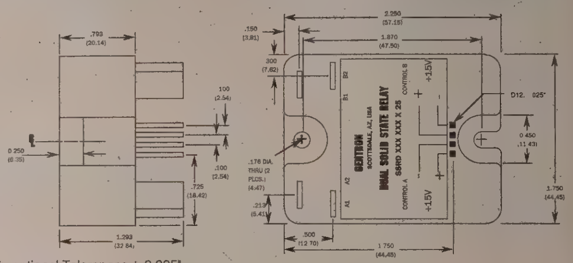
SSR 25 AMPS, SSR 40 AMPS, SSR 55 AMPS SSR 75 AMPS,
SSR 90 AMPS, SSR 125 AMPS - 600-1200V, SSR 55 AMPS - 1400V


.865
(21.97)
0.25
(6.35)
0.75
(19.05)
1.037
(26.34)
2.25
(57.15)
1.87
(47.5)
1.70
(43.18)
1.209
(30.71)
1.10
(27.94)
.170 DIA
THRU
(2PLCS.)
(4.32)
AC
2
1
AC
OUTPUT
GENTRON
SCOTTSDALE, AZ, USA
SOLID STATE RELAY
SSR XXXX XXX X XXX
INPUT
3 TO 32 VDC
+
3
4
-
0.50
(12.7)
1.00
(25.4)
1.75
(44.45)
#10-32
THREAD
#6-32
THREAD

Dimentional Tolerances ± 0.005"
Weight 100 grams
Case Thermal Measure Location Center of Ceramic

SOLID STATE DUAL RELAYS SCR OUTPUT

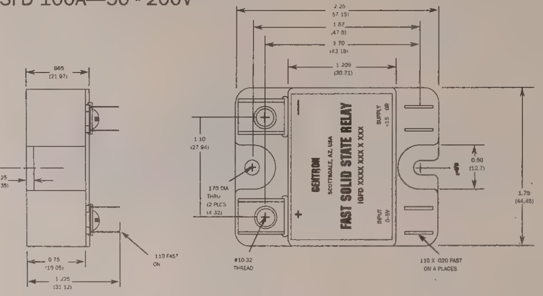
SSRD 25A, SSRD 40A


.793
(20.14)
0.250
(6.35)
100
(2.54)
.100
(2.54)
.725
(18.42)
1.293
(32.84)
.150
(3.81)
300
(7.62)
2.250
(57.15)
1.870
(47.50)
.176 DIA.
THRU (2
PLCS.)
(4.47)
.213
(5.41)
.500
(12.70)
1.750
(44.45)
B2
B1
A2
A1
GENTRON
SCOTTSDALE, AZ, USA
DUAL SOLID STATE RELAY
SSRD XXX XXX X 25
CONTROL B
CONTROL A
+15V
+15V
D12. .025"
0.450
(11.43)
1.750
(44.45)

Dimentional Tolerances ± 0.005"
Weight 100 grams
Case Thermal Measure Location Center of Ceramic

SOLID STATE FAST SWITCHING IGFA-IGFD-MOSFD RELAYS

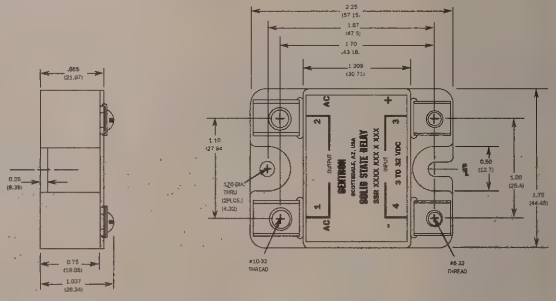
IGFA 25 - 100A—500 - 1000V,
MOSFD 100A—50 - 200V


.865
(21.97)
0.25
(6.35)
0.75
(19.05)
1.225
(31.12)
110 FAST
ON
2.25
(57.15)
1.87
(47.5)
1.70
(43.18)
1.209
(30.71)
1.10
(27.94)
.170 DIA
THRU
(2 PLCS
(4.32)
#10-32
THREAD
GENTRON
SCOTTSDALE, AZ, USA
FAST SOLID STATE RELAY
IGFD XXXX XXX X XXX
SUPPLY
+15 GR
INPUT
0-5V
-
+
0.50
(12.7)
1.75
(44.45)
110 X .020 FAST
ON 4 PLACES

Dimentional Tolerances ± 0.005"
Weight 100 grams
Case Thermal Measure Location Center of Ceramic

SOLID STATE IGBT AND MOSFET RELAYS

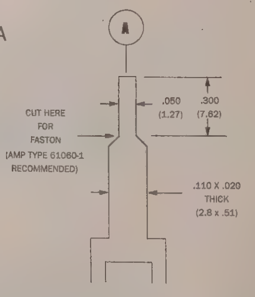
IGBT - AC Out - DC In, AC Out - AC In, DC Out - DC In, DC Out - AC In
MOSFET - DC Out - DC In

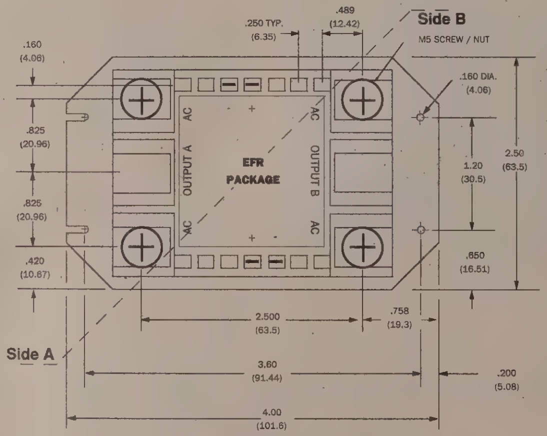

.865
(21.97)
0.25
(6.35)
0.75
(19.05)
1.037
(26.34)
2.25
(57.15)
1.87
(47.5)
1.70
(43.18)
1.209
(30.71)
1.10
(27.94)
.170 DIA.
THRU
(2PLCS.)
(4.32)
AC
2
1
AC
OUTPUT
GENTRON
SCOTTSDALE, AZ, USA
SOLID STATE RELAY
SSR XXXX XXX X XXX
INPUT
3 TO 32 VDC
+
3
4
-
0.50
(12.7)
1.00
(25.4)
1.75
(44.45)
#10-32
THREAD
#6-32
THREAD

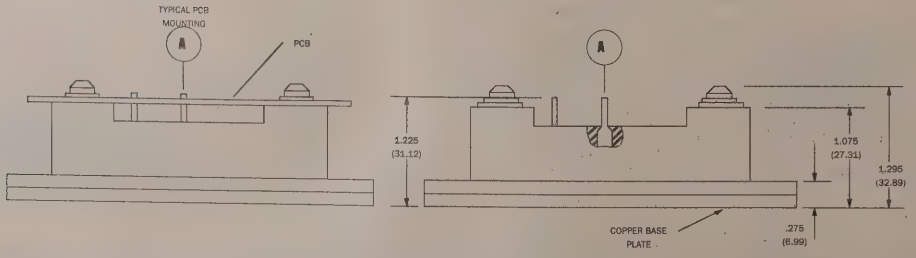
Dimentional Tolerances ± 0.005"
Weight 100 grams
Case Thermal Measure Location Center of Ceramic

SOLID STATE DUAL RELAYS SCR OUTPUT EFR PACKAGE

EFR 150A, EFR 250A


A
.050
(1.27)
.300
(7.62)
CUT HERE
FOR
FASTON
(AMP TYPE 61060-1
RECOMMENDED)
.110 X .020
THICK
(2.8 x .51)


.250 TYP.
(6.35)
.489
(12.42)
Side B
M5 SCREW / NUT
.160
(4.06)
.160 DIA.
(4.06)
.825
(20.96)
.825
(20.96)
.420
(10.67)
AC
OUTPUT A
AC
AC
OUTPUT B
AC
EFR
PACKAGE
1.20
(30.5)
2.50
(63.5)
.650
(16.51)
2.500
(63.5)
.758
(19.3)
Side A
3.60
(91.44)
.200
(5.08)
4.00
(101.6)


TYPICAL PCB
MOUNTING
A
PCB
A
1.225
(31.12)
1.075
(27.31)
1.295
(32.89)
COPPER BASE
PLATE
.275
(6.99)

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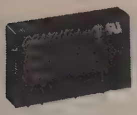
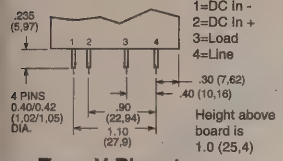
70S2 SERIES PC MOUNT SOLID-STATE RELAYS

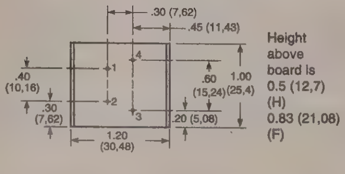

Type V

Type H

Type F



Type V Pinout

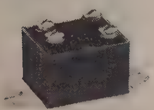


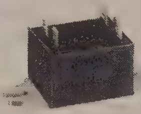
Types F, H Pinout

PC Mount Types V, F, and H are UL Recognized, CSA certified relays which are optically isolated, logic compatible, and have zero voltage turn-on. Also feature built-in EMI-RFI immunity as well as voltage spike protection of 3000V per microsecond. Relays withstand surge of 60A for one cycle or 18A for 60 cycles.

Type	AC Load	DC Control
70S2-04-D-03-V	3A, 24V	3-32V
70S2-04-B-03-V	3A, 120V	3-32V
70S2-05-B-03-V	3A, 120V	6-32V
70S2-04-C-03-V	3A, 240V	3-32V
70S2-05-C-03-V	3A, 240V	6-32V
70S2-04-D-04-F	4A, 24V	3-30V
70S2-04-B-04-F	4A, 120V	3-30V
70S2-05-B-04-F	4A, 120V	6-30V
70S2-04-C-04-F	4A, 240V	3-30V
70S2-05-C-04-F	4A, 240V	6-30V
70S2-04-D-02-H	2.5A, 24V	3-30V
70S2-04-B-02-H	2.5A, 120V	3-30V
70S2-05-B-02-H	2.5A, 120V	6-30V
70S2-04-C-02-H	2.5A, 240V	3-30V
70S2-05-C-02-H	2.5A, 240V	6-30V

70S2 SERIES PANEL MOUNT SOLID-STATE RELAYS

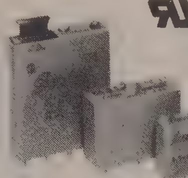

Type S

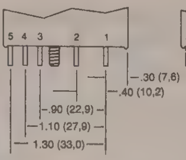

Type N

Types S and N are UL recognized, CSA certified Mini Puck relays. They mount on the same 0.187" (4.75) centers as the bulkier hockey puck packages and switch up to 25A loads. Optically isolated with zero voltage turn-on circuit. Compatible with CMOS and TTL logic. Also feature built-in snubber network, high surge rating, and low offset voltage to minimize RFI and EMI. Ratings are for relays mounted with silicon grease on a 12" x 12" x 0.125" (304.8 x 304.8 x 3.18) aluminum panel or equivalent. Load and logic connections are marked on each relay. **Suffix S** have screw terminals, terminal screws are included. **Suffix N** have quick connect terminals for push-on connectors which fit blade sizes 0.187" (4.75) for the logic/control side and 0.250" (0.635) for the load side. Relay body is 1.2"x1.0"x0.85" (30.48x25.4x21.59) high. Push tabs (Style N) add 0.3" (7.62) to height. Screws (Style S) add 0.1" (2,54).

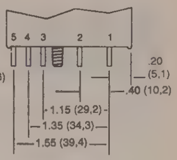
Type	AC Load	DC Control
70S2-04-B-06-S	6A, 120V	3-30V
70S2-04-B-12-S	12A, 120V	3-30V
70S2-03-B-25-S	25A, 120V	3-30V
70S2-04-C-06-S	6A, 240V	3-30V
70S2-04-C-12-S	12A, 240V	3-30V
70S2-03-C-25-S	25A, 240V	3-30V
70S2-04-B-06-N	6A, 120V	3-30V
70S2-04-C-06-N	6A, 240V	3-30V
70S2-04-B-12-N	12A, 120V	3-30V
70S2-04-C-12-N	12A, 240V	3-30V

70 SERIES DIGITAL INPUT/OUTPUT MODULES





Standard and Mini Pin Out



G5 Pin Out

TERMINAL NUMBER AND CONNECTION

TYPE	#5	#4	#3	#2	#1
OAC	N/A	DC– In	DC+ In	AC Out	AC Out
ODC	N/A	DC– In	DC+ In	DC- Out	DC+ Out
IAC	Ground	Output	+Vcc	AC In	AC In
IDC	Ground	Output	+Vcc	DC- In	DC+ In

Only input modules have terminal #5.

I/O Modules provide an optically isolated interface between logic systems and external AC and DC power devices. UL recognized, CSA certified and logic compatible. SPST N.O. with industry standard pinouts, superior noise immunity, transient protection of 4000 V/ microsecond, 4000 volts of isolation, and high blocking voltages of 400 volts (120VAC) and 600 volts (240VAC). G5 modules have built-in status LEDs and 5 x 20 mm glass fuses. Immune to mechanical shock and vibration. Operating temperature range of –40° to +100°C. AC types have zero crossing switching. Meet IEEE 472–1974 and ANSI C37.90 transient withstanding tests, and Electrical Noise Immunity Test per NEMA ICS 2–230.

Standard I/O Modules are form, fit function replacements for competitive product; output modules switch up to 3.5 Amps. Standard modules measure 1.7"L, .6"W, and 1.25" H.
Miniature I/O Modules require only .68 sq inches board area, and switch up to 3.0 Amps. Mini modules measure 1.7"L, .4"W, and 1.0"H.
G5 I/O Modules include a replaceable glass cartridge fuse in the output modules and a status LED indicator. These modules switch up to 3.5 Amps. G-5 modules are 1.9"L, .46"W, and 2.5"H.

ORDERING INFORMATION – MODULES

Size and Description	Nominal Vcc Supply	Nominal Load Voltage	Part Number
AC OUTPUT MODULES — BLACK CASE			
Miniature	5 Vdc	120 Vac	70M-OAC5
Miniature	5 Vdc	240 Vac	70M-OAC5A
Standard	5 Vdc	120 Vac	70-OAC5
Standard	5 Vdc	240 Vac	70-OAC5A
G5 Module	5 Vdc	120 Vac	70G-OAC5
G5 Module	5 Vdc	240 Vac	70G-OAC5A
DC OUTPUT MODULES — RED CASE			
Miniature	5 Vdc	60 Vdc	70M-ODC5
Standard	5 Vdc	60 Vdc	70-ODC5
Standard	5 Vdc	200 Vdc	70-ODC5A
G5 Module	5 Vdc	60 Vdc	70G-ODC5
G5 Module	5 Vdc	200 Vdc	70G-ODC5A
AC INPUT MODULES — YELLOW CASE			
Miniature	5 Vdc	120 Vac	70M-IAC5
Miniature	5 Vdc	240 Vac	70M-IAC5A
Standard	5 Vdc	120 Vac	70-IAC5
Standard	5 Vdc	240 Vac	70-IAC5A
G5 Module	5 Vdc	120 Vac	70G-IAC5
G5 Module	5 Vdc	240 Vac	70G-IAC5A
DC INPUT MODULES — WHITE CASE			
Miniature	5 Vdc	3-32 Vdc	70M-IDC5
Standard	5 Vdc	3-32 Vdc	70-IDC5
G5 Module	5 Vdc	3-32 Vdc	70G-IDC5

Additional types available from stock: Random crossing, Normally Closed, Non-polarized DC Input, 90-140 Vdc Input, or 180-280 Vdc Input.

For prices contact a Sales Office, a Distributor, or GRAYHILL.
Contact GRAYHILL for I/O module racks, controller products
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		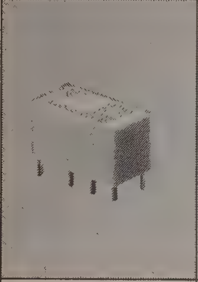	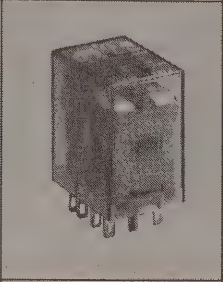	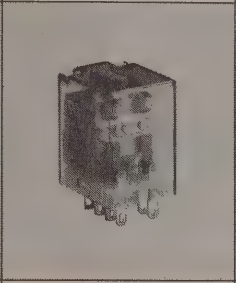	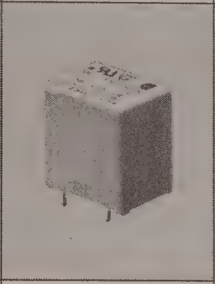	
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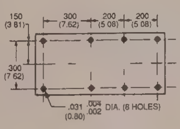
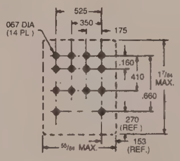
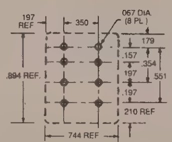
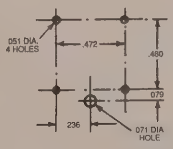
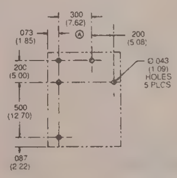
Contact Arrangement		DPDT	4 PDT	DPDT	SPST-SPDT	SPST-SPDT
Size		.797 x .394 x .450	1.10 x .0.85 x 1.42	.894 x .744 x 1.10	.850 x .472 x .890	.862 x .661 x .650
Coil Voltage		DC-5/6/12/24/48	DC-6/12/24/48/110	DC-6/12/24/48 AC-12/24/48/120/240	DC-6/12/24/48 AC-6/12/24/48/120	DC-6/12/24
Coil Power		550 MW	DC 900 MW AC 1.2VA	1.2 VA 1.2 W	360 MW	450 MW
Break-Down Voltage	Across Contact Gap	750V	1000V	500V	500V	750V
	Between Coil And Contacts	1000V	2000V	1500V	1500V	1500V
Life	Mechanical	15,000,000	20,000,000	100,000,000	1,000,000	20,000,000
	Electrical	100,000	200,000	100,000	100,000	100,000
Terminal Type		PC	PC/Solder Lugs	PC/Solder	PC	PC
Terminal Layout		 150 (3 81) 300 (7.62) 200 (5 08) 200 (5 08) 300 (7 62) .031 (0.80) .004 .002 DIA. (8 HOLES)	 067 DIA (14 PL) 525 350 175 .160 410 1 7/64 MAX. .660 270 (REF) 153 (REF.) 55/64 MAX.	 197 REF 350 067 DIA. (8 PL) 179 .157 .354 197 551 .197 .894 REF. 210 REF 744 REF	 051 DIA. 4 HOLES .472 .480 079 236 071 DIA HOLE	 300 (7.62) 073 (1 85) Ⓐ 200 (5 08) Ø 043 (1 09) HOLES 5 PLCS 200 (5 00) 500 (12 70) 087 (2 22)
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			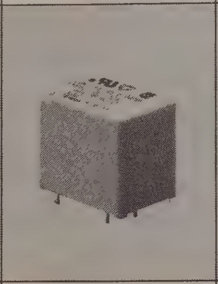	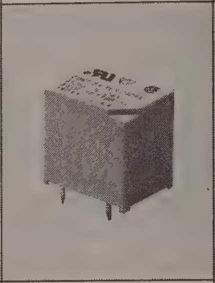	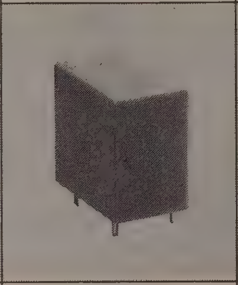	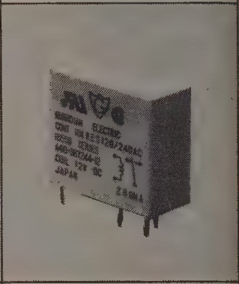
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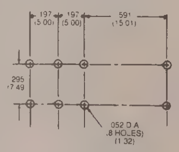
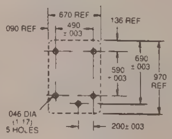
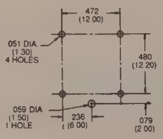
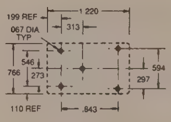
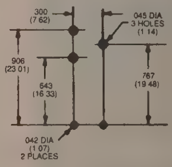
Contact Arrangement		DPDT	SPST-SPDT	SPST-SPDT	SPST-SPDT	SPST-SPDT
Size		1.154 x .504 x .988	.970 x .678 x .810	.866 x .630 x .858	1.220 x .766 x 1.188	1.154 x .504 x .988
Coil Voltage		DC-6/12/24/48	DC-6/12/24	DC-6/12/24	DC-6/12/24	DC-6/12/24
Coil Power		530 MW	800 MW	360 MW	100 MW	530 MW
Break-Down Voltage	Across Contact Gap	1000V	750V	500V	1000V	1000V
	Between Coil And Contacts	5000V	1000V	1500V	1500V	5000V
Life	Mechanical	100,000,000	20,000,000	20,000,000	10,000,000	100,000,000
	Electrical	100,000	200,000	100,000	100,000	100,000
Terminal Type		PC Type	PC	PC	PC	PC
Terminal Layout						
Approved Standards		UL/CSA/VDE	UL/CSA	UL/CSA	UL/CSA	UL/CSA/VDE
Options		Sealed Type	Sealed Type	Sealed Type	Sealed Type	Sealed Type

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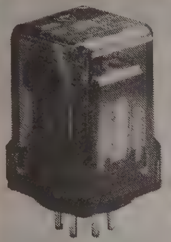
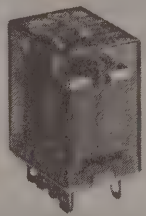
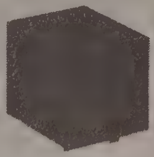
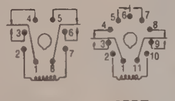
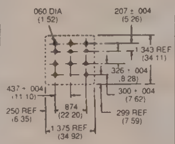
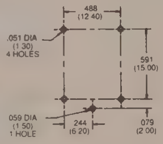
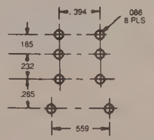
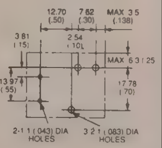
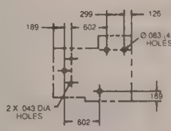
RELAYS

Series		1410/1415	1510/1515	1685	1390/1395	5005	5905
							
Contact Rating		10A-240VAC 10A-30VDC	10A-240VAC 10A-30VDC	10A-120VAC	13A-240VAC 13A-30VDC	SPST-NO 30A 250VAC-28VDC SPDT 20A/10A 24VAC-28VDC	SPST-NO 30A-250VAC SPDT 20A/10A 20VAC5-28VDC
Contact Arrangement		DPDT/ 3PDT	SPDT/ DPDT/ 3PDT	SPST-NO	2PDT	SPST- SPDT	SPST- SPDT
Size		1.378 x 1.378 x 2.134	1.406 x 1.531 x 2.15	.980 x .681 x .843	1.110 x .831 x 1.361	1.27 x 1.08 x 1.1	1.35 x .110 x .850
Coil Voltage		AC-6/12/24/48/120/240 DC-6/12/24/110D	AC-12/24/48/120/240 DC-12/24/48/110	DC-6/12/24	AC-6/12/24/48/120/240 DC-6/12/24/48/110	DC-6/12/24/48	DC-12/24
Coil Power		2.9 VA 1.3W	2.9 VA 1.3W	360 MW	1.2VA@AC 900 MW	900 MW	900 MW
Break-Down Voltage	Across Contact Gap	500V	500V	1000V	500V	1500V	1500V
	Between Coil And Contacts	1500V	1500V	4000V	1500V	2500V	1500V
Life	Mechanical	1,000,000	1,000,000	1,000,000	50,000,000	10,000,000	10,000,000
	Electrical	100,000	100,000	100,000	100,000	100,000	100,000
Terminal Type		Octal Plug	Solder/PC	PC	Solder/PC	PC/QC	PC
Terminal Layout		 DPDT 3PDT					
Approved Standards		UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA
Options		Neon Lamp Test Button	Neon Lamp Test Button Flange Cover	Sealed Type Reversed Pin	Sealed Type Flanged Mt. Cover	Sealed Type	Sealed Type

GUARDIAN Guardian Electric Manufacturing Co.
1425 Lake Avenue • Woodstock, IL 60098 • Phone: 800/762-0369 • FAX: 815/337-0377

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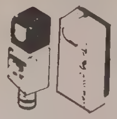
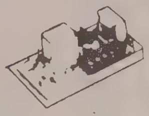
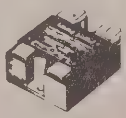
(310) 452-1229

TOGGLE SWITCHES


PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

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CIRCUIT BREAKERS
- Airpax
- Aromat
- Heinemann
- Potter & Brumfield

CONNECTORS & SOCKETS
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- Amphenol
- Aromat
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- Custom Connector
- Idec
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- Vernitron-Beau
- Welcon/Wells

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- Curtis

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- Crydom Controls
- EAC
- Elec-Trol
- Fujitsu
- Gordos
- Grayhill
- Guardian
- Hi-G
- Idec
- ITT
- Line Electric
- Magnecraft
- Master Elecronics
- MEC
- Midtex
- Omron
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- RBM
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- Siemens
- Sigma
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- Telemecanique
- Theta-J
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- Grayhill
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- Amperite
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- Master Electronics
- Midtex
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- Havey Hubbell
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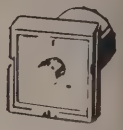
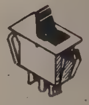
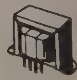
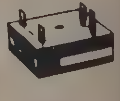
- H.H. Smith
- Modor
- Panduit
- Pomona

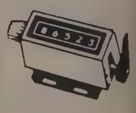

TEMPERATURE CONTROLS

TIMERS


PADDLE SWITCHES


TRANSFORMERS


TIMERS


COUNTERS

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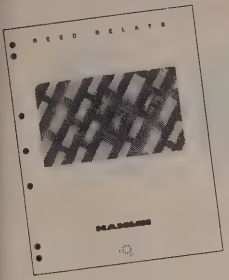
REED RELAYS

HAMLIN INC

ELEC-TROL

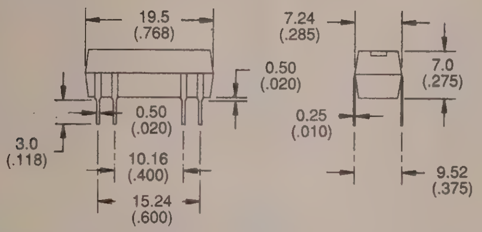


The extensive Hamlin line of standard reed relays represents the merging of the wide range of reed products manufactured by Hamlin, Inc. and Elec-Trol. The merger provides powerful technical capability and manufacturing capacity that assures customers a reed relay supplier that is totally committed and focused. For your convenience both Hamlin and Elec-Trol model numbers are listed. When ordering, refer to the Hamlin model number.

DIMENSIONS

DIMENSION ARE IN MILLIMETERS
INCHES ARE IN PARENTHESIS

700 SERIES DIP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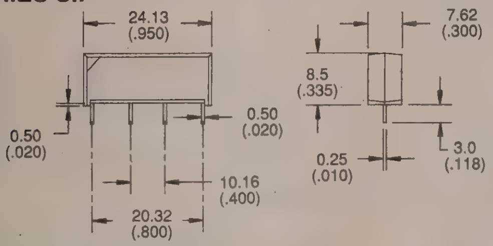
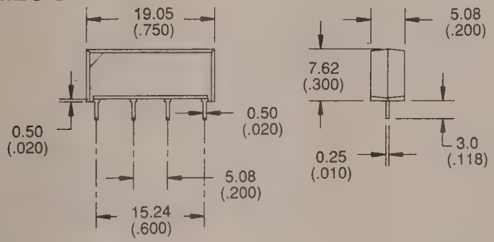
7.24
(.285)
0.50
(.020)
7.0
(.275)
0.50
(.020)
0.25
(.010)
3.0
(.118)
10.16
(.400)
15.24
(.600)
9.52
(.375)

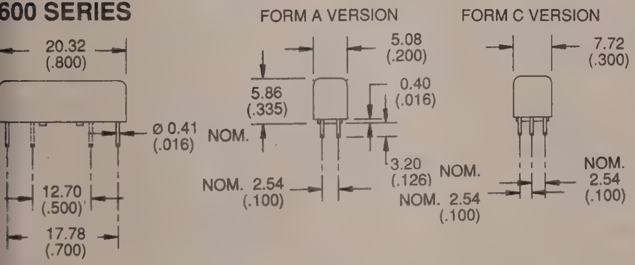
3300 SERIES SIP


24.13
(.950)
7.62
(.300)
8.5
(.335)
0.50
(.020)
0.50
(.020)
3.0
(.118)
0.25
(.010)
10.16
(.400)
20.32
(.800)

3600 SERIES SIP

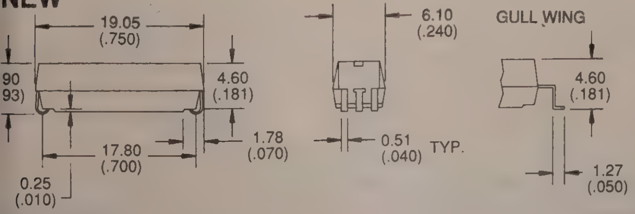

19.05
(.750)
5.08
(.200)
7.62
(.300)
0.50
(.020)
0.50
(.020)
3.0
(.118)
0.25
(.010)
5.08
(.200)
15.24
(.600)

600 SERIES


FORM A VERSION
FORM C VERSION
20.32
(.800)
5.08
(.200)
7.72
(.300)
0.40
(.016)
5.86
(.335)
Ø 0.41
(.016)
NOM.
3.20
(.126)
NOM.
NOM. 2.54
(.100)
NOM. 2.54
(.100)
NOM.
2.54
(.100)
12.70
(.500)
17.78
(.700)

3800 SERIES SURFACE MOUNT

NEW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(.240)
GULL WING
90
93)
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(.181)
4.60
(.181)
1.78
(.070)
0.51
(.040)
TYP.
17.80
(.700)
1.27
(.050)
0.25
(.010)

HAMLIN INC.
612 East Lake Street
Lake Mills, WI 53551 USA
Phone 414/648-3000 FAX 414/648-3001

700 SERIES DIP

CONTACT FORM	CONTACT RATING	HAMLIN MODEL NUMBER	ELEC-TROL MODEL NUMBER	DIODE	COIL Vdc NO.	COIL Ohms ±10%	LIST PRICE 1-24
1A SPST-NO DRY	10W 0.5A 200V	721A0500	RA30451051	—	5	500	$3.11
		721A0510	RA30461051	YES	5	500	3.38
		721A1200	RA30451121	—	24	1000	3.11
		721A1210	RA30461121	YES	12	1000	3.38
		721A2400	RA30451241	—	12	2150	3.83
		721A2410	RA30461241	YES	24	2150	4.10
1C SPST-NO DRY	3W 0.25A 175V	721C0500	RA30421051	—	5	200	5.45
		721C0510	RA30441051	YES	5	200	5.72
		721C1200	RA30421151	—	12	500	5.72
		721C1210	RA30441151	YES	12	200	5.99
		721C2400	RA30421241	—	24	2000	5.72
		721C2410	RA30441241	YES	24	2000	5.99
2A DPST-NO DRY	10W 0.5A 200V	722A0500	NO EQUAL	—	5	200	4.68
		722A0510	NO EQUAL	YES	5	200	4.95
		722A1200	RA30981121	—	12	500	5.18
		722A1210	RA31231121	YES	12	500	5.45
		722A2400	RA30981241	—	24	2150	5.90
		722A2410	RA31231241	YES	24	2150	6.17
1A SPST-NO MERCURY	50W 2.0A 500V	731A0500	RA31501051	—	5	55	7.83
		731A0510	RA31511051	YES	5	55	8.15
		731A1200	RA31501121	—	12	300	8.10
		731A1210	RA31511121	YES	12	300	8.37
		731A2400	RA31501241	—	24	1100	8.33
		731A2410	RA31511241	YES	24	1100	8.60
1A SPST-NO HIGH VOLT.	10W 300V	751A0510	RA32141051	YES	5	500	4.73
		751A1210	RA32141121	YES	12	1000	5.18
		751A2410	RA32141241	YES	24	2150	5.63

3300 SERIES SIP

CONTACT FORM	CONTACT RATING	HAMLIN MODEL NUMBER	ELEC-TROL MODEL NUMBER	DIODE	COIL Vdc NO.	COIL Ohms ±10%	LIST PRICE 1-24
1A SPST-NO DRY	10W 0.5A 200V	3321A0400	BBS1A05A10	—	5	500	$2.70
		3321A1200	BBS1A12A10	—	12	500	2.70
		3321A2400	BBS1A24A10	—	24	2000	3.15
1C SPDT-CO DRY	3W 0.25A 175V	3321C0500	BBS1C05A10	—	5	125	4.73
		3321C1200	BBS1C12A10	—	12	500	4.95
		3321C2400	BBS1C24A10	—	24	2000	5.40
1A SPST-NO MERCURY	50W 2.0A 500V	3331A0500	NO EQUAL	—	5	125	7.20
		3331A1200	NO EQUAL	—	12	500	7.43
		3331A2400	NO EQUAL	—	24	2000	7.88
1A SPST-NO HIGH VOLT.	10W 0.5A 300V	3351A0500	NO EQUAL	—	5	125	3.60
		3351A1200	NO EQUAL	—	12	500	3.60
		3351A2400	NO EQUAL	—	24	2000	4.05

3600 SERIES SIP

CONTACT FORM	CONTACT RATING	HAMLIN MODEL NUMBER	ELEC-TROL MODEL NUMBER	DIODE	COIL Vdc NO.	COIL Ohms ±10%	LIST PRICE 1-24
1A SPST-NO DRY	10W 0.5A 200V	3621A0500	RA32041051	—	5	500	$3.38
		3621A0510	RA32051051	YES	5	500	3.65
		3621A1200	RA32041121	—	12	1000	4.73
		3621A2400	RA32041241	—	24	2150	5.18
1A SPST-NO COAX	10W 0.5A 50W	3621A0520	NO EQUAL	—	5	200	5.63
		3621A1220	NO EQUAL	—	12	500	6.08
		3621A2420	NO EQUAL	—	24	1500	6.53

600 SERIES

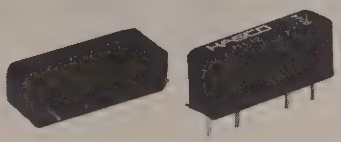
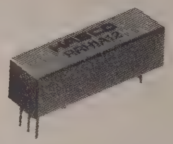
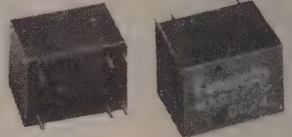
CONTACT FORM	CONTACT RATING	HAMLIN MODEL NUMBER	ELEC-TROL MODEL NUMBER	DIODE	COIL Vdc NO.	COIL Ohms ±10%	LIST PRICE 1-24
1A SPST-NO DRY	10W 0.5A 200V	HE621A0500	NO EQUAL	—	5	150	$9.00
		HE621A0500	NO EQUAL	—	12	900	9.17
1C SPDT-CO DRY	3W 0.25A 175V	HE621C0550	NO EQUAL	—	5	150	10.80
		HE621C1250	NO EQUAL	—	12	900	10.97
1A SPST-NO DRY	10W 0.5A 200V	HE622A0550	NO EQUAL	—	5	200	10.35
		HE622A1250	NO EQUAL	—	12	800	10.52
1A SPST-NO DRY HIGH VOLT.	10W 0.5A 200V	HE651A0550	NO EQUAL	—	5	150	9.20
		HE651A1250	NO EQUAL	—	12	900	9.37

CONTACT FORM	CONTACT RATING	HAMLIN MODEL NUMBER	ELEC-TROL MODEL NUMBER	DIODE	COIL Vdc NO.	COIL Ohms ±10%	LIST PRICE 1-24
1A SPST-NO DRY	10W 1A 200V	3821A0500	NO EQUAL	J	5	150	$5.40
		3821A0501	NO EQUAL	GULL	5	150	5.40
		3821A1200	NO EQUAL	J	12	750	5.40
		3821A1201	NO EQUAL	GULL	12	750	5.40
		3821A2400	NO EQUAL	J	24	1500	5.40
		3821A2401	NO EQUAL	GULL	24	1500	5.40

HASCO

COMPONENTS INT'L., CORP.
SINCE 1976

RELAYS

	700 SIP	RRH SERIES	HAS-111
Hasco Relay Type			
Features	• Epoxy Molded • Low Price • Std, Heavy Duty or Hi-Voltage • FCC Available • Complete Spec Sheet Faxed in 5 Min.	• Fully Sealed • Low Price • Long Life • Complete Spec Sheet Faxed in 5 minutes	• Small Size • 2A Switching • Meets FCC Pt68 • Same Day Sample Service • Complete Spec Faxed in 5 Minutes
Form	1A, 1B	1A, 2A, 1B, 2C	1C
Contact Material	De-activated Rhodium	De-activated Rhodium	Silver-Palladium (Gold overlay)
Contact Rating	TYPE 711: 10VA DC Max, 100V DC Max, 1A 712: 70VA DC Max, 100V DC Max, 2.5A 713: 50VA DC Max, 400V DC Max, 2.5A	10VA DC Max, 100V DC Max .5A Switching, 1A Carry (Higher Voltage & Power Available)	2A 230V DC or 125A
Coil Voltages	3, 5, 6, 12, 24	3, 5, 6, 12, 24V	3, 5, 6, 9, 12, 24, 48V Standard and Sensitive
Dielectric Strength	250V-600V across contacts 1500V contacts to coil	250V-600V across contacts 1500V contacts to coil	Between open contacts: 1000VRM Contact to coil: 1500V RMS

SPECIFICATIONS

Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ohms)
711-5	5-6	3.75	0.5	500
711-12	12	9.0	1.2	500
711-24	24	18.0	2.4	2000

HEAVY DUTY & HIGH VOLTAGE

Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ohms)
712-713	5-6	3.75	0.5	400
712-713	12	9.0	1.2	400
712-713	24	18.0	2.4	1600

SPECIFICATIONS COIL RATINGS

Part Number	Nominal Voltage (V)	Coil Resistance (Ω) ± 10%	Rated Current (mA)	Continuous Voltage (Max V)
RRH1A05	5	500	20	10
RRH1A12	12	1000	15	20
RRH1A24	24	2200	10.90	28
RRH2A05	5	140	14	10
RRH2A12	12	500	15	20
RRH2A24	24	2150	12	28
RRH1C05	5	250	20	10
RRH1C12	12	500	15	20
RRH1C24	24	2200	10.90	28

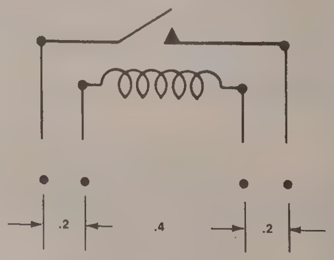
COIL RATINGS FOR STANDARD MODEL HAS 111
Nominal Power (W) Consumption Approximately 0.45

Relay Code	Coil Resist. (Ω ± 10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*
HAS-111-3V	20	150	2.1	0.3	3.3
HAS-111-5V	56	89.3	3.5	0.5	5.5
HAS-111-6V	80	75	4.2	0.6	6.6
HAS-111-9V	180	50	6.3	0.9	9.9
HAS-111-12V	320	37.5	8.4	1.2	13.2
HAS-111-24V	1280	18.8	16.8	2.4	26.4
HAS-111-48V	5120	9.4	33.6	4.8	52.8

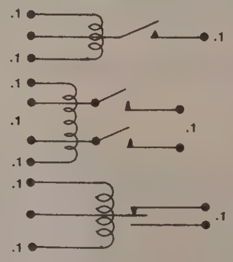
COIL RATINGS FOR SENSITIVE MODEL HS 211
Nominal Power (W) Consumption Approximately 0.20

Relay Code	Coil Resist. (Ω ± 10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*
HS-211-3V	45	66.7	2.1	0.3	4.8
HS-211-5V	120	41.7	3.5	0.5	8.0
HS-211-6V	180	33.3	4.2	0.6	9.6
HS-211-9V	400	22.5	6.3	0.9	14.4
HS-211-12V	700	17.1	8.4	1.2	19.2
HS-211-24V	2800	8.6	16.8	2.4	38.4

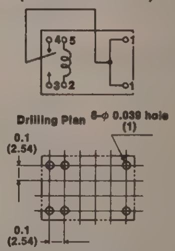
Internal Connections and Mounting Holes



Dimension 1" × 1"



Internal Connections (Bottom View)



HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., FLORAL PARK, NY 11001 / (516) 328-9292 FAX 516-326-9125

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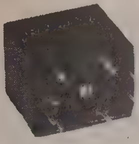
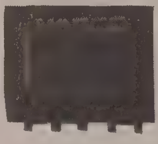
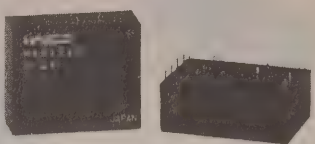
COMPONENTS INT'L., CORP.
SINCE 1976

RELAYS

	KSD-DPDT 3 or 5 AMP	T SERIES	HAS-124
Hasco Relay Type	 *Only .62" H*	 *Through hole* *SMT type* HASCO TS-5 JAPAN 9008	
Features	• Miniature Two Pole Relay • High Reliability • 3 and 5 Amp Switching • Fully sealed • Low Cost • Complete Spec Faxed in 5 Minutes	• Subminiature Size • Meets FCC Pt68 • Latching Available • Coil Latching available • Surface Mount Available	• Low Profile • Meets FCC • Low Cost • Same Day Samples • Complete Spec Faxed in 5 Minutes
Form	2C	2C, 2C latch	4C, 4D
Contact Material	AgCAu plated	Ac-Pd Alloy, Gold coil AgPd Alloy	Gold Coil, Ag Pd Alloy
Contact Rating	120 VAC/24 VDC–Load 250 VAC/125 VDC-Max Oper. Voltage	1A 2 30 VDC, 62.5 VAC 125 V DC/AC	2A 60 W, AC60 VA 125 VAC/DC
Coil Voltages	3, 5, 6, 9, 12, 24VDC	3, 5, 6, 9, 12 & 24V Standard and Sensitive	3, 5, 6, 12, 24, 48V
Dielectric Strength	1,500 VAC, 50/60 Hz for 1 minute between coil and contact, dissimilar pole 750 VAC, 50/60 Hz for 1 minute between non-continuous contacts of same pole	SURGE Between open contacts 1000VAC 1500V Between coil & contacts 1000VAC 1500V Between contact poles 1000VAC 1500V	SURGE Between open contacts 1000VAC 1500V Between coil & contacts 1000VAC 1500V Between contact poles 1000VAC 1500V

KSD-DPDT 3 or 5 AMP

COIL RATING
Power Consumption Approx. 510 (mW)

Type	Item / Rated Voltage	Rated current (mA)	Coil resistance (Ω)	Must operate Voltage	Must drop-out Voltage	Max. Voltage
				% of rated voltage		
KSD	3VDC	167	18	Max	10 min.	
	5VDC	102	49	70 at 20°C		150 at 20°C
	6VDC	85.7	70	72 at 30°C		142 at 30°C
	9VDC	56.3	160	76 at 40°C		133 at 40°C
	12VDC	42.9	280	79 at 50°C		123 at 50°C
	24VDC	21.2	1130	82 at 60°C		113 at 60°C

T SERIES

TYPES AND COIL DATA at 20°C (68°F)

Single side stable Type of relay	Coil resistance (Ω±10%)	Pickup voltage V DC	Dropout voltage V DC	Nom. power consumption W DC	Max. continuous voltage V DC
T-3V	64.3	2.25	0.3	0.14	4.5
T-5V	178	3.75	0.5	0.14	7.5
T-6V	257	4.5	0.6	0.14	9.0
T-9V	579	6.75	0 9	0.14	13 5
T-12V	1028	9.0	1 2	0.14	18.0
T-24V	2880	18.0	2.4	0 2	36.0

1 Coil latching Type of relay	Coil resistance (Ω±)	Pick-up voltage	Drop-out voltage	Nom. power consumption	Max. continuous voltage
TL-3V	90	2.25	−2.25	0.1	4.5
TL-5V	250	3.75	−3.75	0.1	7.5
TL-6V	360	4.5	−4.5	0.1	9.0
TL-9V	810	6.75	−6.75	0.1	13.5
TL-12V	1440	9.0	−9.0	0.1	18.0
TL-24V	3840	18.0	18.0	0.15	36.0

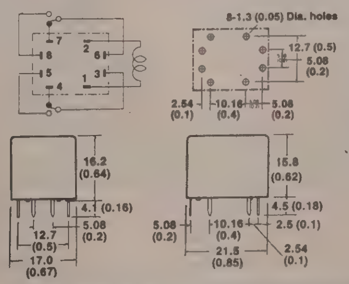
2 Coil latching Type of relay	Coil resistance (Ω±10%)		Set voltage VDC	Reset voltage VDC	Nom. power consumption W DC		Max. continuous voltage V DC
	Set coil	Reset coil			Set coil	Reset coil	
TK-3V	45	45	2 25	2.25	0 2	0 2	4 5
TK-5V	125	125	3.75	3 75	0 2	0.2	7.5
TK-6V	180	180	4.5	4.5	0.2	0 2	9 0
TK-9V	405	405	6.75	6 75	0 2	0.2	13 5
TK-12V	720	720	9.0	9.0	0.2	0.2	18.0
TK-24V	1920	1920	18.0	18.0	0.3	0.3	36.0

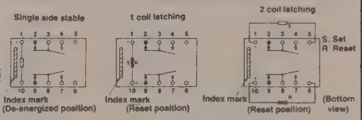
HAS-124

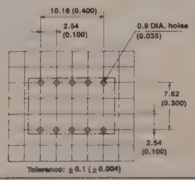
COIL RATING DC Volts — **Nominal Power Consumption (W) 0.48**

Relay Code	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*
HAS-124-5V	52	96.2	3.5	0.5	7.0
HAS-124-6V	85	70.6	4.2	0.6	8.4
HAS-124-9V	170	52.9	6.3	0.9	12.6
HAS-124-12V	330	36.4	8.4	1.2	16.8
HAS-124-24V	1200	20.0	16.8	2.4	33.6
HAS-124-48V	4200	11.4	33.6	4.8	67.2

Internal Connections and Mounting Holes

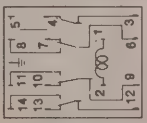

7
8
2
6
5
1
3
4
8-1.3 (0.05) Dia. holes
12.7 (0.5)
5.08 (0.2)
2.54 (0.1)
10.16 (0.4)
5.08 (0.2)
16.2 (0.64)
4.1 (0.16)
5.08 (0.2)
12.7 (0.5)
17.0 (0.67)
15.8 (0.62)
4.5 (0.18)
5.08 (0.2)
10.16 (0.4)
2.5 (0.1)
21.5 (0.85)
2.54 (0.1)


Single side stable
1 coil latching
2 coil latching
1 2 3 4 5
10 9 8 7 6
S. Set
R Reset
Index mark (De-energized position)
Index mark (Reset position)
Index mark (Reset position)
(Bottom view)


10.16 (0.400)
2.54 (0.100)
0.9 DIA. holes (0.035)
7.62 (0.300)
2.54 (0.100)
Tolerance: ±0.1 (±0.004)

consult factory for surface mount

SCHEMATIC


5
4
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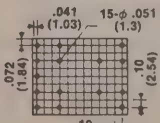
13

MOUNTING HOLE LAYOUT


.041 (1.03)
15-ϕ .051 (1.3)
.072 (1.84)
.10 (2.54)
.10 (2.54)

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COMPONENTS INT'L., CORP.
SINCE 1976

REED RELAYS

OKI
electric industry company, ltd.

DIP SERIES

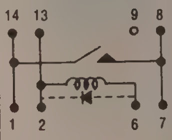
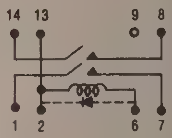
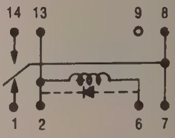
SIP SERIES

FEATURES

- De-activated rhodium contacts. for stable contact resistance.
- Standard TO-116 Terminal Grid fits all standard DIP sockets.
- Interface directly with RTL, DTL, TTL, HTL logic.
- Molded epoxy package for environmental immunity.
- Automatic insertion compatible.
- Relay testing services test report available.

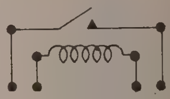
DIP AND MINI SIP SERIES

DIP CHARACTERISTICS

Contact Form	Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ω)	Circuit Schematic (Top view)
1A	D51A05(D)*	5	3.75	0.5	500	
	D51A12(D)	12	9.0	1.2	800	
	D51A24 (D)	24	18.0	2.4	2000	
2A	D52A05 (D)	5	3.75	0.5	140	
	D52A12 (D)	12	9.0	1.2	400	
	D52A24 (D)	24	18.0	2.4	1300	
1C	D51C05 (D)	5	3.75	0.5	200	
	D51C12 (D)	12	9.0	1.2	500	
	D51C24 (D)	24	18.0	2.4	1500	

* (D) optional clamp diode

SIP CHARACTERISTICS

1A	F41A05	5	3.75	0.5	500	
	F41A12	12	9.0	1.2	800	

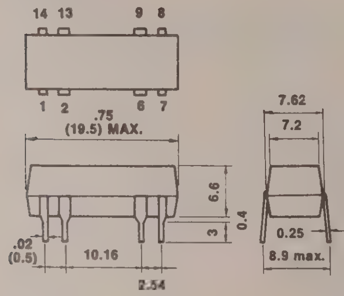
ENGINEERING DATA

	1A, 2A	1C
Operate time	0.5msec max.	0.5msec. max.
Release time	0.2msec max.	0.2msec max.
Bounce time	0.5msec max.	2.0msec max.
Contact resistance	Dip: 150mΩ max. (initial)	150mΩ max. (initial)
	Sip: 0.10Ω max.	150mΩ max. (initial)
Contact ratings	DC10VA max.	DC3VA max.
	DC100V max.	DC30V max.
	DC1.0A max. (carry only)	DC0.5A max. (carry only)
	DC0.5A max. (switched)	DC0.25A max. (switched)
Life expectancy	50 x 10^6 operations at signal level	30 x 10^6 operations at signal level
	3 x 10^6 full rated load	1 x 10^6 at full rated load
Breakdown voltage	DC250V across open contacts	DC200V across open contacts
	DC500V between coil and contact	DC500V between coil and contact
Insulation resistance	10^9Ω min.	10^9Ω min.
Vibration	20G (10 ~ 2000Hz)	20G (10 ~ 2000Hz)
Thermal shock	−55 ~ 105°C	−55 ~ 105°C
Moisture resistance	60°C-90% 240 hours	60°C-90% 240 hours
Terminal strength	225g	225g
Operating temperature	−40 ~ 85°C	−40 ~ 85°C
Storage temperature	−55 ~ 105°C	−55 ~ 105C°
Operations	200 x 10^6 low level	

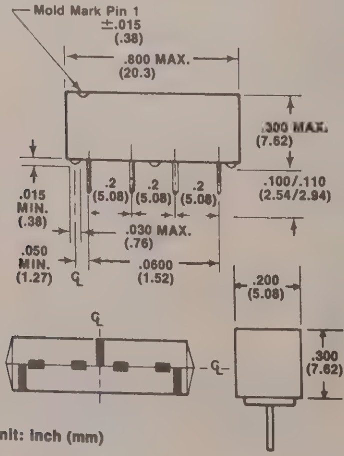
CONSULT CATALOG FOR SURFACE MOUNT SPECIFICATIONS

DIMENSIONS

DIP STYLE



SIP STYLE



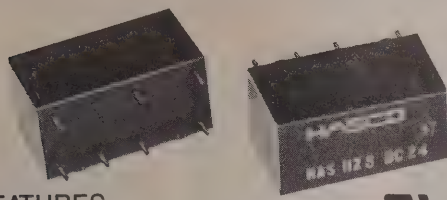
Unit: inch (mm)

EXCLUSIVE AGENT FOR **OKI** REED RELAYS IN USA AND CANADA
FOR INFORMATION ON SURFACE MOUNT, CONTACT FACTORY
HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., FLORAL PARK, NY 11001 / (516) 328-9292 FAX 516-326-9125

HASCO / RELAYS

COMPONENTS INT'L., CORP.
SINCE 1976

DPDT—DIP or PC STANDARD or SENSITIVE HAS 112/HS 212 RELAY



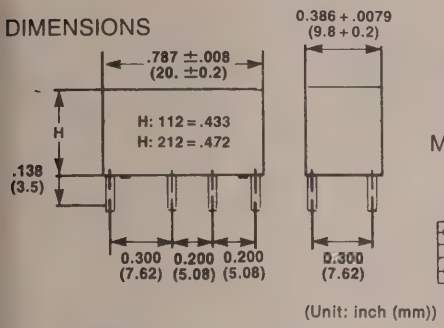
FEATURES

- FCC Pt 68.
- Sensitive available.
- Nitrogen sealing available.
- In stock!

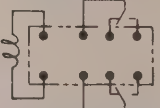
File E75887

LR49291

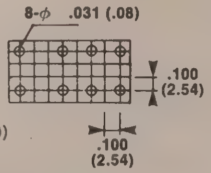
DIMENSIONS



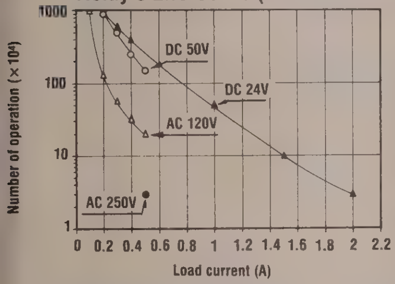
SCHEMATIC
Bottom view



MOUNTING HOLE LAYOUT

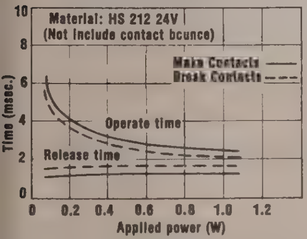


HS212-HAS112
Relay's Life Curve (Resistive Load)

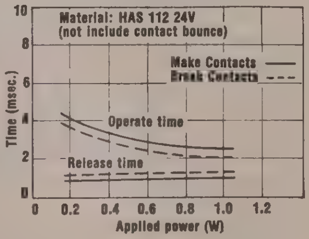


SAMPLES SENT SAME DAY!

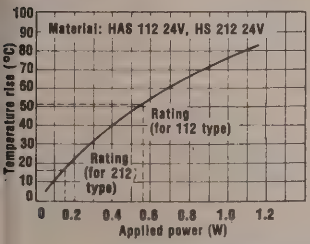
Operate and Release Time For 212 24V Relays



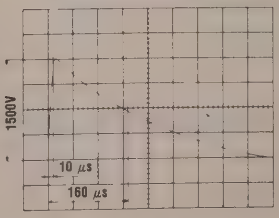
Operate and Release Time For HAS 112 24V Relays



Temperature Rise Of Coil



FCC 1500V Surge Test Wave Form



COIL RATINGS FOR **STANDARD** HAS 112

Relay Code (V)	Contact Arrange-ment	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HAS-112-5	DPDT (2 Form C)	5	45	111.0	3.5	0.5	7.0	Approx. 0.56
HAS-112-6		6	66	90.9	4.2	0.6	8.4	
HAS-112-9		9	140	64.3	6.3	0.9	12.6	
HAS-112-12		12	280	42.9	8.4	1.2	16.8	
HAS-112-24		24	1070	22.4	16.8	2.4	33.6	
HAS-112-48		48	3900	12.3	33.6	4.8	67.2	

Data Measured at 20°C.

COIL RATINGS FOR **SENSITIVE** HS 212

Relay Code (V)	Contact Arrange-ment	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HS-212-5	DPDT (2 Form C)	5	167	29.9	3.5	—	12.5	0.15
HS-212-6		6	240	25.0	4.2	—	15.0	0.15
HS-212-9		9	540	16.7	6.3	—	22.5	0.15
HS-212-12		12	960	12.5	8.4	—	30.0	0.15
HS-212-24		24	2,880	8.3	16.8	—	51.6	0.2
HS-212-48		48	7,680	6.3	32.6	—	84.0	0.3
HS-212A-48		48	9,800	5.0	33.0	—	96.0	0.3
HS-212B-48		48	11,500	4.2	33.6	—	117.5	0.2
HS-212C-48		48	5,760	8.3	33.6	—	83.1	0.4

As for the resistance value, pull-in voltage and drop-out voltage, they show the value at ambient temperature, 20°C, and the tolerance is ±10%.

RATING PERFORMANCE

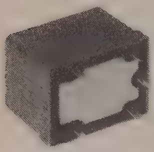
Specifications				Note
Contact	Contact Arrangement		DPDT, 2 Form C	
	Contact Material		Gold-clad, Ag-Pd alloy	
	Contact Resistance		100 mΩ	at initial value
	Max. Switching Power		DC 30W / AC 60 VA	at resistive load 2 amp A DC/AC Available in
	Max. Switching Voltage		220VDC 250VAC	
	Max. Switching Current		1.25 ADC / AC 2.5A @12V	
Time	Operate Time	(Type HS)	Approx. 4.5 msec.	at Nominal Voltage
		(Type HAS)	Approx. 2.5 msec.	
	Release Time	(Type HS)	Approx. 1.5 msec.	
		(Type HAS)	Approx. 1.5 msec.	
	Bounce Time (Operating)		Approx. 0.5 to 2 msec.	
	Bounce Time (Releasing)		Approx. 0.5 to 3.5 msec.	
Insulation Resistance			1000 MΩ	at 500 VAC, 25°C, 50% relative humidity
Dielectric Strength	1000VAC Between coil and contacts Between open contacts			1 minute is at 25°C, 50% relative humidity
FCC Surge Strength	1500V Between coil and contacts Between Adjacent contacts			
Vibration Resistance			1.5 mm DA, 10 ~ 55 Hz	
Temperature			−40°C ~ +90°C −40°C ~ +80°C −40°C ~ +65°C	HS212-5-24V HS212-48 HAS1125
Life	Mechanical Life		10 × 10^7 times	
	Electrical Life		5 × 10^5 times	at 24 VDC, 1A, resistive load
Weight			5 g	

HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., FLORAL PARK, NY 11001 / (516) 328-9292 FAX 516-326-9125

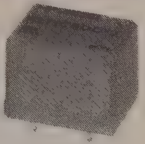
HASCO RELAYS

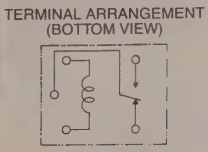
COMPONENTS INT'L., CORP.
SINCE 1976

KLT MINIATURE POWER RELAYS SPDT 3, 6 & 12 AMP

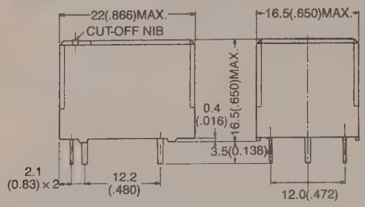


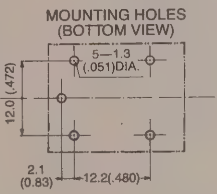
LR49291
File E75887





DIMENSIONS/UNIT mm (inch)





SPECIFICATIONS

CONTACT DATA

Arrangement: 1 Form C (SPDT), 1 Form A (SPST-NO), 1 Form B (SPST-NC)
Material & Rating: Silver: 3A at 28 VDC or 120V AC, 1.5A at 240V AC, resistive
Silver Cadmium oxide: 6A at 28VDC or 120V AC, 3A at 240V AC, resistive
Special alloy: 12A at 28VDC or 120V AC, 6A at 240VDC, resistive
Pilot duty: 40 amp in-rush, 4 amp steady state @ 120 VAC
Max. operating Voltage: 250V AC & 125VDC
Min. permissible load (reference value): Silver contact: 5VDC, 1mA
Other contact: 5VDC, 100mA
Life: Mechanical: 10 million operations/
Electrical: 100,000 operations min.

GENERAL DATA

Contact resistance: 50m Ω Max.
Operate time: 8 ms Max. (at nominal voltage)
Operate bounce time: 3 ms Max.
Release time: 5 ms Max./Release bounce time: 8 ms Max.
Insulation resistance: More than 100M Ω at DC 500V
Dielectric strength: 750V AC (50/60 Hz), between open contact; 1500V AC (50/60 Hz), between coil & contact
Vibration: 1.5mm double amplitude, 10 to 50 Hz
Shock: 100m/sec^2 (approx. 10 G's)
Operation frequency: Mechanical: 18,000 operations/hour
Electrical: 1,800 operations/hour (under rated load)
Temperature range: -45°C to 85°C
Temperature rise: Less than 35 degrees/Humidity: 45%-85% RH
NOTE: The data shown above are of initial value.

ELECTRICAL RATINGS:

- Models KLT 1A, 1B or 1C, followed by 6:
  6A, 120 V ac, 28 V dc: 3 A, 240 V ac general purpose, per pole.
  Models KLT 1A, 1B, or 1C, followed by 12:
  12A, 120 V ac, 28 V dc: 12 A, 240 V ac general purpose, per pole.
- 4 A steady state, 40 A inrush, 125 V ac pilot duty.

N.O. *Only*, Single Pole:
10 A at 12 V dc, Tungsten; 10 A at 125 V ac, General Purpose; 1500 W at 277 V ac, Ballast, 200 W at 120 V ac Tungsten.

COIL RATINGS

Nominal Coil Voltage	Coil Resistance in Ohms, ± 10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	25	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
5VDC	70			
6VDC	100			
9VDC	225			
12VDC	400			
18VDC	900			
24VDC	1600			
48VDC	5120			

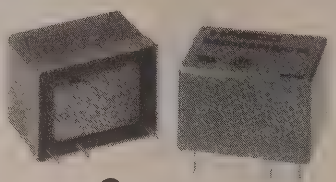
ORDERING INFORMATION

KLT-1C-12-DC12

Model No.
Contact Arrangement:
A = 1 Form A B = 1 Form B C = 1 Form C
Contact Material & Rating:
= Silver, gold flash, 3A = Silver Cadmium oxide, 6A
= Special alloy, 12A

Nominal Voltage:
3 = 3VDC; 5 = 5VDC;
6 = 6VDC; 9 = 9VDC;
12 = 12VDC; 24 = 24VDC;
48 = VL

SSD SERIES/6 or 10 AMP SPDT RELAY



LR49291
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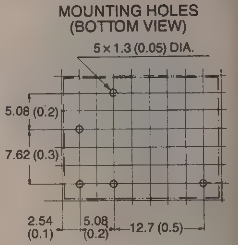
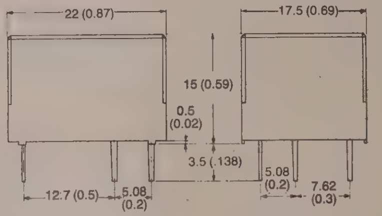
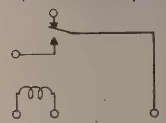
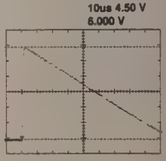


DIMENSIONS/UNIT mm (inch)







SPECIFICATIONS

CONTACT DATA

Arrangement: 1 Form C (SPDT), 1 Form A (SPST-NO), 1 Form B (SPST-NC)
Material & Rating: Silver, gold flash: 3A at 24 VDC or 120V AC, 1.5A at 240V AC, resistive
Silver Cadmium oxide: 6A at 24VDC or 120VDC, 3A at 240V AC, resistive
Special alloy: 10A at 24VDC or 120V AC, 5A at 240VDC, resistive
Max. operating Voltage: 250V AC & 125VDC
Min. permissible load (reference value): Silver contact: 5VDC, 1mA
Other contact: 5VDC, 100mA
Life: Mechanical: 20 million operations/
Electrical: 100,000 operations min.

GENERAL DATA

Contact resistance: 50m Ω Max.
Operate time: Approx. 6ms (at nominal voltage)
Operate bounce time: Approx. 2ms
Release time: Approx. 2ms/Release bounce time: Approx. 4ms
Insulation resistance: More than 100M Ω at DC 500V
Dielectric strength: 750V AC (50/60 Hz), between open contact; 2000V AC (50/60 Hz), between coil & contact
Vibration: 1.5mm double amplitude, 10 to 50 Hz
Shock: 100m/sec^2 (approx. 10G's)
Operation frequency: Mechanical: 18,000 operations/hour
Electrical: 1,800 operations/hour (under rated load)
Temperature range: -45°C to 85°C
Temperature rise: Less than 35 degrees/Humidity: 45%-85% RH
NOTE: The data shown above are of initial value.

COIL RATINGS

Nominal Coil Voltage	Coil Resistance in Ohms, ± 10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	20	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
5VDC	56			
6VDC	80			
9VDC	180			
12VDC	320			
24VDC	1150			

Power (at 20°C): Nominal: 0.45 watt. Available in 48 volts.

ORDERING INFORMATION

SSD 106PH DC12

Model No.
Contact Material & Rating:
= Silver, gold flash, 3A
= Silver Cadmium oxide, 6A = Special alloy, 10A

Nominal Voltage:
3V, 5V, 6V, 9V,
12V, 24V, 48V

HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., FLORAL PARK, NY 11001 / (516) 328-9292 FAX 516-326-9125

HASCO
COMPONENTS INT'L., CORP.
SINCE 1976

RELAYS

HAT-900 SERIES HEAVY DUTY

GENERAL SPECIFICATIONS

Max. continuous rated voltage: 110% of nominal voltage.
Pull-In voltage: 75% of nominal voltage. Max @ 25°C.
Drop-Out voltage: 10% of nominal voltage. Min @ 25°C.
Contact Resistance: 20 mΩ max. (Initial value)
Operating Temp: −55°C to +85°C.
Insulation Resist: DC 500V 10 MΩ min.
Dielectric Strength: AC 2500V between contact and coil, frame and contact, coil and frame one minute. AC 2500V between contacts one minute.
Operate Time: approx 15 ms.
Release Time: approx. 10 ms.
Electrical Life: 10 × 10^4 operation min.
Mechanical Life: 10 x 10^6 operation min.

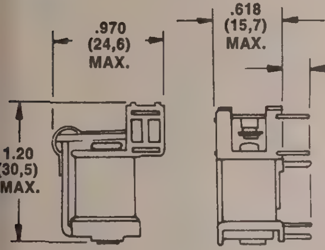
COIL SPECIFICATIONS

Nominal Voltage (VDC)(AC)	Resistance ±10% @ 25°C (Ohms)	Coil Power @ 25°C (Watts)
5	27	.93
6	40	.90
9	97	.84
12	155	.93
15	256	.88
18	380	.85
24	660	.87
48	2560	.88
110	13400	.90

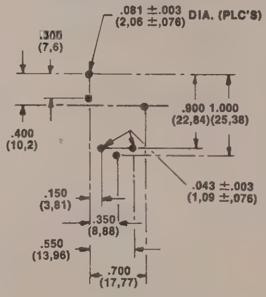
Available 1H AC Coil

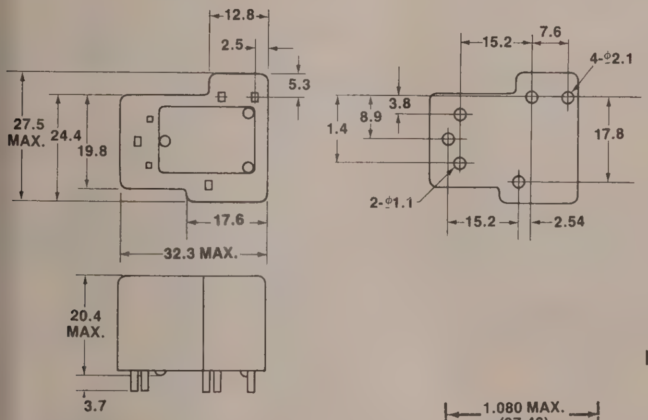
File E75887 LR49291

MECHANICAL SPECIFICATIONS


.970
(24,6)
MAX.
.618
(15,7)
MAX.
.240
(6,10)
MAX.
1.20
(30,5)
MAX.

PC BOARD LAYOUT
VIEWED TOWARD TERMINALS


.081 ±.003 (2,06 ±.076) DIA. (PLC'S)
.300 (7,6)
.400 (10,2)
.900 1.000 (22,84)(25,38)
.043 ±.003 (1,09 ±.076)
.150 (3,81)
.350 (8,88)
.550 (13,96)
.700 (17,77)


12.8
2.5
5.3
27.5 MAX.
24.4
19.8
17.6
32.3 MAX.
20.4 MAX.
3.7
15.2
7.6
4-Φ2.1
3.8
8.9
1.4
17.8
2-Φ1.1
15.2
2.54

MAXIMUM LOAD SPECIFICATIONS

Voltage	Load Type	SPNC	SPDT	SPNO
AC	Resistive Motor	30A 277VAC 1HP 120VAC 2HP 277VAC		30A 277VAC 1HP 120VAC 2HP 277VAC
	General Purpose	30A 277VAC		30A 277VAC
DC	Resistive	30A 28VDC		30A 28VDC

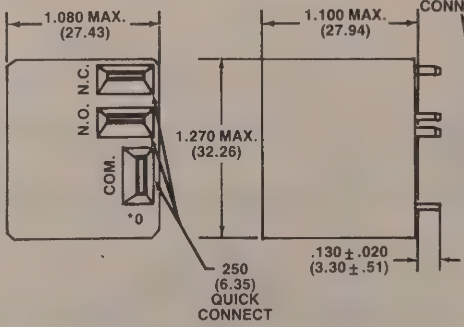
ORDERING INFORMATION

Part Number	Form	Style	DC	UL 840
HAT 901	**A**	Sealed Type = S	Coil Voltage	–1
HAT 902	**B**	Cover Only = C		PIN 6
HAT 903	**C**	Open Style is Standard		is Omitted

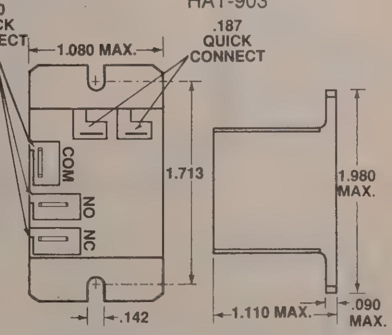
(i.e.: HAT-901C-S 12
is an SPDT fully
sealed version with 12V coil.)

QUICK CONNECT

HAT-902

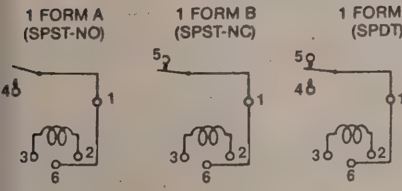

1.080 MAX.
(27.43)
N.C.
N.O.
COM.
*0
1.270 MAX.
(32.26)
1.100 MAX.
(27.94)
.130 ± .020
(3.30 ± .51)
250
(6.35)
QUICK
CONNECT

HAT-903


.250
QUICK
CONNECT
1.080 MAX.
.187
QUICK
CONNECT
COM
NO
NC
1.713
1.980
MAX.
.142
1.110 MAX.
.090
MAX.

WIRING DIAGRAMS

PIN VIEW


1 FORM A
(SPST-NO)
1 FORM B
(SPST-NC)
1 FORM C
(SPDT)
4
1
3
2
6
5
1
3
2
6
5
4
1
3
2
6

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SINCE 1976

RELAYS

PR SERIES
COMPACT POWER RELAYS 1C (16A, 10A), 2C (5A)
High breakdown voltage (4,000V AC between coil and contact)

PR 2C 5 12K
HASCO

File E75887
75267

COIL RATINGS

Rated Voltage	Resistance (±10% at 20°C)	Rated Current (±10% at 20°C)	Pick-up Voltage (Max.)	Drop-Out Voltage (Min.)	Allowable Voltage (Max.)	Rated operating power
5V DC	36Ω	138.9 mA	4V DC	0.5V DC	6 V DC	Approx. 0.7W
6V DC	50Ω	120 mA	4.8V DC	0.6V DC	7.2V DC	
12V DC	200Ω	60 mA	9.6V DC	1.2V DC	14.4V DC	
24V DC	820Ω	29.3 mA	19.2V DC	2.4V DC	28.8V DC	
48V DC	3,300Ω	14.5 mA	38.4V DC	4.8V DC	57.6V DC	

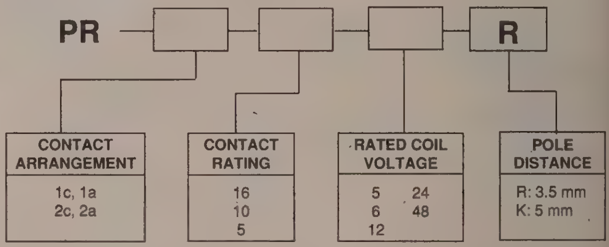
CONTACT RATINGS

Type & Arrangement	PRQ, PR-1 (1a, 1c)		PR-1 (1a, 1c)		PR-2 (2a, 2c)	
Load / Item	R load (cosø = 1)	L load (cosø = 0.4)	R load (cosø = 1)	L load (cosø = 0.4)	R load (cosø = 1)	L load (cosø = 0.4)
Rated load	16A 240V AC 16A 30V DC	8A 240V AC 8A 30V DC	10A 240V AC 10A 30V DC	5A 240V AC 5A 30V DC	5A 240V AC 5A 30V DC	2.5A 240V AC 2.5A 30V DC
Carry current	16A		10A		5A	
Max. operating voltage	380V AC, 120V DC					
Max. operating current	16A		10A		5A	
Max. switching capacity	3,520VA, 480W	1,760VA, 240W	2,200VA, 300W	1,100VA, 150W	1,100VA, 150W	550VA, 75W
Material	AgCdO					
Contact resistance	Less than 50mΩ (initial value)					

SPECIFICATIONS

Operate time		15m sec. max.
Release time		10m sec. max.
Breakdown voltage		1,000V AC (60Hz) for 1 minute between open contacts 4,000V AC (60Hz) for 1 minute between coil and contacts
Insulation resistance		More than 1,000 MΩ at 500V DC
Vibration resistance		10 ~ 55 Hz at double amplitude of 1.5 mm
Shock resistance		10G min.
Ambient temperature range		-40°C ~ +65°C
Operating speed		1,800 operations/hour
Life	Mechanical	Over 10,000,000 operations
	Electrical (R load)	Over 100,000 operations
Weight		Approx. 17 grs (PR-1), Approx. 22 grs (PRQ)

ORDERING INFORMATION

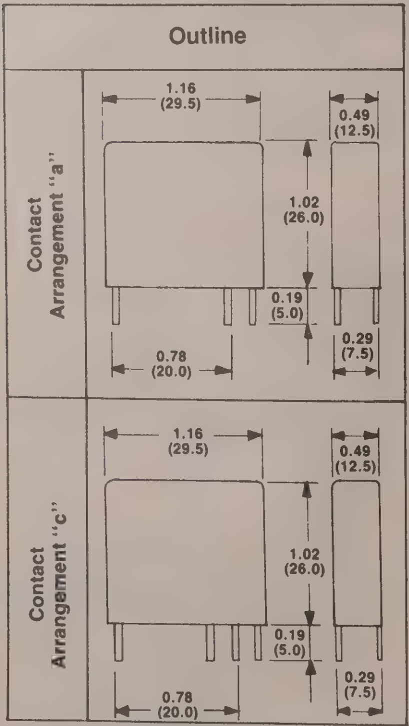


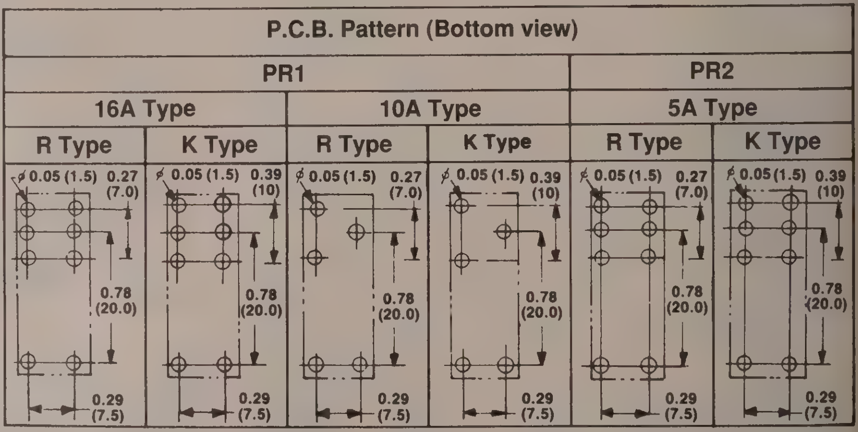
PR – ☐ – ☐ – ☐ – R

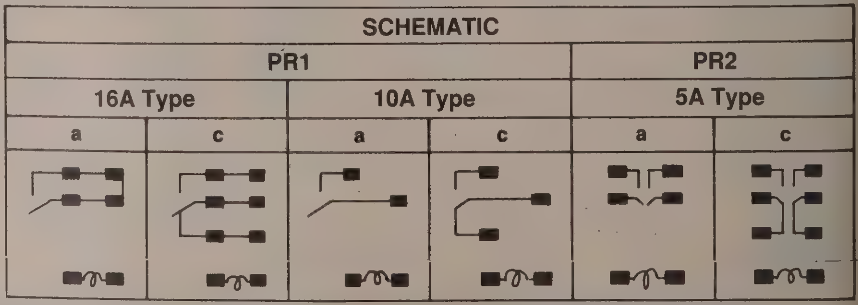
CONTACT ARRANGEMENT	CONTACT RATING	RATED COIL VOLTAGE	POLE DISTANCE
1c, 1a 2c, 2a	16 10 5	5 24 6 48 12	R: 3.5 mm K: 5 mm

Dimensions and Schematics PR

Unit: inch (mm)


Outline
Contact Arrangement "a"
Contact Arrangement "c"
1.16 (29.5)
0.49 (12.5)
1.02 (26.0)
0.19 (5.0)
0.78 (20.0)
0.29 (7.5)


P.C.B. Pattern (Bottom view)
PR1
PR2
16A Type
10A Type
5A Type
R Type
K Type
ø 0.05 (1.5)
0.27 (7.0)
0.39 (10)
0.78 (20.0)
0.29 (7.5)


SCHEMATIC
PR1
PR2
16A Type
10A Type
5A Type
a
c

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- OTTO
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- Unimax

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- Guardian
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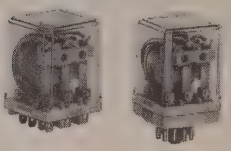
RR Series



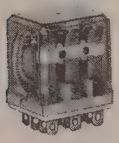
Contacts
Form: 1C, 2C, 3C
Current: 10A
Rating: 10A, 240V AC (Resist.)
1/3 HP @ 240V
1/4 HP @ 120V
10A/30V DC (Resist.)
Material: Silver
Resistance: 30mΩ, max.

Nominal Operating Voltages And Coil Resistance (Ω)
6V AC: 4.9
12V AC: 18
24V AC: 79
120V AC: 2100
240V AC: 8330
Power Consumption: 2.5VA

6V DC: 25
12V DC: 100
24V DC: 400
48V DC: 1600
110V DC: 8460
Power Consumption: 1.5W

Operating Temperature
-30° C to +70° C
Life Expectancy
Mechanical: 10,000,000
Electrical: 500,000
Terminals
Pin & Blade/Plug-In
Compatible IDEC Socket
SR Series

RH Series



Contacts
Form: 1C, 2C, 3C, 4C
Current: 10A
Rating: 10A, 240V AC (Resist.)
1/3 HP @ 240V
1/6 HP @ 120V
10A/30V DC (Resist.)
Material: Silver Cadmium Oxide
Resistance: 50mΩ, max.

***Nominal Operating Voltages And Coil Resistance (Ω)**
6V AC: 9.4
12V AC: 39.3
24V AC: 153
120V AC: 4170
240V AC: 15210

6V DC: 40
12V DC: 160
24V DC: 650
48V DC: 2600
110V DC: 12100

*Specification for 2C version.

Power Consumption: 1.2VA

Power Consumption: 0.9W

Operating Temperature
-30° C to +70° C
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
Blade/Plug-In
P.C. Mount
Compatible IDEC Socket
SH Series

RY Series

Contacts
Form: 2C, 4C
Current: 5A
Rating: 5A, 240V AC (Resist.)
5A/30V DC (Resist.)
Material: Silver (Gold Plated)
Resistance: 50mΩ, max.

***Nominal Operating Voltages And Coil Resistance (Ω)**
6V AC: 9.4
12V AC: 39.3
24V AC: 153
120V AC: 4170
240V AC: 15210

6V DC: 40
12V DC: 160
24V DC: 650
48V DC: 2600
110V DC: 12100

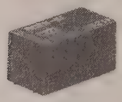
*Specifications for 4C version.

Power Consumption: 1.2VA

Power Consumption: 0.9W

Operating Temperatures
-30° C to +70° C
Life Expectancy
Mechanical: 50,000,000
Electrical: 200,000
Terminals
Solder/Plug-In
P.C. Mount
Compatible IDEC Socket
SY Series

RD Series

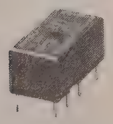


Contacts
Form: 2C
Current: 1.25A, max.
Material: Silver(Gold-Clad)
Resistance: 100mΩ, max.
Surge Withstand Voltage: 1500V (FCC)

Nominal Operating Voltages And DC Coil Resistance (Ω)
3V DC: 22.5
5V DC: 62.5
6V DC: 90
12V DC: 360
24V DC: 1440
48V DC: 4000
Power Consumption:
400mW, 510mW (48V DC)

Operating Temperature
-30 C° to +70° C
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
P.C. Mount

RW Series

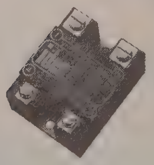


Contacts
Form: 2C
Current: 2A, max.
Material: Silver (Gold-Clad)
Resistance: 50mΩ, max.
Surge Withstand Voltage: 1500V (FCC)

Nominal Operating Voltages And DC Coil Resistance (Ω)
1.5V DC: 11.3
3V DC: 45
5V DC: 125
6V DC: 180
12V DC: 720
24V DC: 2880
Power Consumption: 200mW

Operating Temperature
-30 C to +70 C
Life Expectancy
Mechanical: 100,000,000
Electrical: 500,000
Terminals
P.C. Mount

RSS Series



Input (DC)
Voltage Range: 3-32V DC
Turn -ON/Turn-Off Voltage: 3V/1V DC
Isolation Voltage: 4000V AC (Input to Output)
Output (AC)

Current Ratings:	10A	25A	40A
1 Cycle Surge Peak:	100A	250A	650A

Voltage Range: 24-330V AC
Voltage Drop-Out @ Rated Current: 1.5V max.
Over Voltage Rating: 600PIV

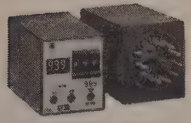
Input (AC)
Voltage Range: 90-280V AC
Turn-On/Turn-Off Voltage: 80V/20V AC
Isolation Voltage: 4000V AC (Input to Output)
Output (AC)

Current Ratings:	10A	25A	40A
1 Cycle Surge Peak:	100A	250A	650A

Voltage Range: 24-330V AC
Voltage Drop-Out @ Rated Current: 1.5V max.
Over Voltage Rating: 600 PIV

For Complete Information On IDEC Relays, Sockets & Time Delay Relays See Catalog No. U900.

GT3D - *New*



Contacts

Form: Delayed SPDT
Delayed SPDT +
Instantaneous SPDT
Delayed DPDT

Output: 250V AC, 5A
30V DC, 5A

Operating Voltages:
100-240V AC
12V AC/DC
24V AC/DC

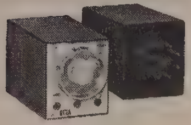
Operation Modes
- ON-Delay, Interval, Cycle, Cycle-ON
- ON-Delay (2 types), Cycle (2 types), Signal ON/OFF Delay (3 types), Interval (2 types), One-Shot (2 types), Signal OFF Delay (2 types), Cycle-ON, One-Shot ON-Delay, One-Shot Cycle (w/input)
- ON-Delay 1, ON-Delay 2, Cycle (One-shot output) (w/input)

Timing

Time Range: 0.01 sec to 99.9 hrs
Repeat Accuracy: 0.3%
Reset Time: 60 msec, max.
Terminals: 8-/11-Pin, Plug-In

Compatible IDEC Socket
SR Series
(Optional panel mount adaptor available.)

GT3A Series



Contacts

Form: Delayed SPDT
Delayed SPDT +
Instantaneous SPDT
Delayed DPDT

Output: 250V AC, 5A
30V DC, 5A

Operating Voltages:
100-240V AC
12V AC/DC
24V AC/DC

Operation Modes

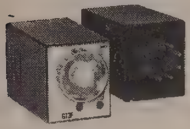
Multi-Mode
- ON-Delay, Interval, Cycle, Cycle ON
- ON-Delay, Cycle, Signal ON/OFF, OFFDelay (w/Input)
- Interval ON, Single-Shot Cycle, Signal ON/OFF Delay, Signal OFF Delay (w/Input)
- Single-Shot, Single-Shot ON Delay, Single-Shot, Signal ON/OFF Delay (w/Input)

Timing

Time Range: 0.05 sec to 180 hrs
Repeat Accuracy: 0.2%
Reset Time: 60 msec, max.
Terminals: 8-/11-Pin, Plug-In

Compatible IDEC Socket
SR Series
(Optional panel mount adaptor available.)

GT3F Series



Contacts

Forms: Delayed SPDT
Delayed DPDT

Output: 250V AC, 5A
30V DC, 5A

Operating Voltages:
100-120V AC
200-240V AC
24V DC

Operation Modes
- Power OFF Delay
- Power OFF Delay (w/Reset Input)

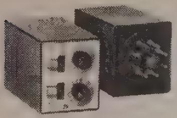
Timing

Time Range: 0.05 sec to 180 sec.
6 sec to 10 min
Repeat Accuracy: 0.2%

Terminals: 8-/11-Pin, Plug-In

Compatible IDEC Socket
SR Series
(Optional panel mount adaptor available.)

GT3W Series



Contacts

Form: Delayed SPDT +
Delayed SPDT

Output: 250V AC, 3A
30V DC, 1A

Operating Voltages:
100-120V AC
200-240 V AC
24V AC/DC

Operation Mode
- Recycle
(Dual Timing Adjustment)

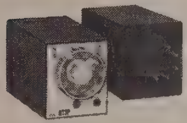
Timing

Time Range: 0.1 sec to 1 hr
0.6 sec to 6 hrs
Repeat Accuracy: 0.2%
Repeat Time: 0.1 sec, max.

Terminals: 8-/11-Pin, Plug-In

Compatible IDEC Socket
SR Series
(Optional panel mount adaptor available.)

GT3P Series



Contacts

Form: Triac One Circuit (AC)
Transistor
One Circuit (DC)

Output: 250V AC, 0.6A
28V DC, 100mA

Operating Voltages:
100-240V AC
24 V AC/DC

Operation Modes
- Sequence
(Variable Ratio Duty)

Timing

Time Range: 0.01 sec to 10 min
Duty Ratio: 0 to 100% variable
Repeat Accuracy: 0.2%
Reset Time: 60 msec, max.

Terminals: 8-/11-Pin; Plug-In

Compatible IDEC Socket
SR Series
(Optional panel mount adaptor available.)

RTE Series

Contacts

Form: DPDT

Output: 240V AC, 10A
30V DC, 10A

Operating Voltages:
120V AC
12V AC/DC
24V AC/DC

Operation Modes
- ON Delay, Interval
- OFF Delay, Single Shot**Timing**

Time Range: 1 sec to 10 hrs
Repeat Accuracy: 0.2%
Reset Time: 0.1 sec, max.

Terminals: 8-Pin/Blade, Plug-In
11-Pin/Blade, Plug-In

Compatible IDEC Socket
SR Series
(Optional panel mount adaptor available.)

DIN Rail Mount Sockets (IDEC offers a complete line of "Finger-Safe" DIN rail mount sockets, panel and PC mount sockets)

SR Series

Type: 2-Pole, 8-Pin Plug-In
3-Pole, 11-Pin Plug-In
Ratings: 10A/300V, 15A/300V

SH Series

Type: 1-4 Pole, Blade, Plug-In
Ratings: 10A/300V

SY Series

Type: 2 & 4-Pole, Solder, Plug-In
Ratings: 7A/300V

For Complete Information On IDEC Relays, Sockets & Time Delay Relays See Catalog No. U900.

INSTRUMENTATION & CONTROL SYSTEMS, INC. ICS

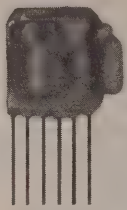
INSTRUMENTATION & CONTROL SYSTEMS, INC.
520 Interstate Rd. Addison, IL 60101
Phone 708-543-6200 FAX 708-543-6244

SOLID STATE DELAY TIMERS

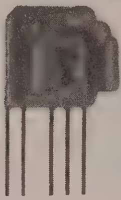
KH Series **Timing Module**/PC Mount

KH 1

KH 2



KH 3



Thick Film Hybrid Circuit, Miniature Size, Thick Conformal Coating, Printed Circuit Mounting, Time Ranges from .1 to 300 sec*, External Adjustable or Fixed Times.

OUTPUT CURRENT RATING: Action 1:10 ma. min, 100 max. Actions 2&3:10 ma. min. 500 ma .max.
REPEAT ACCURACY: Fixed conditions = ± 3 %, OVERALL ±10 %. over -10° to 70° C.
SIZE: Action 1 = 1.25"L x .6"W x .3" Thick. Action 2 & 3 = 1.25"L x 1.0" W x .5" Thick.

Ordering Code: KH ___ ___ ___

Timing Actions:

Timing Actions:	
ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3)
N/A in all voltages.	

Timing Ranges:

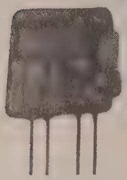
Standard:		Non-standard:	
.1 to 1 sec.	(1).	1 to 10 sec.	(5).
.5 to 5 sec.	(2).	5 to 50 sec.	(3).
3 to 30 sec.	(7).	6 to 60 sec.	(8).
30 to 300 sec.	(4).	12 to 120 sec.	(6).
		*Special time.	(0).

Input Voltages:

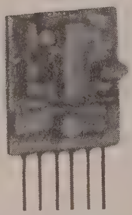
Standard:		Non-standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

KD Series **Digital Countdown Timer**/PC Mount

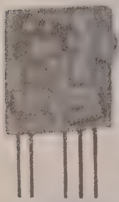
KD 1



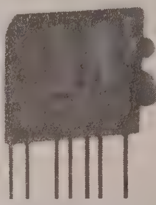
KD 2



KD 3
KD 5



KD 6



Digital Countdown Circuit, Miniature PC Board, Thick Conformal Coating, Printed Circuit Mounting, Time Ranges from .1 sec. to 10 hr.*, External Adjustable or Fixed Times.

OUTPUT CURRENT RATING: 20 ma. min, 500 max.
REPEAT ACCURACY: Fixed conditions = ± .5 %, OVERALL ± 3 %. over -10° to 70° C.
SIZE: Action 1 = 1.25" L x 1.0" W x .5" Thick Action 2, 3, 5 = 1.38" sq. x .5" Thick.
Action 6 = 2.0" L x 1.38" W x .5" Thick.

Ordering Code: KD ___ ___ ___

Action 6 "ON" time is inserted here.

Timing Actions:

Timing Actions:	
ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3).
RECYCLE Timer (OFF & ON times are equal; single adjustment).	(5)
RECYCLE Timer (OFF & ON times independently adjustable).	(6)

Timing Ranges:

Standard:		Non-standard:	
.1 to 10 sec.	(1).	10 - 600 min.	(3).
.1 to 60 sec.	(4).	*Special time	(0).
10 to 600 sec.	(2).		
1 to 60 min.	(5).		

Input Voltages:

Standard:		Non standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

Custom Engineered Electronic Controls and Sensors

INFRARED SENSOR

Our Infrared Proximity Sensor is one of the latest developments where hygiene is a vital issue, such as in restaurants, hospitals, and public washrooms. When the IR beam detects an object it turns on a device. A preset timer turns off the device. This design provides the engineer with a myriad range of new product development possibilities. The touchless concept is currently being extended to include hand dryers, soap dispensers, automatic water-flow control, and closet flushers.

MODULAR TIMER ASSEMBLY

A PC Board using the standard ICS, Inc. timing modules may be designed to fit a customer's logic controls criteria.

SOLID STATE SEQUENCE CONTROL

A custom designed sequence control is used to overcome the critical problem of occluded surfaces in industrial dust collection cyclones. Another type of sequencer designed and manufactured by ICS, Inc. controls the crucial directional strobe lights used at airports.

SOLID STATE SENSORS AND TIMING CONTROLS

Current Sensing Relays & Monitors, Voltage Sensors, Motor Speed Controls, Machine Controls, Timing Controls, True Off Delay TDR, Flashers, Vending Controls, Garbage Compactor, Incinerator, and Dispensing Controls.

MICROPROCESSOR CONTROLS

PROVEN RELIABILITY FOR 25 YEARS

INSTRUMENTATION & CONTROL SYSTEMS, INC. ICS

INSTRUMENTATION & CONTROL SYSTEMS, INC.
520 Interstate Rd. Addison, IL 60101
Phone 708-543-6200 FAX 708-543-6244

TIME DELAY RELAYS

KG 1

KG 2
KG 3

KG Series **Time Delay Relay**/Chassis Mount

Thick Film Hybrid Timing Element, Heavy Duty Long Life Relay, Stand off for Chassis Mounting, 1/4" Quick Connect Terminals, Time Ranges from .1 to 300 sec*, On Board Time Adjustment Pot.

OUTPUT RELAY RATING: 10 Amps resistive or 1/3 HP @ 120 VAC.
REPEAT ACCURACY: Fixed conditions = ± 3 %, OVERALL ±10%. over -10° to 70° C.
SIZE: 2.1" sq. x 1.8" high, 1/4" Q.C. terminals.

Ordering Code: KG ___ ___ ___

Timing Actions:

ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3)

N/A in all voltages.

Timing Ranges:

Standard:		Non-standard:	
.1 to 1 sec.	(1).	1 to 10 sec.	(5).
.5 to 5 sec.	(2).	5 to 50 sec.	(3).
3 to 30 sec.	(7).	6 to 60 sec.	(8).
30 to 300 sec.	(4).	12 to 120 sec.	(6).
		*Special time.	(0).

Input Voltages:

Standard:		Non-standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

OP41
OP43

OP42

OP4 Series **Time Delay Relay**/ Plug In

Thick Film Hybrid Timing Element, Heavy Duty Long Life Relay, Enclosed Octal Plug In Base, LED Operation Indicator, Time Ranges from .1 to 300 sec*, Built in Time Adjustment Pot with Knob.

OUTPUT RELAY RATING: 10 Amps resistive or 1/3 HP @ 120 VAC.
REPEAT ACCURACY: Fixed conditions = ± 3 %, OVERALL ±10 %. over -10° to 70° C.
SIZE: 2.0 " sq. x 4.0" high, Action 1 & 3= 8 pin octal base. Action 2 = 11 pin round base.

Ordering Code: OP4 ___ ___ N ___

Timing Actions:

ON Delay	(1).
OFF Delay	(2).
INTERVAL Delay	(3)

N/A in all voltages.

Timing Ranges:

Standard:		Non-standard:	
.1 to 1 sec.	(1).	1 to 10 sec.	(5).
.5 to 5 sec.	(2).	5 to 50 sec.	(3).
3 to 30 sec.	(7).	6 to 60 sec.	(8).
30 to 300 sec.	(4).	12 to 120 sec.	(6).
		*Special time.	(0).

Input Voltages:

Standard:		Non-standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

OP45

OP46

OP4 Series **Recycle Timer**/ Plug In

Digital Countdown Timing Module, Heavy Duty Long Life Relay, Enclosed Octal Plug In Base, LED Operation Indicator, Time Ranges from .1 to 10 hrs*, Built in Time Adjustment Pot with Knob.

OUTPUT RELAY RATING: 10 Amps resistive or 1/3 HP @ 120 VAC.
REPEAT ACCURACY: Fixed conditions = ± .5 %, OVERALL ± 3 %. over -10° to 70° C.
SIZE : Action 5 = 2.0" sq. x 4.0" high, Action 6 = 1.8" W x 2.4" L x 3.6" H, 8 pin octal base.

Ordering Code: OP4 ___ ___ ___ ___

For action 5, insert "N" here.
For action 6, insert time range here.

Timing Actions:

RECYCLE Timer (OFF & ON times are equal, single adjustment).	(5)
RECYCLE Timer (OFF & ON times independently adjustable).	(6)

Timing Ranges:

Standard:		Non-standard:	
.1 to 10 sec.	(A).	10 - 600 min.	(C).
1 to 60 sec.	(D).	*Special time	(0).
10 to 600 sec.	(B).		
1 to 60 min.	(E).		

Input Voltages:

Standard:		Non standard:	
24 VAC	(2).	12 VAC	(7).
120 VAC	(1).	240 VAC	(5).
12 VDC	(8).	48 VDC	(6).
24 VDC	(4).	110 VDC	(3).

International IOR Rectifier

MICROELECTRONIC POWER IC RELAYS

ChipSwitch® Solid State Relay

UL, CSA, VDE Rated

The ChipSwitch relays utilize power integrated circuits for AC power line switching while maintaining turn-on at zero voltage crossing and turn-off at zero current crossing. They are a compact, low cost, and highly reliable interface for isolating and switching AC loads such as solenoids, valves, lamps, contactors, small motors, and heaters from low level DC signals.

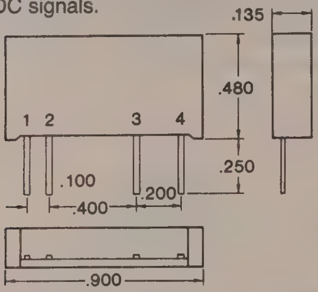


Figure 1 ChipSwitch SP

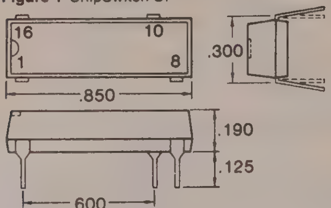


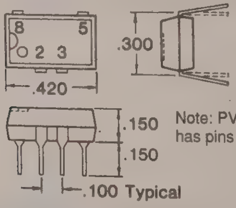
Figure 2 ChipSwitch DP

SERIES	PART NUMBER	Operating Voltage Range V(RMS)	Max. Load Current @40°C A(RMS)	Trans. Over-Volt V(Pk)	Turn-On Signal (DC)	Outline Drawing	Tech. Bulletin No.
SP 1 FORM A	SP1110	20-140	1.0 Free Standing 3.0 With Heat Sink	300	5mA	Figure 1	MPIC-4
	SP1210	20-140		300	10mA		
	SP2110	20-280		450	5mA		
	SP2210	20-280		450	10mA		
	SP6110	20-280		600	5mA		
	SP6210	20-280		600	10mA		
DP 1 FORM A	DP1110	20-140	1.0	300	5mA	Figure 2	MPIC-4
	DP1210	20-140		300	10mA		
	DP1610	20-140		300	3.5V		
	DP2110	20-280		450	5mA		
	DP2210	20-280		450	10mA		
	DP2610	20-280		450	3.5V		
	DP6110	20-280		600	5mA		
	DP6210	20-280		600	10mA		
	DP6610	20-280		600	3.5V		
CS 1 FORM A	CS5005	20-280	0.3	500	5mA	Figure 3	MPIC-4
	CS5010	20-280		500	10mA		
	CS6005	20-280		600	5mA		
	CS6010	20-280		600	10mA		

GENERAL CHARACTERISTICS	SP	DP	CS	UNITS
Dielectric Strength Input/Output	4000			VRMS
Min. off state dv/dt @ rated V 25°C	600		1200	V/µ sec
Max. off state leakage	10			µ A
Power factor range	0.2 to 1	0.2 to 1	0.2 to 1	—
Ambient operating temperature	−30 to +85			°C

BOSFET® PhotoVoltaic Relay

International Rectifier Photo-Voltaic Relays utilize a unique power integrated circuit termed a BOSFET to form a solid state replacement for signal level electromechanical relays. They feature high speed, zero offset voltage, low pick-up power, miniaturization, and are widely applied in instrumentation, multiplexing, automatic test equipment, thermocouple switching and telecommunications for general purpose switching of AC/DC analog and digital signals. The PVI isolators provide a DC output with a 2500VAC isolation level for driving MOSFETs, IGBTs and serving as an isolated DC bias.



Note: PVI1050 has pins 6, 7.

Figure 3 ChipSwitch CS, BOSFET PVD, PVA & PVI

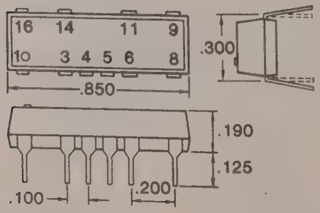
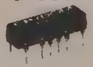
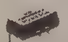
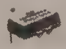
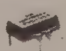


Figure 4 BOSFET PVR

SERIES	PART NUMBER	Operating Voltage Range V(Pk)	Max. On-State Res. @25°C Ohms AC	Max. On-State Res. @25°C Ohms DC	Max. Load Current @40°C (DC) mA	Nom. Control Current (DC) mA	Min. Off-State Res. Ohms	Outline Drawing	Tech. Bulletin No.
PVR  2 FORM A	PVR1300	±100	5.0	1.5	700	10	10^8	Figure 4	MPIC-4
	PVR1301	±100	5.0	1.5	700		10^{10}		
	PVR2300	±200	24	6.0	260		10^8		
	PVR3300	±300	24	6.0	260		10^8		
	PVR3301	±300	24	6.0	260		10^{10}		
PVA  1 FORM A	PVA1052	±100	35	35	70	5.0	10^8	Figure 3	MPIC-4
	PVA1054	±100	35	35	70	5.0	10^{10}		
	PVA1352	±100	5.0	5.0	315	5.0	10^8		
	PVA1354	±100	5.0	5.0	315	5.0	10^{10}		
	PVA2352	±200	24	24	130	5.0	10^8		
	PVA3054	±300	160	160	40	5.0	10^{10}		
	PVA3055	±300	160	160	40	5.0	10^{11}		
	PVA3324	±300	24	24	130	2.0	10^{10}		
	PVA3354	±300	24	24	130	5.0	10^{10}		
	PVAZ172	±60	0.5	0.5	1000	10	10^8		
PVD  1 FORM A	PVD1052	+100		8.0	160	5.0	10^8	Figure 3	MPIC-4
	PVD1054	+100		8.0	160	5.0	10^{10}		
	PVD1352	+100		1.5	500	5.0	10^8		
	PVD1354	+100		1.5	500	5.0	10^{10}		
	PVD2352	+200		6.0	220	5.0	10^8		
	PVD3354	+300		6.0	220	5.0	10^{10}		
	PVDZ172	+60		0.25	1400	10	10^8		

SERIES	PHOTOVOLTAIC ISOLATOR							
		Number Outputs	Output Volts(DC)	Short Circuit Current (µA)				
PVI 	PVI1050	2	5.0/10	10/5.0	10	—	Figure 3	MPIC-4
	PVI5100	1	5.0	10.0				

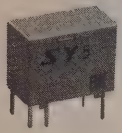
GENERAL CHARACTERISTICS	PVR	PVA	PVD	PVI	UNITS
Isolation Input/Output	1500	1500 and 2500		2500	VRMS
Min. off state dv/dt @ 25°C	1000			—	V/µ sec
Max. thermal offset voltage	0.2			—	µV
Output	AC or DC		DC		—
Ambient operating temp.	−40 to +85				°C

TAKAMISAWA ELECTRIC CO. LTD.

Sub Miniature Printed Circuit Board Relays

SY RELAYS

1 Amp SPDT
L — 0.492″,
W — 0.291″,
H — 0.374″



CONTACT DATA

Arrangement — 1 Form C

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial value)

Ratings — 0.5A, 120V AC or 1A, 24V DC (resistive) switched
2.0A carrying curent

Life Expectancy — Mechanical: Min. 5 million operations
Electrical: SY Min. 150,000 operations at rated load

COIL DATA

Voltages — 1.5 to 24V DC

Power (at 20°C) —
Operate — 0.075 watt
Nominal — 0.15 watt

Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 100 MΩ minimum at 500V DC

Dielectric Strength — 500V AC (50, 60 Hz), between open contacts
1000V AC between contacts and coil

Temperature Range — −40°C to +90°C

Time Values (approx.) — Operate 1.5 mS, Release 1 mS (at nominal voltage)

Vibration Resistance — 20G (10 ~ 300 Hz) amplitude 3 mm

Shock Resistance — 50G

Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.)

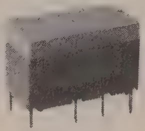
Approximate Weight — 1.7 gr (0.06 oz.)

Enclosure — Polybutylene terephthalate (PBT)

Nominal Coil Voltage	Coil Resistance	Operate Voltage	Type No.	List Price
1.5	15	1.05	SY-15-K	$2.89
3	60	2.1	SY-3-K	$2.89
5	**167**	**3.5**	**SY-5-K**	**$2.89**
6	240	4.2	SY-6-K	$2.89
9	540	6.3	SY-9-K	$2.89
12	**960**	**8.4**	**SY-12-K**	**$2.89**
24	3290	16.8	SY-24-K	$2.89

RY RELAY

1 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.472″



CONTACT DATA

Arrangement — 2 Form C, 2 Form D

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial)

Ratings — 0.5A 120V AC or 1A 24V DC (resistive)

Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 1A 24V DC
Min. 200,000 operations at 0.5A 120V AC

COIL DATA

Voltages — 4.5 to 48V DC

Power (at 20°C) —
Operate — 0.075 watt (0.098 watt for 18V, 24V coil, 0.138 watt for 48V coil)
Nominal — 0.15 watt (0.2 watt for 18V, 24V coil, 0.3 watt for 48V coil)

Operate (at 20°C) — 68 ~ 71% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ min. at 500V DC

Dielectric Strength — 500V AC between open contact
1000V AC between all other conductors

Temperature Range — −40°C ~ +85° at nominal voltage

Surge Strength — 1500V between all conductors

Time Values (max.) — Operate 6 ms, Release 3 ms at nominal voltage

Vibration Resistance — 10G (10 ~ 55 Hz)

Shock Resistance — 10G 11 ±1 ms) — Unerror, 100G (6 ±1 ms) — Destruction

Enclosure — Polybutylene terephthalate (PBT)

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
B-M (2 form C) Sensitive Type					
5	**3.6**	**12.5**	**167**	**RY-5W-K**	**$3.42**
6	4.3	15.0	240	RY-6W-K	$3.42
9	6.4	22.5	540	RY-9W-K	$3.42
12	**8.5**	**30.0**	**960**	**RY-12W-K**	**$2.47**
24	**16.8**	**51.6**	**2880**	**RY-24W-K**	**$3.77**
48	32.6	84.0	7680	RY-48W-K	$4.40
M-B (2 form D)					
5	**3.3**	**7.1**	**55**	**RY-5D-K**	**$3.77**
6	4.0	8.5	80	RY-6D-K	$3.77
9	5.9	12.8	180	RY-9D-K	$3.77
12	**7.9**	**17.0**	**320**	**RY-12D-K**	**$3.77**
24	**15.8**	**34.1**	**1280**	**RY-24D-K**	**$3.77**
48	31.8	65.8	4800	RY-48D-K	$4.75
B-M (2 form C) Standard Type					
5	**2.5**	**7.0**	**45**	**RY-5WZ-K**	**$3.33**
6	**3.0**	**8.4**	**66**	**RY-6WZ-K**	**$3.33**
9	4.5	12.6	140	RY-9WZ-K	$3.33
12	**6.0**	**16.8**	**280**	**RY-12WZ-K**	**$3.33**
24	**12.0**	**33.6**	**1070**	**RY-24WZ-K**	**$3.60**
48	**24.0**	**67.2**	**4000**	**RY-48WZ-K**	**$4.26**

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TAKAMISAWA
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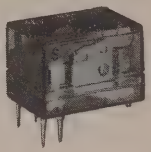
Sub Miniature Printed Circuit Board Relays

MZ RELAY



2 Amp SPDT
L — 0.606",
W — 0.449,
H — 0.433"

CONTACT DATA

Arrangement — 1 Form C

Material — Gold overlay silver-palladium alloy

Resistance — 100 milliohms maximum (initial value)

Ratings — 50µ amps to 1 amp at 30V DC or 120V AC, resistive
2A maximum carrying current

Life Expectancy — Mechanical: 20 million operations
Electrical: 500,000 operations minimum at 1 amp 24V DC resistive load
200,000 operations minimum at 0.5 amps 120V AC resistive load

COIL DATA

Voltages — 1.5 to 24 volts DC

Power (at 20°C) —
Standard type: Operate—0.22 watt, Nominal—0.45 watt, Maximum—1 watt
High sensitive type: Operate—0.1 watt, Nominal—0.2 watt, Maximum—1 watt

Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 100 megohms minimum at 500V DC

Dielectric Strength — 500V AC (50/60 Hz), between all insulated elements

Temperature Range — Standard type: −40°C to +55°C
(at nominal voltage) High sensitive type: −30°C to +75°C

Time Values — Operate <3 ms standard, <6 ms sensitive; release <1 ms

Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2.5 mm (0.98 in.)

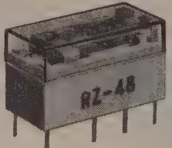
Approximate Weight — 3.5 gr. (0.12 oz.)

Enclosure — Standard — polycarbonate
Washable or sealed — PBT

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard Types – 1A					
1.5	1.05	2.0	5	MZ-1.5HG-U	$2.66
3	2.1	4.1	20	MZ-3HG-U	$2.66
5	**3.5**	**6.8**	**56**	**MZ-5HG-U**	**$2.66**
6	4.2	8.1	80	MZ-6HG-U	$2.66
9	6.3	12.2	180	MZ-9HG-U	$2.66
12	**8.4**	**16.2**	**320**	**MZ-12HG-U**	**$2.66**
24	**16.8**	**32.4**	**1280**	**MZ-24HG-U**	**$2.66**
High Sensitive Types – 1A					
1.5	1.05	3.0	12	MZ-1.5HS-U	$2.84
3	2.1	6.0	45	MZ-3HS-U	$2.84
5	**3.5**	**10.0**	**120**	**MZ-5HS-U**	**$2.84**
6	**4.2**	**12.0**	**180**	**MZ-6HS-U**	**$2.84**
9	6.3	18.0	400	MZ-9HS-U	$2.84
12	**8.4**	**24.0**	**700**	**MZ-12HS-U**	**$2.84**
24	**16.8**	**48.0**	**2800**	**MZ-24HS-U**	**$2.84**
Standard Types – 2A					
3	2.1	4.1	28	MZD-3-U	$2.84
5	3.5	6.8	56	MZD-5-U	$2.84
6	4.2	8.1	80	MZD-6-U	$2.84
9	6.3	12.2	180	MZD-9-U	$2.84
12	**8.4**	**16.2**	**320**	**MZD-12-U**	**$2.84**
24	16.8	32.4	720	MZD-24-U	$2.84

RZ RELAYS



2 Amp DPDT
L — 0.795",
W — 0.386",
H — 0.457"

CONTACT DATA

Arrangement — DPDT (B-M) — RZ, RZ( )W Type

Material — Gold overlaid silver-palladium alloy

Max. Switching Power —
30W/60VA — Single Contact
30W/50VA — Bifurcated contact at resistive load

Max. Switching Current —
2A AC or DC — Single Contact
1A AC or DC — Bifurcated contact at resistive load

Max. Switching Voltage —
150V DC/125V AC — Single Contact
100V DC/90V AC — Bifurcated contact at resistive load

Contact Resistance (Pin-pin) — 100mΩ Max.

Capacitance — 1.5PF max. between open contact
0.5PF max. between adjacent change-over contact

Life Expectancy —
Mechanical: 20 million operations — Single Contact
15 million operations — Bifurcated contact
Electrical: 0.5 million operations at 1.25A 24V DC or 0.4A 125V AC at resistive load — Single contact
0.5 million operations at 0.7A 24V DC or 0.25A 125V AC at resistive load — Bifurcated contact

COIL DATA

Nominal Voltage — 3 to 48 V DC — RZ, RZ( )W Type,
3 to 24V DC — RZ1, RZ1( )W Type

Power (at 20°C) — Nominal: 515 ~ 560 mW — RZ, RZ( )W Type,
Operate: 200 ~ 324 mW — RZ, RZ( )W Type
Max: 1050 mV

Temperature Range — −40°C ~ +65°C — RZ RZ( )W Type
(at nominal voltage) −40°C ~ +75°C — RZ1 RZ1( ) Type

GENERAL DATA

Dielectric Strength — 500V AC (50/60 Hz) between open contacts, 1000V AC contact-coil

Insulation Resistance — 1000 MΩ min. at 500V DC

Timing — Operate <4 ms, release <2

Bounce Time — Approx. 1 ms on operate
Approx. 4 ms on release

Vibration Resistance — 10 to 60 Hz amplitude 1.5 mm (10G)

Shock Resistance — Destruction shock: 100G (11 ms ±1 ms)
Unerror shock: 10G (11 ms ± 1 ms)

Surge Strength — 1500V AC between all conductors

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Single Contact					
5	**3.2**	**7.0**	**45**	**RZ-5-C**	**$3.51**
6	**3.8**	**8.4**	**66**	**RZ-6-C**	**$3.51**
9	5.1	12.6	140	RZ-9-C	$3.51
12	**7.6**	**16.8**	**280**	**RZ-12-C**	**$3.51**
24	**15.2**	**33.6**	**1070**	**RZ-24-C**	**$3.64**
48	**36.0**	**67.2**	**4000**	**RZ-48-C**	**$4.48**
Bifurcated Contact					
5	3.2	7.0	45	RZW-5-C	$3.60
6	3.8	8.4	66	RZW-6-C	$3.60
9	5.7	12.6	140	RZW-9-C	$3.60
12	**7.6**	**16.8**	**280**	**RZW-12-C**	**$3.60**
24	15.2	33.6	1070	RZW-24-C	$3.73
48	36.0	67.2	4000	RZW-48-C	$4.57

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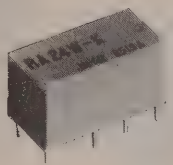
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

RA RELAY



1 Amp DPDT Relay
L — 0.795″
W — 0.394″
H — 0.394″

CONTACT DATA

Arrangement — 2 Form C (DPDT)
Material — Gold overlaid silver palladium alloy vs silver palladium alloy
Resistance — Max. 100 mΩ (Initial)
Rating — 24V DC 2A, or 120V AC 0.5A
Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 24V DC 1A
Min. 200,000 operations at 120V AC 0.5A
Max. Carrying Current — 2A

COIL DATA

Voltages — 1.5 to 48V DC

Power (at 20°C) — Operate:

Operate:	Standard	100–200 mW
	Single winding latching	35~100 mW
	Double winding latching	75~180 mW
Nominal:	Standard	200~400 mW
	Single winding latching	75~200 mW
	Double winding latching	150~360 mW

Operate (at 20°C) — Less than 70% of nominal voltage
Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ at 500V DC
(Expect between P & S coil)
Dielectric Strength — 1000V AC between open contact
1500V AC between all other conductors
(Expect between P & S coil)
Temperature Range — −40°C~+80°C (RA-W, RA-WN, RAL-W, RAL-DW, RAL-WP, RAL-DWP)
−40°C~+70°C (RA-WM, RAL-DWM), at nominal voltage, Non charring Contact
Surge Strength — 1500V between coil and contact, adjacent contacts
Time Value (Max.) — Operate: (RA-WM, RAL-DWM) 4 mS
(RA-W, RA-WN, RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS
Release: (RA-WM) 3 mS
(RA-W, RA-WN, RAL-DWM) 4 mS
(RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS, at nominal voltage
Vibration Resistance — 30G (10~55 Hz) Unerror
30G (10~55 Hz) Destruction
Shock Resistance — 50G (11 ±1 mS) Unerror
100G (11 ±1 mS) Destruction
Enclosure — Polybutylene terephthalate (PBT)

RA( )W-K TYPE

Non-Latching

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA 1.5W-K	1.5	15	+1.0	+0.15	$4.08
RA 3W-K	3	60	+2.0	+0.3	$4.08
RA 4.5W-K	4.5	135	+3.1	+0.45	$4.08
RA 5W-K	**5**	**167**	**+3.4**	**+0.5**	**$4.08**
RA 6W-K	6	240	+4.0	+0.6	$4.08
RA 9W-K	9	540	+6.1	+0.9	$4.08
RA 12W-K	**12**	**900**	**+8.1**	**+1.2**	**$4.08**
RA 18W-K	18	2160	+12.3	+1.8	$4.08
RA 24W-K	**24**	**2880**	**+16.1**	**+2.4**	**$4.08**
RA 48W-K	**48**	**11520**	+32.2	+4.8	$5.11

RA( )W-K TYPE) (Continued)

Single Winding Latching

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RAL 1.5W-K	1.5	30	+1.0	−1.0	$4.53
RAL 3W-K	3	120	+2.1	−2.1	$4.53
RAL 4.5W-K	4.5	270	+3.1	−3.1	$4.53
RAL 5W-K	5	335	+3.4	−3.4	$4.53
RA 6W-K	6	480	+4.1	−4.1	$4.53
RAL 9W-K	9	1080	+6.3	−6.3	$4.53
RAL 12W-K	**12**	**1920**	**+8.3**	**−8.3**	**$4.53**
RAL 18W-K	18	4320	+12.5	−12.5	$4.53
RAL 24W-K	24	5760	+16.6	−16.6	$4.53
RAL 48W-K	48	11520	+21.0	−21.0	$5.55

Double Winding Latching

Ordering Code	Nominal Coil Voltage (VDC)		Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RAL D1.5W-K	1.5	P/S	15	+1.0*	+1.0*	$4.84
RAL D3W-K	3	P/S	60	+2.0*	+2.0**	$4.84
RAL D4.5W-K	4.5	P/S	135	+3.1*	+3.1**	$4.84
RAL D5W-K	**5**	**P/S**	**167**	**+3.4***	**+3.4****	**$4.84**
RAL D6W-K	6	P/S	240	+4.0*	+4.0**	$4.84
RAL D9W-K	9	P/S	540	+6.1*	+6.1*	$2.84
RAL D12W-K	**12**	**P/S**	**960**	**+8.1***	**+8.1****	$4.84
RAL 18W-K	18	P/S	2160	+12.3*	+12.3*	$4.84
RAL D24W-K	**24**	**P/S**	**2880**	**+16.1***	**+16.1****	**$4.84**
RAL D48W-K	48	P/S	11520	+32.2*	+32.2*	$7.77

RA( )WN-K TYPE

Non-Latching

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA 1.5WN-K	1.5	11.3	+1.0	+0.15	$4.00
RA 3WN-K	3	45	+2.0	+0.3	$4.00
RA 4.5WN-K	4.5	100	+3.1	+0.45	$4.00
RA 5WN-K	5	125	+3.4	+0.5	$4.00
RA 6WN-K	6	180	+4.0	+0.6	$4.00
RA 9WN-K	9	405	+6.1	+0.9	$4.00
RA 12WN-K	12	720	+8.1	+1.2	$4.00
RA 18WN-K	18	1620	+12.3	+1.8	$4.00

Double Winding Latching

Ordering Code	Nominal Coil Voltage (VDC)		Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RAL D1.5WN-K	1.5	P/S	12.5	+1.0*	+1.0**	$4.75
RAL D3WN-K	3	P/S	50	+2.0*	+2.0**	$4.75
RAL D4.5WN-K	4.5	P/S	113	+3.1*	+3.1**	$4.75
RAL D5WN-K	5	P/S	139	+3.4*	+3.4**	$4.75
RAL D6WN-K	6	P/S	200	+4.0*	+4.0**	$4.75
RAL D9WN-K	9	P/S	450	+6.1*	+6.1**	$4.75
RAL D12WN-K	12	P/S	800	+8.1*	+8.1**	$4.75
RAL D18WN-K	18	P/S	1800	+12.3*	+12.3**	$4.75

RA( )WM-K TYPE

Non-Latching

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA 1.5WM-K	1.5	5.63	+0.9	+0.15	$3.91
RA 3WM-K	3	22.5	+1.9	+0.3	$3.91
RA 4.5WM-K	4.5	50.6	+2.9	+0.45	$3.91
RA 5WM-K	**5**	**62.5**	**+3.3**	**+0.5**	**$3.91**
RA 6WM-K	6	90.0	+3.9	+0.6	$3.91
RA 9WM-K	9	203.0	+5.9	+0.9	$3.91
RA 12WM-K	**12**	**360.0**	**+7.9**	**+1.2**	**$3.91**
RA 18WM-K	18	810.0	+11.8	+1.8	$3.91
RA 24WM-K	**24**	**1440**	**+15.8**	**+2.4**	**$3.91**
RA 48WM-K	**48**	**5760**	**+31.6**	**+4.8**	**$4.88**

Double Winding Latching

Ordering Code	Nominal Coil Voltage (VDC)		Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RAL 1.5WM-K	1.5	P/S	6.2	+1.0*	+1.0**	$4.66
RAL D3WM-K	3	P/S	25	+2.0*	+2.0**	$4.66
RAL D4.5WM-K	4.5	P/S	56	+3.0*	+3.0**	$4.66
RAL D5WM-K	**5**	**P/S**	**69**	**+3.3***	**+3.3****	**$4.66**
RAL D6WM-K	6	P/S	100	+4.0*	+4.0**	$4.66
RAL D9WM-K	9	P/S	225	+6.0*	+6.0*	$4.66
RAL D12WM-K	**12**	**P/S**	**400**	**+8.0***	**+8.0****	**$4.66**
RAL 18WM-K	18	P/S	900	+12.0*	+12.0**	$4.66
RAL D24WM-K	**24**	**P/S**	**1600**	**+16.0***	**+16.0****	**$4.66**
RAL D48WM-K	48	P/S	6400	+32.1*	+32.1*	$7.64

Notes:
- If correct polarity is not applied to the coil terminals, relay does not operate properly.
- To release latched contact, polarity to be applied to coil terminals should be reversed.

* P only. ** S only.

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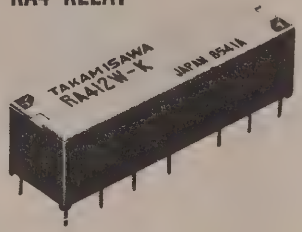
TAKAMISAWA
ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

RA4 RELAY

1 Amp 4PDT
L — 1.387",
W — 0.390",
H — 0.433"



CONTACT DATA

Arrangement — 4 Form C (4PDT)

Material — Gold overlaid silver palladium alloy vs silver palladium alloy

Resistance — Max. 100 mΩ

Ratings — 120V AC 0.5A, 24V DC 2A (Resistive)

Max. Current — 2A

Life Expectancy Mechanical — Min. 20 million operations

Electrical — Min. 500,000 operations at 24V DC
Min. 200,000 operations at 120V AC 0.5A

COIL DATA

Voltages — 1.5 to 48V DC Power (at 20°C)

Type	RA4, RA4L		RA4-M, RA4L-M	
	Operate	Nominal	Operate	Nominal
Single Winding Non Latching	0.1W	0.2W	0.2W	0.4W
Single Winding Latching	0.045W	0.09W		
Double Winding Latching	0.09W	0.18W	0.18W	0.36W

Operate (at 20°C) 70% of nominal voltage
Pulse Length—20ms min.

GENERAL DATA

Insulation Resistance — 1000 mΩ min. at 500V DC

Dielectric Strength — 1000V AC between open contacts
1500V AC btween all other conductors

Temperature Range — −40°C ~ +80°C (RA4, RA4L),
−40°C ~ +70°C (RA4-M, RA4L-M)

Surge Strength — 1500V between coil and contact, adjacent contacts

Time Value — Operate: 6 msec max.
Release: 4 msec max.

Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring

Shock Resistance — 100G (6 ±1 msec) Destructive
30G (11 ±1 msec) Unerring

} reference value

Enclosure — PBT

ORDERING INFORMATION

RA4 L D 12 W M —K
Enclosure K: Washable
Coil Sensitivity Nill: HighSensitive Power
M: Standard
Contact W: Bifurcated
Nominal Coil Voltage
Coil Winding Nill: Single Winding
D: Double Windings
Type of Relays Nill: Non Latching Type
L: Latching Type
Type

Ordering Code		Nominal Coil Voltage (VDC)		Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
Standard							
RA4	1.5W-K	1.5		11	+1.0	0.15	$ 9.01
RA4	3W-K	3		45	+2.1	0.3	$ 9.01
RA4	4.5W-K	4.5		101	+3.1	0.45	$ 9.01
RA4	**5W-K**	**5**		**125**	**+3.5**	**0.5**	**$ 9.01**
RA4	6W-K	6		180	+4.2	0.6	$ 9.01
RA4	9W-K	9		405	+6.3	0.9	$ 9.01
RA4	**12W-K**	**12**		**720**	**+8.4**	**1.2**	**$ 9.01**
RA4	18W-K	18		1620	+12.6	1.8	$ 9.01
RA4	**24W-K**	**24**		**2880**	**+16.8**	**2.4**	**$ 9.01**
RA4	**48W-K**	**48**		**11520**	**+33.6**	**4.8**	**$11.06**
RA4	1.5WM-K	1.5		5.63	+1.0	0.15	$ 8.57
RA4	3WM-K	3		22.5	+2.1	0.3	$ 8.57
RA4	4.5WM-K	4.5		50.6	+3.1	0.45	$ 8.57
RA4	**5WM-K**	**5**		**62.5**	**+3.5**	**0.5**	**$ 8.57**
RA4	6WM-K	6		90	+4.2	0.6	$ 8.57
RA4	9WM-K	9		203	+6.3	0.9	$ 8.57
RA4	**12WM-K**	**12**		**360**	**+8.4**	**1.2**	**$ 8.57**
RA4	18WM-K	18		810	+12.6	1.8	$ 8.57
RA4	**24WM-K**	**24**		**1440**	**+16.8**	**2.4**	**$ 8.57**
RA4	**48WM-K**	**48**		**5760**	**+33.6**	**4.8**	**$10.52**
Single winding latching							
RA4L	1.5W-K	1.5		25	+1.0	−1.0	$ 9.41
RA4L	3W-K	3		100	+2.1	−2.1	$ 9.41
RA4L	4.5W-K	4.5		225	+3.1	−3.1	$ 9.41
RA4L	5W-K	5		278	+3.5	−3.5	$ 9.41
RA4L	6W-K	6		400	+4.2	−4.2	$ 9.41
RA4L	9W-K	9		900	+6.3	−6.3	$ 9.41
RA4L	**12W-K**	**12**		**1600**	**+8.4**	**−8.4**	**$ 9.41**
RA4L	18W-K	18		3600	+12.6	−12.6	$ 9.41
RA4L	24W-K	24		6400	+16.8	−16.8	$ 9.41
RA4L	48W-K	48		25600	+33.6	−33.6	$11.46
Double winding latching							
RA4L	D1.5W-K	1.5	P/S	12.5	+1.0	+1.0	$ 9.55
RA4L	D3W-K	3	P/S	50	+2.1	+2.1	$ 9.55
RA4L	D4.5W-K	4.5	P/S	113	+3.1	+3.1	$ 9.55
RA4L	**D5W-K**	**5**	**P/S**	**139**	**+3.5**	**+3.5**	**$ 9.55**
RA4L	D6W-K	6	P/S	200	+4.2	+4.2	$ 9.55
RA4L	D9W-K	9	P/S	450	+6.3	+6.3	$ 9.55
RA4L	**D12W-K**	**12**	**P/S**	**800**	**+8.4**	**+8.4**	**$ 9.55**
RA4L	D18W-K	18	P/S	1800	+12.6	+12.6	$ 9.55
RA4L	**D24W-K**	**24**	**P/S**	**3200**	**+16.8**	**+16.8**	**$ 9.55**
RA4L	**D48W-K**	**48**	**P/S**	**12800**	**+33.6**	**+33.6**	**$11.59**
RA4L	D1.5WM-K	1.5	P/S	6.3	+1.0	+1.0	$ 9.06
RA4L	D3WM-K	3	P/S	25	+2.1	+2.1	$ 9.06
RA4L	D4.5WM-K	4.5	P/S	56	+3.1	+3.1	$ 9.06
RA4L	**D5WM-K**	**5**	**P/S**	**69**	**+3.5**	**+3.5**	**$ 9.06**
RA4L	D6WM-K	6	P/S	100	+4.2	+4.2	$ 9.06
RA4L	D9WM-K	9	P/S	225	+6.3	+6.3	$ 9.06
RA4L	**D12WM-K**	**12**	**P/S**	**400**	**+8.4**	**+8.4**	**$ 9.06**
RA4L	D18WM-K	18	P/S	900	+12.6	+12.6	$ 9.06
RA4L	**D24WM-K**	**24**	**P/S**	**1600**	**+16.8**	**+16.8**	**$ 9.06**
RA4L	**D48WM-K**	**48**	**P/S**	**6400**	**+33.6**	**+33.6**	**$11.01**

Notes

- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

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TAKAMISAWA
ELECTRIC CO. LTD.

Sub Miniature RF Printed Circuit Board Relays

UM RELAY

0.1 Amp SPDT W — 0.449″,
L —0.787″, H — 0.394″

TAKAMISAWA
UM1 12W-K
8603A
JAPAN

CONTACT DATA

Arrangement — 1 form C (SPDT bifurcated)
Ratings — 24V DC 10 mA, 1W at 900 MHz
Resistance — 100 mΩ max. (initial value)
Max. Current — 100 mA DC
Max. Voltage — 30V DC
Max. Power — 1W DC, 10W at 900 MHz
Life Expectancy — Mechanical: 1,000,000 operations min.
Electrical: 300,000 operating min. at rated load

COIL DATA

Voltage — 1.5 to 48V DC
Power — (at 20°C)

Type	Operate	Nominal
Single Winding Non Latching	0.1W (0.11W for 48V coil)	0.2W (0.22W for 48V coil)
Single Winding Latching	0.1W	0.2W
Double Winding Latching	0.2W	0.4W

Operate wattage less than 70% of nominal voltage

GENERAL DATA

Insulation Resistance — 1000 MΩ min. at 500V DC (UMIL-D, except between P.S. Coil)
Dielectric Strength — 500V AC between open contacts, between contacts and earth
1000V AC between coil and other terminals
Temperature Range — −30°C ~ +80°C at nominal voltage
Time Value — 6 msec max. at nominal voltage (UMI Release Time 5 ms)
Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring
Shock Resistance — 100G (6 msec) Destructive
50G (11 msec) Unerring
} reference value

HIGH FREQUENCY CHARACTERISTICS

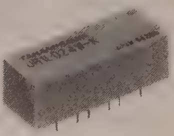
Isolation — 60 dB min. at 900 MHz
Insertion Loss — 1 dB max. at 900 MHz
V.S.W.R. — 1.2 max. at 900 MHZ
(Impedance of the measuring devices is 75Ω)

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
Standard					
UM1—3W-K	3	45	+2.1	+0.3	$6.35
UM1—5W-K	**5**	**125**	**+2.1**	**+0.3**	**$6.35**
UM1—6W-K	6	180	+4.2	+0.6	$6.35
UM1—9W-K	9	405	+6.3	+0.9	$6.35
UM1—12W-K	**12**	**720**	**+8.4**	**+1.2**	$6.35
UM1—18W-K	18	1620	+12.6	+1.8	$6.35
UM1—24W-K	**24**	**2880**	**+16.8**	**+2.4**	**$6.35**
UM1—48W-K	48	10472	+33.6	+4.8	$8.13
Single Winding Latching					
UM1L—3W-K	3	45	+2.1	−2.1	$7.02
UM1L—5W-K	5	125	+3.5	−3.5	$7.02
UM1L—6W-K	6	180	+4.2	−4.2	$7.02
UM1L—9W-K	9	405	+6.3	−6.3	$7.02
UM1L—12W-K	**12**	**720**	**+8.4**	**−8.4**	**$7.02**
UM1L—18W-K	18	1620	+12.6	−12.6	$7.02
UM1L—24W-K	24	2880	+16.8	−16.8	$7.02
UM1L—48W-K	48	11520	+33.6	−33.6	$8.79
Double Winding Latching					
UM1L—D 3W-K	3	22.5	+2.1	−2.1	$7.50
UM1L—D 5W-K	5	62.5	+3.5	−3.5	$7.50
UM1L—D 6W-K	6	90	+4.2	−4.2	$7.50
UM1L—D 9W-K	9	202.5	+6.3	−6.3	$7.50
UM1L—D 12W-K	**12**	**360**	**+8.4**	**−8.4**	**$7.50**
UM1L—D 18W-K	18	910	+12.6	−12.6	$7.50
UM1L—D 24W-K	24	1440	+16.8	−16.8	$7.50
UM1L—D 48W-K	48	5760	+33.6	−33.6	$9.28

Notes

- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
  As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

UR RELAY



CONTACT DATA

Arrangement—2 Form C (DPDT bifurcated contact)
Ratings—24VDC 10mA, 1W at 900 MHz
Resistance—100 mΩ max. (Initial value)
Max. Current—100 mA DC
Max. Voltage—30 VDC
Max. Power—1WDC, 10W at 900 MHz
Life Expectancy—Mechanical: 1,000,000 operations min.
Electrical: 300,000 operations min.

L-1.291″
W-0.504″
H-0.425″

COIL DATA

Voltage—1.5 to 48 VDC **Power**—(at 20°C)

Type	Operate	Nominal
Single winding non latching	0.18W (0.2W for 48V coil)	0.36W (0.39W for 48V coil)
Single winding latching	0.125W	0.25W
Double winding latching	0.25W (0.28W for 48V coil)	0.5W (0.55W for 48V coil)

GENERAL DATA

Insulation Resistance—1000MΩ min. at 500 VDC (Except between P & S Coil)
Dielectric Strength—500VAC between open contact, between contact & Shield terminals 1000VAC between coil & other terminals
Temperature Range—−30°C ~ +80°C at nominal voltage
Time Value—approx. 6 ms at nominal voltage
Vibration Resistance—30G (10 ~ 55Hz)…Destructive
20G (10 ~ 55Hz)…Unerring
Shock Resistance—100G (6ms)…Destructive
50G (11ms)…Unerring
Reference value

TABLE-1 Non Latching type

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ± 10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
UR1—1.5W-K	1.5	5.3	+1.05	+0.08	$11.90
UR1—3W-K	3	25	+2.1	+0.15	$11.90
UR1—4.5W-K	4.5	56.3	+3.15	+0.23	$11.90
UR1—5W-K	**5**	**69.5**	**+3.5**	**+0.25**	**$11.90**
UR1—6W-K	6	100	+4.2	+0.3	$11.90
UR1—9W-K	9	225	+6.3	+0.45	$11.90
UR1—12W-K	**12**	**400**	**+8.4**	**+0.6**	**$11.90**
UR1—18W-K	18	900	+12.6	+0.9	$11.90
UR1—24W-K	**24**	**1600**	**+16.8**	**+1.2**	**$11.90**
UR1—48W-K	48	5900	+33.6	+2.4	$13.68

TABLE-2 Single winding latching type

UR1L—1.5W-K	1.5	9	+1.05	−1.05	$12.03
UR1L—3W-K	3	36	+2.1	−2.1	$12.03
UR1L—4.5W-K	4.5	81	+3.15	−3.15	$12.03
UR1L—5W-K	5	100	+3.5	−3.5	$12.03
UR1L—6W-K	6	144	+4.2	−4.2	$12.03
UR1L—9W-K	9	324	+6.3	−6.3	$12.03
UR1L—12W-K	**12**	**576**	**+8.4**	**−8.4**	**$12.03**
UR1L—18W-K	18	1296	+12.6	−12.6	$12.03
UR1L—24W-K	24	2304	+16.8	−16.8	$12.03
UR1L—48W-K	48	9216	+33.6	−33.6	$13.81

TABLE-3 Double winding latching type

UR1L—D1.5W-K	1.5	P S	4.5 4.5	+1.05	+1.05	$12.65
UR1L—D3W-K	3	P S	18 18	+2.1	+2.1	$12.65
UR1L—D4.5W-K	4.5	P S	40.5 40.5	+3.15	+3.15	$12.65
UR1L—D5W-K	5	P S	50 50	+3.5	+3.5	$12.65
UR1L—D6W-K	6	P S	72 72	+4.2	+4.2	$12.65
UR1L—D9W-K	9	P S	162 162	+6.3	+6.3	$12.65
UR1L—D12W-K	**12**	**P S**	**288 288**	**+8.4**	**+8.4**	**$12.65**
UR1L—D18W-K	18	P S	648 648	+12.6	+12.6	$12.65
UR1L—D24W-K	24	P S	1152 1152	+16.8	+16.8	$12.65
UR1L—D48W-K	48	P S	4189 4189	+33.6	+33.6	$14.43

Notes • If correct polarity is not applied to the coil terminals, relay does not operate properly. • To release latched contact, polarity to be applied to coil terminals should be reversed. • Since this is the polarized relay, Confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

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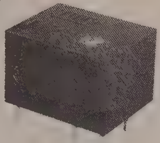
TAKAMISAWA ELECTRIC CO., LTD.

Miniature General Purpose Relays

LZ RELAY



5 Amp SPDT
L — 0.843″
W — 0.646″
H — 0.583″

CONTACT DATA

Arrangement — 1 Form C

Material — 5A type: Gold overlay silver-nickel alloy (single)
3A type: Gold overlay silver (single)
1A type: Gold overlay silver-palladium alloy (bifurcated)

Load — 5A type: 5A @ 30V DC or 120V AC, 4A @ 240V AC resistive, ⅛ HP
3A type: 3A @ 30V DC or 120V AC, 2.5A @ 240V AC resistive, $^{1}/_{10}$ HP
1A type: 1A @ 30V DC or 120V AC, resistive

Life — Mechanical: 20 million operations minimum
Electrical: 0.1 x 10^6 operations minimum at rated load

Timing — Operate: $<$ 5 ms (standard type), $<$ 6 ms (high sensitive type)
Release: $<$ 2 ms

COIL DATA (@ 20°C)

Operate Power — 210 mW (standard type), 150 mW (high sensitive type)

Nominal Power — 450 mW (standard type), 330 mW (high sensitive type)

Maximum Power — 1.4W

GENERAL DATA

Insulation Resistance — 250 MΩ at 500V DC

Dielectric Strength — 750V AC between open contacts
2000V AC between all other points

Temperature Range — standard type −40°C to +70°C
sensitive type −40°C to +80°C

Vibration Resistance — 15G (10-55 Hz)

Shock Resistance — 15G (11 ms ±1 ms)

Approximate Weight — 8 gr (0.28 oz.)

Enclosure — Standard — polycarbonate
Washable or sealed — PBT

Surge Strength — 3000V

Standard Coil and Contact Combinations (20°C)

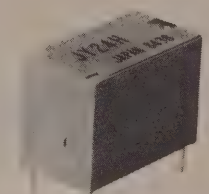
Nominal Voltage	Pull-In Voltage	Maximum Con-tinuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code		List Price
				5A*	3A	
Standard types						
5	3.25	8.3	56	LZ-5H-C	LZ-5-C	$2.66
6	3.90	9.9	80	LZ-6H-C	LZ-6-C	$2.66
9	5.85	14.9	180	LZ-9H-C	LZ-9-C	$2.66
12	7.80	19.8	320	LZ-12H-C	LZ-12-C	$2.66
24	15.6	39.6	1280	LZ-24H-C	LZ-24-C	$2.66
48	28.8	79.2	3800	LZ-48H-C	LZ-48-C	$3.06
High sensitive types						
5	3.25	9.8	80	LZ-5HS-C	LZ-5S-C	$2.75
6	3.90	11.7	110	LZ-6H-C	LZ-6S-C	$2.75
9	5.85	17.6	250	LZ-9HS-C	LZ-9S-C	$2.75
12	7.80	23.4	440	LZ-12H-C	LZ-12S-C	$2.75
24	15.6	45.6	1780	LZ-24H-C	LZ-24S-C	$2.75

*Add 5% to List Price

S PST-NO 10A type

5	3.25	NA	56	LZVM-5-C	$2.93
6	3 9	NA	80	LZVM-6-C	$2.93
9	5.85	NA	180	LZVM-9-C	$2.93
12	7.8	NA	320	LZVM-12-C	$2.93
24	15.6	NA	1280	LZVM-24-C	$2.93
48	28.8	NA	3800	LZVM-48-C	$3.33

JY RELAYS



5 Amp SPST-NO
L —0.795″
W—0.394″
H—0.504″

CONTACT DATA

Arrangement — 1 Form A (SPST-N.O.)

Material & Rating —
JY-( )H, JY-( ) — Gold plated silver cadmium oxide alloy
JY-( )H — 5A, 30V DC or 250V AC resistive
JY-( ) — 3A, 30V DC or 250V AC resistive

Life Expectancy — Mechanical — 20 million operations
Electrical — 100,000 operations at rated load

COIL DATA

Voltage — JY- 4.5 to 24V DC

Power (at 20°C) — JY- Nominal 0.2W
JY- Operate 0.098W

Max. Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — Min. 1000MΩ at 500V DC

Dielectric Strength — JY- 750V AC (50/60 Hz) between open contacts

Surge Strength — 6000V (1 x 40μs)

Temperature Range (at Nominal Voltage) —
JY- −40°C to +80°C — Non-carrying condition of contacts

Time Value — Operate Max. 10ms
Release Max. 10ms

Weight — 5gr (Approx.)

Enclosure — PBT

Standard Coil and Contact Combinations

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance	Ordering Code	List Price
5	3.5	11.5	125	JY-5-H-K	$4.08
6	4.2	13.8	180	JY-6-H-K	$4.08
9	6.3	20.7	405	JY-9-H-K	$4.08
12	8.4	27.6	720	JY-12-H-K	$4.08
18	12.6	41.4	1620	JY-18-H-K	$4.08
24	16.8	55.2	2880	JY-24-H-K	$4.08
48	32.6	81.6	6400	JK-48H-K	$4.75
JY Socket				JK-4N	$1.82

TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature General Purpose Relays

NA RELAY

L—0.590"
W—0.295"
H—0.385"

CONTACT DATA

Arrangement—2 form C (bifurcated contact)
Material—Gold overlaid silver alloy
Contact Resistance—50 mΩ max. (initial value)
Max. Switching Power—62.5 VA, 30 W
Max. Switching Voltage—125 VAC, 150 VDC
Ratings—125 VAC 0.5 A, 30 VDC 1A (resistive load)
Max. Carrying Current—2A
Life Expectancy—Mechanical: 100 million operations min.
Electrical: 600,000 operations min. at 30 VDC 1A
200,000 operations min. at 125 VAC 0.5A

COIL DATA

Voltages—3 to 48 VDC
Power (at 20°C)—
Single Winding Non--Latching—0.14 W (0.2 W for 24 V coil, 0.3 W for 48 V coil)
Single Winding Latching—0.1 W (0.15 W for 24 V coil)
Pick-up Voltage (at 20°C)—less than 75% of nominal voltage

GENERAL DATA

Insulation Resistance—1000 MΩ min. at 500 VDC
Dielectric Withstanding—1000 VAC 1 min. between open contacts
1000 VAC 1 min. between adjacent contacts
1500 VAC 1 min. between contacts and coil
[Single winding Non-latching
Single winding latching]
Lightning Surge—2500 V 2/10μs, between contacts and coil
[Single winding Non-latching
Single winding latching]
Temperature Range— –40°C ~ +85°C
Time Value—Operate: 4 msec max.
Release: 4 msec max. (with diode)
Vibration Resistance—20 G (10 ~ 500Hz) ... Non-erring
30 G (10 ~ 500Hz) ... Destructive
Shock Resistance—50 G (11±1 msec) ... Non-erring
100 G (6±1 msec) ... Destructive

Single Winding Non-Latching

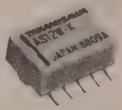
Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	??? ??? ???	List Price
NA 1.5 W-K	1.5	16.1	+ 1.13	+0.15	140	4.88
NA 3 W-K	3	64.3	+ 2.25	+0.15	140	4.88
NA 4.5 W-K	4.5	145	+ 3.37	+0.3	140	4.88
NA 5 W-K	5	178	+ 3.75	+0.5	140	4.88
NA 6 W-K	6	257	+ 4.5	+0.6	140	4.88
NA 9 W-K	9	570	+ 6.75	+0.9	140	4.88
NA 12 W-K	**12**	**1,028**	**+ 9.0**	**+1.2**	**140**	**4.88**
NA 18 W-K	18	1,820	+ 13.5	+1.8	200	4.88
NA 24 W-K	**24**	**2,880**	**+ 18.0**	**+2.4**	**200**	**4.88**
NA 48 W-K	48	7,680	+ 36.0	+4.8	300	5.77

Single Winding Latching

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	??? ??? ???	List Price
NAL 1.5 W-K	1.5	22.6	+ 1.13	–0.13	100	5.33
NAL 3 W-K	3	90	+ 2.25	–2.25	100	5.33
NAL 4.5 W-K	4.5	203	+ 3.37	–3.37	100	5.33
NAL 5 W-K	**5**	**250**	**+ 3.75**	**–3.75**	**100**	**5.33**
NAL 6 W-K	6	360	+ 4.5	–4.5	100	5.33
NAL 9 W-K	9	810	+ 8.75	–8.75	100	5.33
NAL 12 W-K	**12**	**1,440**	**+ 9.0**	**–9.0**	**100**	**5.33**
NAL 18 W-K	18	2,160	+ 13.5	–13.5	150	5.33
NAL 24 W-K	**24**	**3,840**	**+ 18.0**	**–18.0**	**150**	**5.33**

A/AS RELAY

L—0.551",
W—0.354",
H—0.197"



CONTACT DATA

Arrangement—2FormC (DPDT)
Material—Stationary...Gold overlaid silver palladium
Movable...Silver palladium
Resistance—Max. 100mΩ (Initial)
Rating—1A 30V DC or 0.5A 125V AC (Resistive)
Life expectancy—Mechanical: Min 100 million operations
Electrical: Min 500,000 operations at 1A 30V DC
: Min 200,000 operations at 0.5A 125V AC

COIL DATA

Voltages—4.5 to 48V DC
Power (at 20°C)—Operate 0.07W (0.11W for 24V coil)
Nominal 0.14W (0.2W for 24V coil)
Operate (at 20°C)—70% of nominal voltage
Duty—Continuous.

GENERAL DATA

Insulation resistance—Min. 1000MΩ at 500V DC
Dielectric strength—1000V AC between open contact, coil-contact, adjacent contact
Surge strength—1500V
Temperature range— –40°C ~ +85°C at nominal voltage
Time Value (at nominal voltage)—Operate Max. 6mS Release Max. 4mS
Vibration Resistance—10 to 55Hz amplitude 3mm...Unerring
10 to 55Hz amplitude 5mm...Destructive
Shock Resistance—50G (11 mS)...Unerring
100G (6mS)...Destructive
} Reference Value

Enclosure—PBT

Notes:
- Since this is the polarized relay, confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

Single Winding Non-Latching

Substitute AS Prefix for SMD Type

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ± 10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
A—3W-K	3	64.3	+2.1	+0.3	3.91
A—4.5W-K	**4.5**	**145**	**+3.15**	**+0.45**	**3.91**
A—5W-K	**5**	**178**	**+3.5**	**+0.5**	**3.91**
A—6W-K	6	257	+4.2	+0.6	3.91
A—9W-K	9	579	+6.3	+0.9	3.91
A—12W-K	**12**	**1028**	**+8.4**	**+1.2**	**3.91**
A—18W-K	18	1620	+12.6	+1.8	3 91
A—24W-K	**24**	**2880**	**+16.8**	**+2.4**	**3.91**
A—48W-K	**48**	**7680**	**+33.6**	**+4.8**	**4.80**

Single Winding Latching

AL—3W-K	3	90	+2.1	–2.1	4.97
AL—4.5W-K	4.5	203	+3.15	–3.15	4.97
AL—5W-K	5	250	+3.5	–3.5	4.97
AL—6W-K	6	360	+4.2	–4.2	4.97
AL—9W-K	9	810	+6.3	–6.3	4.97
AL—12W-K	**12**	**1440**	**+8.4**	**–8.4**	**4.97**
AL—18W-K	18	2160	+12.6	–12.6	4.97
AL—24W-K	24	3840	+16.8	–16.8	4.97

Double Winding Latching

AL—D3W-K	3	P S	45 45	+2.1	+2.1	5.33
AL—D4.5W-K	4.5	P S	101 101	+3.15	+3.15	5.33
AL—D5W-K	**5**	**P S**	**125 125**	**+3.5**	**+3.5**	**5.33**
AL—D6W-K	6	P S	180 180	+4.2	+4.2	5.33
AL—D9W-K	9	P S	405 405	+6.3	+6.3	5.33
AL—D12W-K	**12**	**P S**	**720 720**	**+8.4**	**+8.4**	**5.33**
AL—D18W-K	18	P S	1080 1080	+12.6	+12.6	5.33
AL—D24W-K	**24**	**P S**	**1920 1920**	**+16.8**	**+16.8**	**5.33**

P: Single Winding Coil, S: Double Winding Coil

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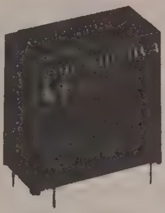
TAKAMISAWA ELECTRIC CO., LTD.

Miniature General Purpose Relays

VE RELAY



CONTACT DATA

Arrangement—1 Form A (SPST-NO)
or 1 Form C (SPDT)

Material & Rating

Type	Material	Contact Rating*	
		N.O.	N.C.
VE-( )H	Gold overlay silver-nickel alloy	5A	3A
VE-( )HE	Silver-nickel alloy		
VE-( )H5	Silver-cadmium oxide alloy	5A	5A

*250 VAC resistive

Resistance (Initial)— 70 mΩ..........................VVE-( ) H
100 mΩ (6VDC.1A) ....VVE-( ) HE
200 mΩ (6VDC.1A) ....VVE-( ) H5

Life Expectancy—Mechanical: 10 million operations
Electrical: 100,000 operations

COIL DATA

Voltage—5 to 48 VDC

Power (at 20°C)—

	Standard	High Sensitive
Nominal	0.36 W	0.25 W
Operate	0.18 W	0.13 W

Operate (at 20°C)—70% of nominal voltage

GENERAL DATA

Insulation Resistance—1000 MΩ min, at 500 VDC

Dielectric Strength—750 VAC (50/60 Hz) between open contact (N.C.),
1000 VAC (50/60 Hz) between open contact (N,O)
2000 VAC (50/60 Hz) between all other conductor

Surge Strength—4000 V or 6000 V

Temperature Range—Standard type −40°C ~ +85°C } Non-carring
High sensitive type −40°C ~ +90°C } condition of contacts

Time Value (at nominal voltage)—Operate Max. 10 ms
Release Max. 5 ms

Weight—Approx. 8 gr

Vibration Resistance*—10 ~ 55 Hz (Double amplitude of 3.3mm)
....Destructive, Unerring

Shock Resistance*—50 G (11±1 ms) ....Destructive
(*Reference Value) 10 G (11±1 ms).........................Unerring

Enclosure – PBT

Ordering Code	Nominal Voltage V DC	Coil Resistance Ω±10%	Must Operate Voltage VDC	List Price	
				3A	5A
Standard types					
VE-( ) H E-K VE-( ) H 5-K	5	69	Nominal Voltage ×70%	2.31	2.49
	6	100		2.31	2.49
	9	225		2.31	2.49
	12	400		2.31	2.49
	14	544		2 31	2.49
	18	900		2.31	2.49
	24	1600		2.31	2.49
	48	6400		2.66	2.84
High Sensitive types					
VE-( ) H SE-K VE-( ) H S5-K	5	100	Nominal Voltage ×70%	2.40	2.58
	6	145		2.40	2.58
	9	325		2 40	2.58
	12	575		2.40	2.58
	14	790		2.40	2.58
	18	1300		2.40	2.58
	24	2310		2.40	2.58
	48	9220		2.75	2.93

JS RELAY

L—1.142"
W—0.394"
H—0.492"

CONTACT DATA

Arrangement—1 form A or 1 form C
Material—Gold plate silver alloy
Resistance—Max. 30 mΩ (at 1A 6 VDC)
Rating—8A 250 VAC/24 VDC (Resistive)
Max. Switching Power—2,000 VA/192 W
Max. Switching Voltage—250 VAC/150 VDC
Max. Switching Current—8A
Max. Carrying Current—10A
Life Expectancy—Mechanical: 5 x 10^6
Electrical: 1 x 10^5 (Rated load)

COIL DATA

Nominal Voltage—5 ~ 60 VDC
Power (at 20°C)—Nominal: 220 ~ 280 mW
Operate: 110 ~ 140 mW
Operate & Release Voltage (at 20°C)—See back side
Max. Continuous Voltage (at 20°C)—Nominal Voltage x 225%

GENERAL DATA

Insulation Resistance—1.000 MΩ (at 500 VDC)
Dielectric Strength—1000 VAC (open contacts)
5000 VAC (coil and contacts)
Surge Strength—10kV (at 1.2 x 50μs Surge wave)
Temperature Range— −40°C ~ +85°C
Time Value (at Nominal Voltage)—Operate: Max. 10 ms
Release: Max. 5ms
Vibration Resistance—
Misoperation: 10 ~ 55 Hz at double amplitude 1.65 mm
Endurance: 10 ~ 55 Hz at double amplitude 3.3 mm
Shock Resistance—Misoperation: 100 m/s^2 (11=^{1}ms)
Endurance: 1000 m/s^2 (6=^{1}ms)
Weight—Approx. 5g
Enclosure—PBT

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance (Ω±10% at 20°C)	Must Operate Voltage at 20°C (VDC)	Must Release Voltage (VDC at 20°C)	List Price
JS - 5 E - K	5	112	3.5	0.5	3.46
JS - 6 E - K	6	160	4.2	0.6	3.46
JS - 12 E - K	12	660	8.5	1.2	3.46
JS - 18 E - K	18	1.455	12.7	1.8	3.46
JS - 24 E - K	24	2,350	16.8	2.4	3.46
JS - 48 E - K	48	8,000	33.4	4.8	4.17

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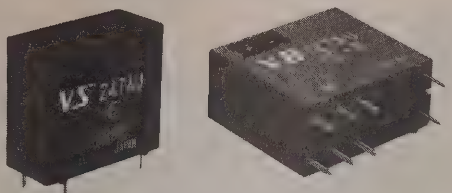
Miniature Power Relays

VB/VS RELAY



L — 1.150″
W — 0.508″
H — 0.996″

CONTACT DATA

Arrangement—1 Form A or C 15/10 Amp (VS)
2 Form C 5 Amp (VB)

Material—Silver Nickel (Standard), silver tin oxide (15A)

Rating—5 10/15 Amp at 24V DC or 240V AC
⅙ or ⅓ HP 120V AC motor load

Inrush Current — 51 or 78A at 120 V AC

Max. Carrying Current — SPDT 14A, DPDT 7A

Life Expectancy — Mechanical 5 million operations
Electrical: 100,000 operations at 5 or 10A 24V DC or 240V AC
200,000 operations at 5 or 10A 120V AC resistive
3.5 or 7A 24V DC or 240V AC
30,000 operations at ⅙ or ⅓ 120V AC motor load

COIL DATA

Nominal Voltage — 3 to 60V DC

Power (at 20°C) — Nominal: 0.72W Standard Type
0.53W High Sensitive Type
Operate: 0.35W Standard Type
0.26W High Sensitive Type
Maximum: 1.4W

GENERAL

Dielectric Strength — Min. 1000V AC between open contact
Min. 5000V AC between all other conductors

Insulation Resistance — Min. 1000MΩ at 500V DC between conductors

Surge Strength — 10,000V

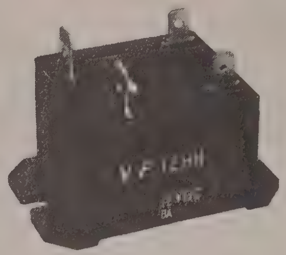
Temperature Range — (TV types) −40°C to +50°C
Standard types) −40°C to +65°C
(Sensitive types) −40°C to +75°C

Enclosure Standard — Polycarbonate
— Washable — PBT

Standard Coil and Contact Combinations

Type	Nominal Voltage DC (V)	Coil Resistance —10% at 20°C (V)	Must Operate Voltage at 20°C (V)	Ordering Code	List Price
Standard types					
SPDT 16A	5	36	3.5	VSB- 5TC	$3.77
	6	50	4.2	VSB- 6TC	$3.77
	12	200	8.4	VSB- 12TC	$3.77
	24	820	16.8	VSB- 24TC	$3.77
SPDT 10A	5	36	3.5	VS- 5TCU-E	$3.60
	6	50	4.2	VS- 6TCU-E	$3.60
	12	200	8.4	VS- 12TCU-E	$3.60
	24	820	16.8	VS- 24TCU-E	$3.60
DPDT 5A	5	36	3.5	VB- 5TCU-E	$4.13
	6	50	4.2	VB- 6TCU-E	$4.13
	12	200	8.4	VB- 12TCU-E	$4.13
	24	820	16.8	VB- 24TCU-E	$4.13
High Sensitive Types					
SPDT 16A	5	47	3 5	VSB- 5STC	$3.92
	6	68	4.2	VSB- 6STC	$3.92
	12	270	8.4	VSB- 12STC	$3.92
	24	1100	16.8	VSB- 24STC	$3.92
SPDT 10A	5	47	3 5	VS- 5STCU-E	$3.82
	6	68	4 2	VS- 6STCU-E	$3.82
	12	270	8.4	VS- 12STCU-E	$3.82
	24	1100	16.8	VS- 24STCU-E	$3.82
DPDT 5A	5	47	3.5	VB- 5STCU-E	$4.35
	6	68	4.2	VB- 6STCU-E	$4.35
	12	270	8.4	VB- 12STCU-E	$4.35
	24	1100	16.8	VB- 24STCU-E	$4.35

VF RELAY



L — 1.968″
W — 1.268″
H — 0.949″

CONTACT DATA

Arrangement — 1 Form A

Material — Silver Alloy

Rating: See Table

Classification	Rating		Maximum Inrush Current
	Resistive	Motor Load	
H	30A 250V AC	2HP 25A 250V AC	70A 200V AC
M	25A 250V AC	1.5HP 20A 250V AC	60A 200V AC
L	20A 250V AC	1HP 15A 250V AC	55A 100V AC

Maximum Carry Current — 30A

Life Expectancy — Mechanical: 5 million operations
Electrical: 200,000 operations at motor load
100,000 operations at resistive load

COIL DATA

Nominal Voltage — 3 to 60V DC

Power (at 20°C) — Nominal: 1.2W
Operate: 0.59W
Maximum: 3.0W

GENERAL DATA

Dielectric Strength — 1200V AC between open contacts
4000V AC between all other conductors

Insulation Resistance — 1000MΩ (min.) at 500V DC

Surge Voltage — 10,000V

Timing (approx.) — Operate: 15ms at nominal
Release: 3ms at nominal

Temperature Range — −40°C to +70°C

Weight — 55 gr

Vibration — 10 - 55Hz

Shock — 20G

Enclosure Cover — Cover — Polycarbonate (PC)
— Base — Polyetherimide (PEI)

Standard Coil and Contact Combinations

Coil Data at 20°C			Ordering Code		
Nominal Coil Voltage	Coil Resistance in Ohms ±10%	Must Operate Voltage	Quick Connect Terminals	PCB Coil Terminals	List Price
6	30	4.2	VF- 6HU	VFB- 6HU	$9.99
12	120	8.4	VF-12HU	VFB-12HU	$9.99
24	480	16.8	VF-24HU	VFB-24HU	$9.99
48	1920	33.6	VF-48HU	VFB-48HU	$9.99
6	30	4.2	VF- 6MU	VFB- 6MU	$9.19
12	120	8.4	VF-12MU	VFB-12MU	$9.19
24	480	16.8	VF-24MU	VFB-24MU	$9.19
48	1920	33.6	VF-48MU	VFB-48MU	$9 19
6	30	4.2	VF- 6LU	VFB- 6LU	$8.48
12	120	8.4	VF-12LU	VFB-12LU	$8.48
24	480	16.8	VF-24LU	VFB-24LU	$8.48
48	1920	33.6	VF-48LU	VFB-48LU	$8.48

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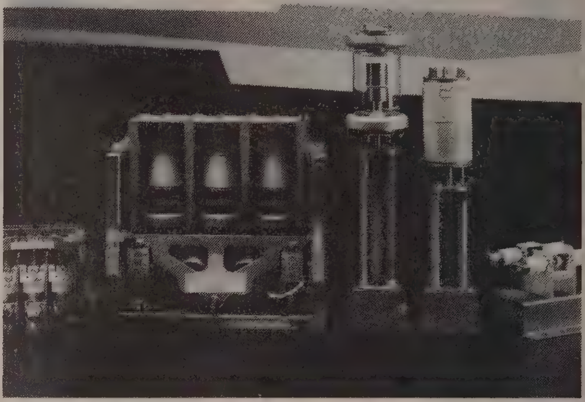
JENNINGS VACUUM CONTACTORS

Vacuum Contactors are used to control large amounts of DC power and RF currents with ratings up to 50 kv and currents up to 600 Amperes continuous. These contactors are recommended wherever high voltage capability, small size, and high speed operation with a long and low maintenance life are important. Applications include primary control of power supplies, industrial motors, and induction heating equipment, RF system tap changing, and fault protection of high power transmitters. The 18 page catalog provides complete specifications with a variety of specific applications for 3-pole, high voltage AC and DC, RF contactors and overcurrent relays actuated by solenoid, air or motor drives.



GENERAL PURPOSE

Model Number	Operate Voltage (Pk KV)	Continuous Current (Amps)	Max. Interrupt AC Current (Amps RMS)	Capacitor Discharge Decaying to 0 in 200 μS (KAmps Pk)	Contact Arrangement	Actuator Voltage (Volts)	Time to Close (Ms)	Break Time (Ms)	Weight (Lbs.)
RP101F4903D21B20 RP101F4904D21B20	30	200 DC	N/A	50	N/O N/C	115 60 Hz	60	50	15
RP101F4304D26B20 RP103F4304D26B20	30	200 DC 200 RMS	N/A 2000	50	N/C	100 DC	55	42	10
RP103F4903D21B20 RP103F4904D21B20	30	200 RMS	2000	50	N/O N/C	115 60 Hz	60 30	50 60	10
RP901K4903D21B30 RP901K4904D21B30	50	400 DC	N/A	100	N/O N/C	115 60 Hz	60 30	50 60	20
RP900K4601D26B30 RP900K4602D26B30	50	400 DC	4000	100	N/O N/C	100 DC	34 27	11 17	15
RP900K4903D21B30 RP900K4904D21B30	50	400 RMS	4000 at 13 KV RMS	100	N/O N/C	115 60 Hz	60 50	50 60	20
RT1G4201C22A10 RT1G4202C21A10	20	100	500	1	N/O N/C	230 AC 115 VAC 50/60	60 60	25 30	4
RT5C4202A21A10	15	30	100	0.5	N/C	115 AC	60	30	3

RF

Unit	Pk Operate Voltage 32 MHz	Contact Current 32 MHz RMS	Contact Resistance Ohms Max.	Contact Capacitance pF	Contact Inductance Nh	Contact Arrangement	Open Time	Close Time	Pull-in Current RMS	Hold Current RMS	Hold Power Watts	Actuating Voltage or Air Pressure	Approx. Weight	Life	Auxiliary Contacts Ratings Volt RMS Current RMS
RT224070A31NB (Solenoid Operated)	5*	25	.0005	2.5	n/a	Latching	< 300 Ms.	< 300 Ms.	.3	n/a	n/a	230 VAC	12 lbs.	2.5×10^5	Form C 230/15
RP233D1585 (Air Operated)	25	35	.0005	2	25	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	40 ± 5 psig	13 oz.	1×10^5	n/a
RF22-D2488 (Air Operated)	20	45	.00075	3	25	N/O	50 Ms.	100 Ms.	n/a	n/a	n/a	20 ± 10 psig	15 oz.	10×10^6	n/a
RF20B1586 (Air Operated)	20	100	.0004	10	2.5	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	35 ± 5 psig	2 lbs. 12 oz.	1×10^6	n/a

*Higher voltage ratings available at lower frequencies.

3-PHASE

Model Number	Operate Voltage V (RMS)	Continuous Current 60 Hz	Interrupt Current Amps RMS	Mechanical Life (Min.)	Actuator Voltage	Approx. Pull-in Current Amps Max.	Approx. Hold Current Amps Max.	Interrupt Time	Auxiliary Contacts	Approx. Weight
RP151B4541X44R20 RP151B4541X46R20	600	250	2000	2.5×10^5	26.5 VDC 100 VDC	4.6 1.7	.5 .07	Less than 2 Cycles	DPDT 115/230 VAC	16 lbs.
RP173-2310-00	7200	450	6000	1×10^6	115 VAC 50/60 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	67 lbs.
RP173-2311-00	7200	450	6000	1×10^6	230 VAC 220 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2N/C	67 lbs.
RP133-2332-00	1500	450	4500	1×10^6	115 VAC 50/60, 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	30 lbs.

JOSLYN JENNINGS CORPORATION

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JENNINGS

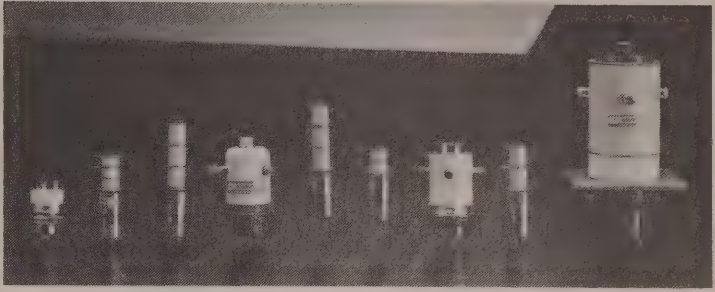
VACUUM/GAS RELAYS

Relay Testing

Jennings operates test facilities to provide all environmental, high voltage, and radio frequency (RF) test parameters. All relays are individually tested prior to shipment for pull-in voltage, timing characteristics, contact resistance, and dielectric strength.

Vibration, shock, humidity, salt spray, temperature effects, current load and reliability tests are regularly performed on a sampling basis.

Mechanical life reliability tests are performed on a sample basis with equipment that only passes relays which cycle with proper sequences of contact operation. Some relay types have been checked to more than 10^8 operations.



Peak Test Voltage ~(kV)	Model Number	Peak Working Voltage (kV) DC/60 Hz	Continuous Current Amps (RMS) DC/60 Hz	Maximum Capacitance Between Open Contacts or Contacts to Ground	Contact Configuration	Contact Resistance (ohms)	Operate Time (ms, Max)	Release Time (ms, Max)	Coil Resistance*	Expected Mech Life $\times 10^6$	Connector Type	Weight Ozs. (Nom.)
SPST/VACUUM												
4	RF40(1)	3.6	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
4	RF41, RF42	3.6	12	1.6	N/C	.020	10	10	290	1	Sol.	1
4	RF44	3.6	12	1.6	Latch	.012	4	N/A	80	1	Sol.	1
8	RF5A	7.5	12	1.6	N/C	.050	12	12	920	1	Sol.	1
8	RF6A	7.5	12	1.6	N/O	.050	12	12	920	1	Sol.	1
9	RF43(1)	7.0	12	1.6	Latch	.020	10	N/A	47	1		
10	RF47	8.0	35	1.6	Latch	.004	4	N/A	80	1	Sol.	1
10	RF4A, RF4B(1)	8.0	30	4.0	N/C	.015	18	18	156	1	Sol.	2
12	RF50, RF51	10.0	12	1.6	N/C	.020	15	15	290	1	Sol.	1
12	RJ5	12.0	15	1.0	N/C	.030	10	10	180	1	S, N300, N400	3
15	RD5A, RF5B	12.0	15	1.0	N/O	.010	18	8	265	1	N300, N400	3
15	RD6A, RD6B	12.0	15	1.0	N/C	.010	18	8	265	1	N300, N400	3
30	RS8, RS10	28.0	75	1.5	N/O	.003	30	10	120	1	T	7
33	RJ8A	28.0	110	1.3	N/O	.003	18	8	120	2	T	10
33	RJ10	28.0	110	1.3	N/C	.003	18	8	120	2	T	10
SPDT/VACUUM												
4	RF1D, RF1E	2.0	8	2.0	SPDT	.050	10	10	920	2	Sol.	1
4	RF60(1), RF61	3.6	12	2.0	Latch	.020	10	N/A	47	1	Sol.	1
5	RJ1A	3.5	18	2.5	SPDT	.010	8	8	335	2	Sol.	1
5	RJ1H	2.5 Hot Switch	3	N/A	SPDT	.030	6	6	335	1	Sol.	1
9	RF62, RF63(1)	7.0	12	1.6	SPDT	.020	10	10	290	1	Sol.	1
9	RF63A	7.0	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
10	RF3A, RF3C(1)	8.0	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
10	RF3D	8.0 Hot Switch	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
15	RB1H, RB1J	12.0	15	1.0	SPDT	.012	18	9	265	1	S, N300, N400	3
15	RJ2B, RJ2C	12.0	50	1.0	SPDT	.012	18	9	270	.5	S, N300, N400	3
15	RJ4	12.0	50	1.0	SPDT	.012	18	9	270	1	S, N300, N400	3
18	RB1D, RB1E	12.0	15	1.0	SPDT	.012	18	8	265	1	S, N300, N400	3
20	RF10B	15.0	75	1.8	SPDT	.012	30	10	225	.1	Sol.	16
30	RE6B	25.0	25	2.5	SPDT	.012	25	10	120	.5	S, N300, N400	7
DPDT/VACUUM												
9	RB7A, RB7B	7.0	14	2.0	DPDT	.020	15	5	270	1	S, N300, N400	2
15/8(2)	RB3	12/6(2)	30	2.5	DPDT	.010	20	8	120	.5	S, N300, N400	6
22	RB2A	20.0	20	2.5	DPDT	.010	20	10	225	.5	S, N300, N400	8
4PDT/VACUUM												
17	RB4	15.0	20	2.5	4PDT	.010	45	10	131	.1	S, N300, N400	16
SPST/GAS FILLED												
70	RGH3	70.0	15	N/A	N/C	1.000	N/A	15	24	5	Solder/ Screw	16
DPDT/GAS FILLED												
14	RGD6	7.5	30	N/A	DPDT	.100	20	N/A	18(3)	.01(4)	Flex	11
20	RGD1	18.0	30	N/A	DPDT	.100	25	N/A	52	.01(4)	Sol.	16

* 26.5 VDC operate at 25°C (other coil voltages available)

S - Standard Nickel Tabs
N300 - Copper
N400 - Heavy duty copper Bolt
Flex - Flying leads
Sol. - Solder terminals
T - Threaded mount

1 Latching Model
2 Lower Contacts
3 12 volt DC Coil
4 Rated Load Life

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JENNINGS VACUUM/COAXIAL RELAYS

Applications for these units include high speed switching from omnidirectional to directional antennas, transmit-receive switching, and switching between transmitters for standby control.

Other applications include crossbar matrices and switching trees, CCTV, CATV, and microwave telemetry and data acquisition links, as well as general coaxial instrumentation.

Jennings vacuum coaxial relays have a recorded history of dependable, maintenance free operation. Because of this, they were chosen for ground and airborne applications for the tracking network of the Apollo program and the Atlantic Missile Range Communications.

Model Number	Power Rating (CW in KW)	Frequency Range† (MHz)	VSWR†	Crosstalk† (db isolation)	Actuating Voltage	Insertion Loss† (Max)	Coil Resistance (Ohms ± 10•)	Contact Configuration	Connector size	Position Indicators Auxiliary Contacts	Operate Time†† (Max)	Weight Lbs. (Nom.)
GENERAL TRANSMITTER/RECEIVER SWITCH												
RC41E6000K440	3 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	C	None	25 ms	0.9
RC43E6050N440	5 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	LC	None	25 ms	3.3
CROSS OVER TYPE/4-PORT: 2 INPUT, 2 OUTPUT												
RC53A6300K24B	2.25 @ 30 MHz (connector limited)	0-600	1.1:1 Max to 300 MHz	75 @ 30 MHz	26.5 VDC	0.1 dB	19**	Transfer	N	DPDT	30 ms	2.8
RC54A6325H24B	7.5 @ 30 MHz	0-400	1.1:1 Max to 300 MHz	53 @ 500 MHz	26.5 VDC	0.1 dB	19**	Transfer	LC	DPDT	30 ms	6.4
1 5/8" LINE SIZE												
RC5A5101A24B	25 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	70 @ 30 MHz	26.5 VDC	0.02 dB	Opening 19.9 Closing 18.7	SPST	1 5/8"	DPDT	30 ms	1.8
RC6A5126F14B	25 @ 30 MHz	0-400	1.1:1 Max to 150 MHz	65 @ 30 MHz	26.5 VDC Latching	0.01 dB	15.4	SPDT	1 5/8"	DPDT	50 ms	8.0
3 1/8" LINE SIZE												
RC10C5227A24B	90 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	65 @ 30 MHz	26.5 VDC	0.02 dB	Opening 20.3 Closing 18.7	SPST	3 1/8"	DPDT	30 ms	3.8
RC21A5500F14B	90 @ 30 MHz	0-500	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	4.8	SPDT	3 1/8"	DPDT	40 ms	14.0
SWITCH ASSEMBLY												
RC265552G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPDT	3 1/8"	DPDT	50 ms	14.0
ATTENUATOR												
RC275576G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPST	3 1/8"	DPDT	50 ms	13.0

* Power rating applies when connecting line pressurized 45 PSIA Dry Air or 31 PSIA Dry Nitrogen.

** ± 15%

† All measurements with a characteristic impedance of 50 ohms.

†† faster operate times can be obtained on most units by coil pulse circuits. Information available from factory.

NOTE: This power ratings is for the frequency at which the relay is most commonly used. The power rating for any point in the frequency range of the unit other than that shown may be obtained by consulting factory.

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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	D•2221
Batteries, Product Selection Guide	D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	C•1003
Capacitors, Product Selection Guide	A•1003
Coils, Chokes, Inductors, Product Selection Guide	A•1179
Connectors, Terminals & Sockets, Product Selection Guide	C•1139
Cores, Magnets & Ferrites	A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	A•1326
DC-DC Converters	D•2049
DC Power Supplies, Product Selection Guide	D•1488
Delay Lines, Product Selection Guide	A•1513
Discrete Semiconductors, Product Selection Guide	A•2130
Displays, Readouts, & CRTs, Product Selection Guide	B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	C•1557
Fiber Optics, Product Selection Guide	B•1200
Filters, Power, Product Selection Guide	A•1584
Filters, Signal, Product Selection Guide	A•1617
Instruments, Test & Measuring, Product Selection Guide	D•1215
Interconnection Systems, Product Selection Guide	C•1670
Keyboards & Keypads, Product Selection Guide	B•1818
Lamps, Lights, & Indicators, Product Selection Guide	B•1131
Microwave Components, Product Selection Guide	A•1719
Military Qualified Products List	B•1002
Motors, Drives, & Rotating Components, Product Selection Guide	B•1231
Oscilloscopes, Product Selection Guide	D•1402
Panel Hardware, Product Selection Guide	C•1522
Panel Meters, Analog & Digital, Product Selection Guide	D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	A•2053
Power Supplies, AC, Product Selection Guide	D•2221
Power Supplies, DC, Product Selection Guide	D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	B•1341
Relays, Product Selection Guide	B•1401
Resistors, Product Selection Guide	A•1859
Solenoids, Product Selection Guide	B•1626
Switches, Product Selection Guide	B•1658
Thermal Components, Product Selection Guide	B•1857
Transducers & Encoders, Product Selection Guide	B•1911
Transformers, Product Selection Guide	A•2229
Wire & Cable, Product Selection Guide	C•1701

Kilovac®

THE EXPERTS IN HIGH VOLTAGE RELAYS
AND DC POWER SWITCHING DEVICES.

DC Relays & Contactors

A NEW GENERATION OF DC CONTACTORS for the most demanding Industrial and Aerospace Applications:

- Electric Vehicles
- Industrial Control
- Power Distribution Systems
- Safety Disconnect
- Circuit Protection
- Transfer Switching

Kilovac's unique vacuum-sealed design provide significant advantages when switching tough DC loads:

- Lightest Weight and Smallest Size
- Bi-directional Switching
- Lowest Power Consumption
- High Overload Capability
- Sealed Contacts
- Rugged Design

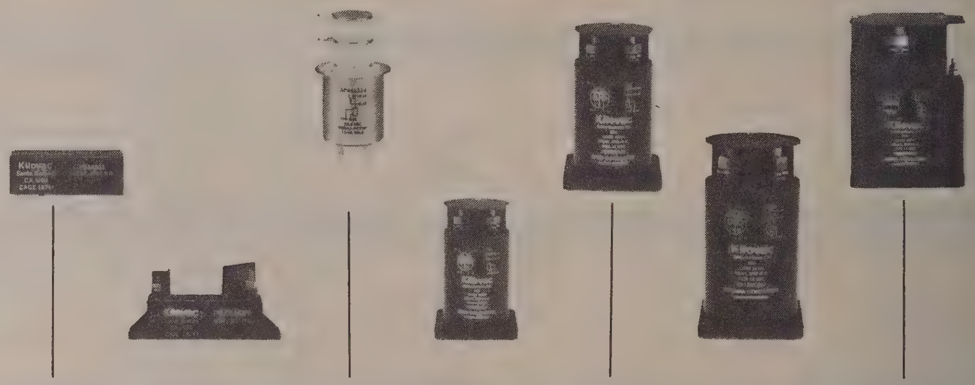
VOLTAGE INDEPENDENT SWITCHES result in Kilovac's DC relays and contactors being able to switch a broad range of voltages from 24Vdc to 1000Vdc, with overload capabilities up to 1500A. Ratings shown are at 270Vdc, which is an industry standard for aerospace applications. Contact Kilovac sales representative for ratings at other voltages.

INDUSTRIAL AND AEROSPACE APPLICATIONS. Kilovac's DC relay and Contactors were originally proven in tough and demanding manned space applications like the Space Station Freedom, aerospace rated parts have an "AP" prefix part number.

By changing the environmental specifications, eliminating some of the aerospace testing and controls, and applying cost reduction measures, these aerospace products are now available at economical prices for industrial applications. Industrial rated parts have a "PD" prefix part number. These parts can be found in Kilovac's "DC Relay and Contactor" catalog.

REMOTE POWER CONTROLLERS AND "SMART" CONTACTORS. All of Kilovac's DC power switching relays and contactors are available as remote power controllers with electronic sensing and control to provide short circuit protection. This allows the relay or contactor to function as a circuit breaker as well as a relay.

VOLTAGE → **POWER SWITCHING 24 VDC TO 1000 VDC** →



Kilovac Part Number	PD5/AP5[2]	PD10/AP10[2]	AP44	AP50[2]	PD90/AP90[2]	PD150/AP150[2]	PD250/AP250[2]
Contact Arrangement	SPST-NO, SPST-NC, SPDT, LATCH	SPST-NO, SPST-NC, SPDT, LATCH	SPST-NO, LATCH	SPST-NO	SPST-NO	SPST-NO SPDT, LATCH	SPST-NO
Continuous Carry Current contacts closed, max. (amps DC or Hz peak)	5	10	45	50	90	150	250
Power Switching @ **270 Vdc**	5 Amps	10 Amps	15 Amps	50 Amps	90 Amps	150 Amps	250 Amps
Dielectric Strength	2000 Vac	2000 Vac	2000 Vac	2000 Vac	2000 Vac	2000 Vac	2000 Vac
Contact Resistance max. (miliohms)	10	10	10	2	2	1	.4
Operate Time, max (ms)	10	10	5	90	90	40	35
Release Time, max (ms)	10	10	5	10	10	10	15
Coil Resistance (ohms 10% @ 20°C)	290	290	80	103	103	52	18/120
Coil Voltage (Vdc, nominal)[1]	24	24	28	24	24	24	24
Nominal Dimensions (inches)	.8 x 2.2 x .7	.9 x 3.1 x 1.5	.75 x 3.69	2.2 x 2.2 x 3.6	2.2 x 2.2 x 3.6	2.5 x 2.5 x 46	2.6 x 3.4 x 4.9
Nominal Weight (oz.)	2	2	1.5	16	16	27	54
Mounting Style	Various	Various	Various	Flange	Flange	Flange	Flange

(1) 12 Vdc and 125 Vdc coils available on request.

(2) "PD" part numbers for Industrial Applications, "AP" for Military/Aerospace applications.

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High Voltage Relays

KILOVAC CAN PROVIDE THE SOLUTION TO YOUR HIGH VOLTAGE AND DC SWITCHING NEEDS

Test Equipment

Aerospace Power Distribution and Control

Medical Equipment

RF and Communications Equipment

Rapid Transit and Electric Vehicles

KILOVAC CAN QUICKLY MEET YOUR REQUIREMENTS

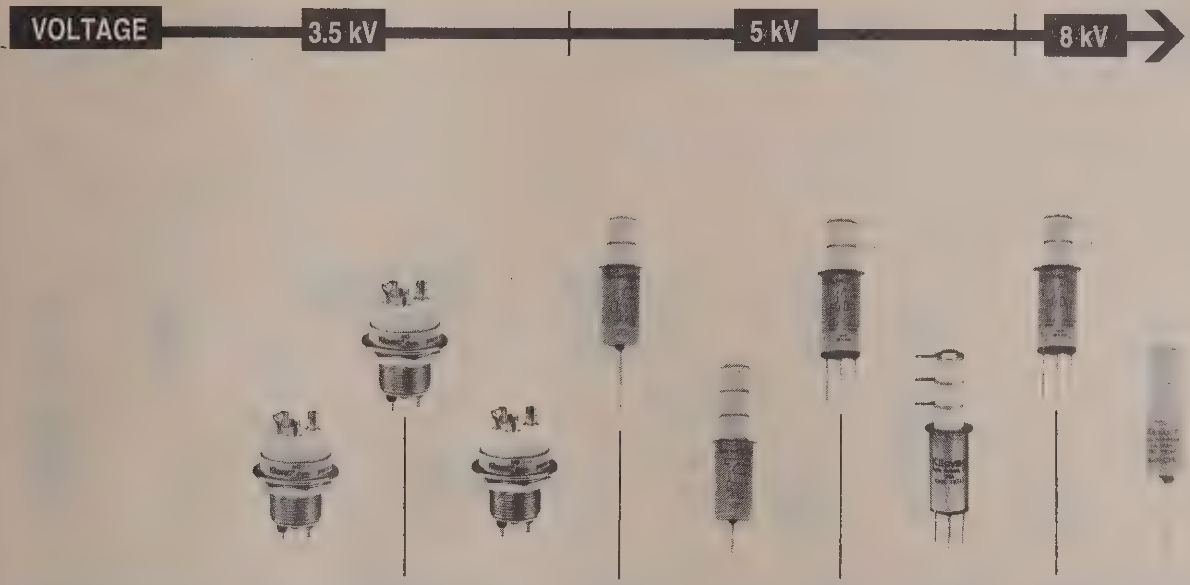
Kilovac's extensive manufacturing capability allows us to respond to your needs with a wide variety of special modifications and special relays, such as the following:

- Special high voltage connectors or wire
- Relays packaged with other components
- Multiple function relay packages
- Special coil voltages

YOU CAN RELY ON KILOVAC

High voltage circuits are often difficult to design and debug. Kilovac has 28 years of experience working with customers' like you to solve your switching problems. We can often supply engineering samples for test and evaluation in your circuit or conduct the tests in our well-equipped test lab.

Don't experiment with high voltage. . . rely on the proven experience of Kilovac.



Kilovac Part Number	HC-1	HC-3	HC-5[2,3]	K41A, B	K41C	K41P	K41R	K40P	K47A, B
Contact Arrangement	SPDT	SPDT	SPDT	SPST-NO, SPST-NC,	SPDT	LATCH	LATCHING SPDT	LATCH	SPST-NO, SPST-NC
Rated Operating Voltage	3.5 KVdc	3.5 KVdc	3.5 KVdc	5.0 KVdc	5.0 KVdc	5.0 KVdc	5.0 KVdc	5.0 KVdc	8.0 KVdc
Test Voltage	5.0 KVdc	5.0 KVdc	5.0 KVdc	6.0 KVdc	6.0 KVdc	6.0 KVdc	6.0 KVdc	6.0 KVdc	9.0 KVdc
Continuous carry current contacts closed, max. (amps dc or 60 Hz peak)	25	18	8	15	15	15	25	35	12
Power Switching?	N	Y[1]	Y[1]	Y[1]	Y[1]	N	N	N	Y[1]
Contact Resistance max. (ohms)	.010	.020	.5[3]	.020	.020	.020	.020	.020	.030
Operate Time, max (ms)	6	6	6	10	10	6	6	1	10
Coil Resistance (ohms ±10% @ 20°C)	335	335	335	290	290	80	80	80	920
Coil Voltage (Vdc, nominal)	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5	26.5	26.5	26.5[4]
Nominal Dimensions (inches)	.75D x 1.5H	.75D x 1.5H	.75D x 1.5H	.65D x 1.7H	.65D x 2.1H	.65D x 1.7H	.65D x 2.1H	.65D x 1.7H	.65D x 1.82H
Nominal Weight (oz.)	1	1	1	1	1	1	1	1	.6
Mounting Style	Threaded Base	Threaded Base	Threaded Base	Flange	Flange	Flange	Flange	Flange	Flange

[1] Suitable for power switching. Contact factory for details.
[2] Gas-filled for power switching on the "make".
[3] Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
[4] 12 Vdc and/or 115 Vdc coils available on request.

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Kilovac® High Voltage Relays

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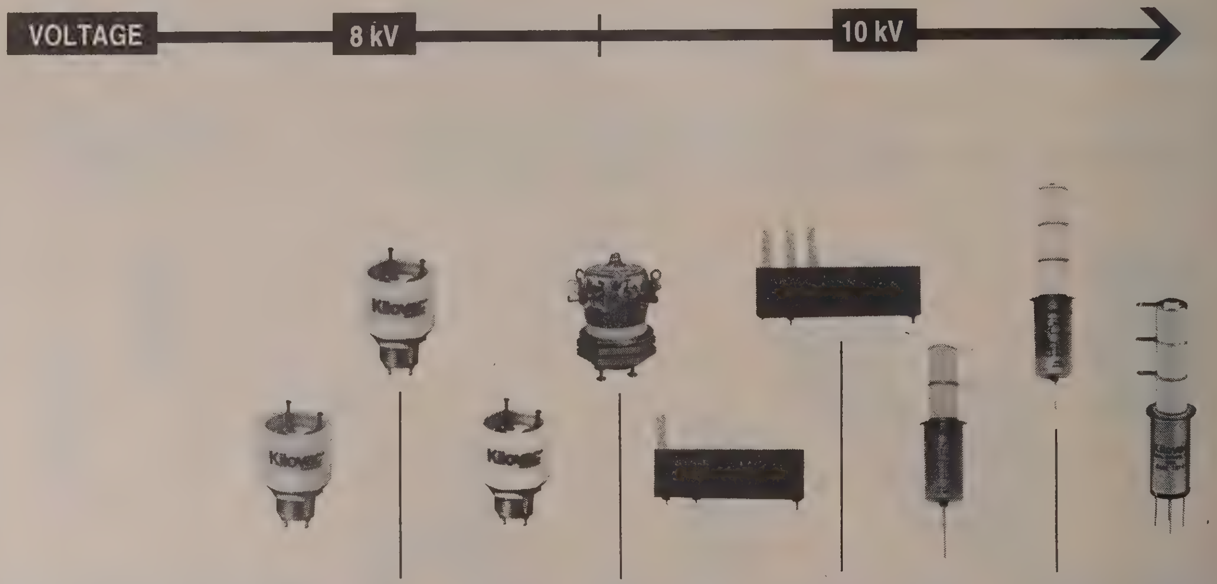
FEATURES OF VACUUM AND GAS-FILLED RELAYS

- Smaller size, lighter weight for a given rating
- Extremely low and stable contact resistance in vacuum relays
- No contact oxidation due to arcing
- Fast operate times
- High resistance to thermal and mechanical shock
- Capable of switching large capacitive loads using gas-filled relays.
- Safe for use in corrosive or explosive atmospheres
- Can be mounted in any orientation
- No contact maintenance
- Usable at frequencies above 32 MHz
- Rapid arc extinction when power switching
- Lower coil power due to small contact gaps



Kilovac Part Number	HC-2	HC-4	HC-6	H-18	K81A, B	K81C	K43A, B	K43C	K43R
Contact Arrangement	SPDT	SPDT	SPDT	DPDT	SPST-NO, SPST-NC	SPDT	SPST-NO, SPST-NC	SPDT	LATCHING SPDT
Rated Operating Voltage	8.0 KVdc	8.0 KVdc	8.0 KVdc	8.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc
Test Voltage	10.0 KVdc	10.0 KVdc	10.0 KVdc	10.0 KVdc	11.0 KVdc	11.0 KVdc	11.0 KVdc	11.0 KVdc	11.0 KVdc
Continuous carry current contacts closed, max. (amps dc or 60 Hz peak)	25	15	8	10	5/10	5/10	15	15	24
Power Switching?	N	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N
Contact Resistance max. (ohms)	.010	.020	.050[3]	.020	.050	.050	.020	.020	.020
Operate Time, max (ms)	6	6	6	15	10	10	10	10	6
Coil Resistance (ohms ±10% @ 20°C)	335	335	335	250	290	290	290	290	80
Coil Voltage (Vdc, nominal)	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5
Nominal Dimensions (inches)	1.13Dx1.88H	1.13Dx1.88H	1.13Dx1.88H	1.5Dx1.97H	2.25Lx.75H	2.5Lx.75H	.65Dx2.18H	.65Dx2.62H	.65Dx2.62H
Nominal Weight (oz.)	1.25	1.25	1.25	4	1.5	2	1	1	1
Mounting Style	Threaded Base	Threaded Base	Threaded Base	Threaded Base	PCB/ Panel	PCB	Flange	Flange	Flange

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
(3) Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
(4) 12 Vdc and 115 Vdc coils available on request.

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Kilovac® Corporation

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Kilovac®

THE EXPERTS IN HIGH VOLTAGE RELAYS
AND DC POWER SWITCHING DEVICES.

High Voltage Relays

TYPICAL APPLICATIONS

TEST EQUIPMENT - Electrostatic discharge testing, dielectric testing, cable and harness testing.

AEROSPACE POWER SWITCHING - Aircraft, space systems, submarine, and ground equipment where 48 Vdc, 155 Vdc, 270 Vdc, and 20 KHz switching and control is required.

MEDICAL INSTRUMENTS - Heart defibrillators, surgical lasers, magnetic resonance imaging (MRI), electrophoresis.

GENERAL - Safety interlock applications, high voltage power supplies, polarity reversal, nuclear instrumentation, switching in explosive or corrosive atmospheres.

ELECTRIC VEHICLES - Battery disconnect, inverter precharge, and climate control relays.

TRANSIT - Lighting, heating, and air conditioning relays up to 1000 Vdc ratings.

RADAR - Pulse forming networks, modulators/transmitters, TWT and klystron switching.

COMMUNICATIONS - H.F. SSB radio, digital antenna couplers and tuners,transmit/receive switching.

LASERS - Pulse forming network discharge, safety interlock, simmer circuit isolation, Pockels cell isolation.

UTILITIES - Nuclear industry approved DC relays for 110 Vdc control circuits.

SEMICONDUCTOR PROCESSING - Multiple target switching.

HIGH INTENSITY LIGHTING SYSTEMS

VOLTAGE
12 kV
15 kV

Kilovac Part Number	H-14	KC-2	KC-8	KC-11	KC-12	KC-15[2]	KC-16[2]	H-8
Contact Arrangement	DPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT
Rated Operating Voltage	12.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc	15.0 KVdc
Test Voltage	15.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	17.0 KVdc	20.0 KVdc
Continuous carry current contacts closed, max. (amps dc or 60 Hz peak)	30	50	30	50	30	12	12	15
Power Switching?	Y[1]	N	Y[1]	N	Y[1]	Y[1]	Y[1]	Y[1]
Contact Resistance max. (ohms)	.015	.012	.025	.012	.025	1.0[3]	1.0[3]	.015
Operate Time, max (ms)	20	15	15	15	15	15	15	15
Coil Resistance (ohms ±10% @ 20°C)	120	250	180	250	180	180	180	265
Coil Voltage (Vdc, nominal)	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]
Nominal Dimensions (inches)	1.8Dx2.77H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1.37Dx2.26H	1Dx3H
Nominal Weight (oz.)	8	3	3	3	3	3	3	3
Mounting Style	Threaded Base	Flange	Flange	Threaded Base	Threaded Base	Flange	Threaded Base	Threaded Base

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
(3) Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
(4) 12 Vdc and 115 Vdc coils available on request.

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High Voltage Relays

VACUUM OR GAS AS A DIELECTRIC?

Both vacuum and gas-filled relays are offered by Kilovac, but each has unique characteristics which should be considered.

VACUUM RELAYS OFFER:

- Low stable contact resistance for dry or low level switching
- Good performance in power switching that requires load interruption.
- Ideal performance for RF applications
- Contacts remain clean and oxide-free under all conditions.

GAS-FILLED RELAYS OFFER:

- The best choice for power switching that requires only "making" of load.
- Superb performance in capacitive discharge applications.
- Best performance for applications above 15kV
- Widely used for "bounce-free" characteristics
- Lowest leakage current

VOLTAGE 15 kV | 20 kV | 25 kV →

Kilovac Part Number	H-26	H-19	H-17	KC-22	KC-32	KC-28[2]	KC-38[2]	KC-30	K62
Contact Arrangement	4PDT	DPDT	SPDT	SPST-NO	SPST-NC	SPST-NO	SPST-NC	SPST-NO	SPST-NO, SPST-NC, SPDT
Rated Operating Voltage	15.0 KVdc	20.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc	25.0 KVdc
Test Voltage	17.0 KVdc	25.0 KVdc	30.0 KVdc	28.0 KVdc	28.0 KVdc	28.0 KVdc	28.0 KVdc	28.0 KVdc	30.0 KVdc
Continuous Carry Current contacts closed, max. (amps DC or 60 Hz peak)	30	30	30	65	45	30	15	55	18
Power Switching?	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N	Y[1]
Contact Resistance max. (ohms)	.020	.015	.015	.005	.010	1.0[3]	1.0[3]	.010	.5
Operate Time, max (ms)	30	30	25	18	18	18	18	18	15
Coil Resistance (ohms ±10% @ 20°C)	130	225	120	120	120	120	120	120	125
Coil Voltage (Vdc, nominal)	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]
Nominal Dimensions (inches)	2.3Dx3.92H	2.28Dx3.25H	2.38Dx3.57H	1.31Sqx4.0H	1.31Sqx4.0H	1.31Sqx4.0H	1.31Sqx4.0H	1.31Sqx4.0H	1.98Dx2.8H
Nominal Weight (oz.)	16	7	5	10	10	10	10	10	12
Mounting Style	Threaded Base	Threaded Base	Flange	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base

(1) Suitable for power switching. Contact factory for details.
(2) Gas-filled for power switching on the "make".
(3) Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
(4) 12 Vdc and/or 115 Vdc coils available on request.

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Kilovac® High Voltage Relays

THE EXPERTS IN HIGH VOLTAGE RELAYS
AND DC POWER SWITCHING DEVICES.

LOW LEAKAGE, HIGH VOLTAGE RELAYS

Kilovac has specialized relays for test equipment and instrument applications which require very low leakage currents and/or very high insulation resistance. We can provide you with standard relays or special relays built for your application with leakage currents in the picoamp range and insulation resistance of 10^{13} or 10^{14} ohms.

KILOVAC MEDICAL RELAYS

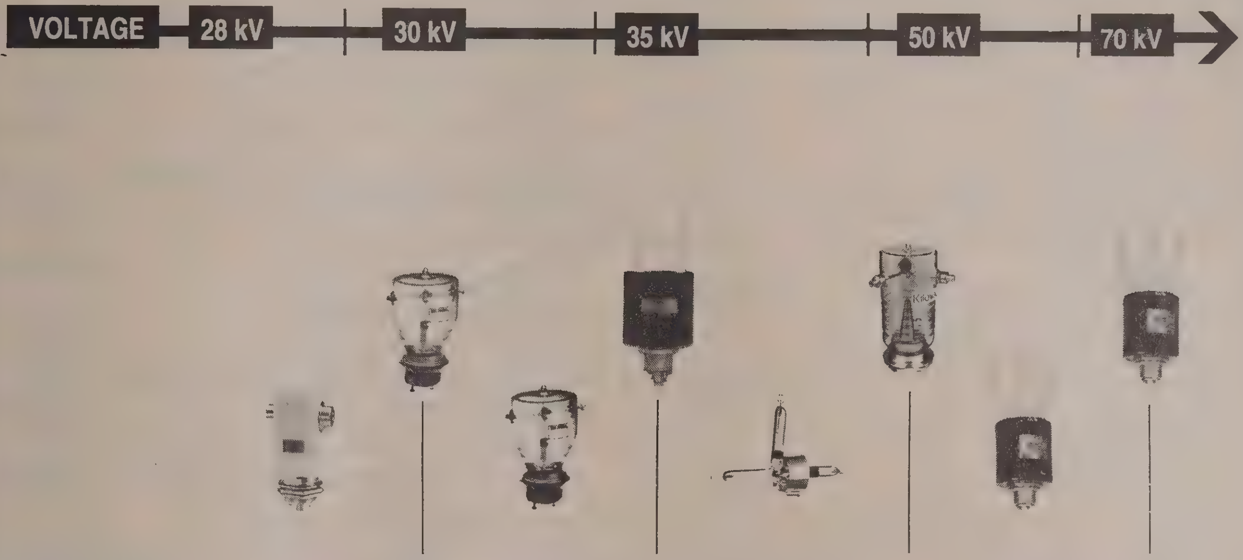
Kilovac has supplied high voltage relays for a number of medical applications ranging from portable heart defibrillators to magnetic resonance imaging equipment.

Kilovac relays are used as polarity reversal switches in electrophoresis equipment to analyze DNA and kidney stone lithotrypters to discharge energy stored in high voltage capacitors.

The small size and high reliability of Kilovac relays make them ideally suited for portable, battery operated equipment.

STRICT STANDARDS OF QUALITY CONTROL

Kilovac maintains an on-going reliability test program to ensure that all relays continue to perform reliably time after time. In addition, since medical relays are often considered a "Critical Component" by the FDA, Kilovac maintains the required quality control and configuration control systems necessary to meet these strict standards.



Kilovac Part Number	KC-20	H-23	H-24	K-61[2]	H-35	H-25	K64C[2]	K70C[2]
Contact Arrangement	SPST-NO	SPST-NC	SPST-NO	SPST-NO, SPST-NC, SPDT	SPDT	SPDT	SPDT	SPDT
Rated Operating Voltage	28.0 KVdc	30.0 KVdc	30.0 KVdc	35.0 KVdc	35.0 KVdc	50.0 KVdc	50.0 KVdc	70.0 KVdc
Test Voltage	30.0 KVdc	35.0 KVdc	35.0 KVdc	40.0 KVdc	40.0 KVdc	55.0 KVdc	55.0 KVdc	75.0 KVdc
Continuous Carry Current contacts closed, max. (amps DC or 60 Hz peak)	110	30	30	10	10	30	10	10
Power Switching?	N	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]
Contact Resistance max. (ohms)	.005	.015	.015	1[3]	.015	.015	1[3]	2[3]
Operate Time, max (ms)	18	30	30	15	30	60	15	15
Coil Resistance (ohms ±10% @ 20°C)	120	120	120	125	50	120	80	75
Coil Voltage (Vdc, nominal)	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5[4]	26.5	26.5	26.5
Nominal Dimensions (inches)	1.31 Sq x 4.0 H	2 D x 3.62 H	2 D x 3.62 H	1.98 D x 2.8 H	8.4 L x 6.03 H	3 D x 7.5 H	1.98 D x 2.8 H	1.98 D x 4.25 H
Nominal Weight (oz.)	10	7	7	12	15	30	12	14
Mounting Style	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base	Threaded Base

[1] Suitable for power switching. Contact factory for details.
[2] Gas-filled for power switching on the "make".
[3] Contact resistance in gas-filled relays is tested at 28 Vdc and 1 amp.
[4] 12 Vdc and 115 Vdc coils available on request.

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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

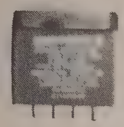
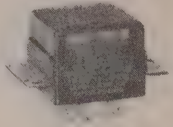
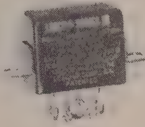
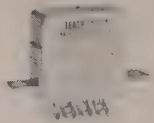
AC Power Supplies, Product Selection Guide	**D•2221**
Batteries, Product Selection Guide	**D•1419**
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	**C•1003**
Capacitors, Product Selection Guide	**A•1003**
Coils, Chokes, Inductors, Product Selection Guide	**A•1179**
Connectors, Terminals & Sockets, Product Selection Guide	**C•1139**
Cores, Magnets & Ferrites	**A•1317**
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**A•1326**
DC-DC Converters	**D•2049**
DC Power Supplies, Product Selection Guide	**D•1488**
Delay Lines, Product Selection Guide	**A•1513**
Discrete Semiconductors, Product Selection Guide	**A•2130**
Displays, Readouts, & CRTs, Product Selection Guide	**B•1017**
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**C•1557**
Fiber Optics, Product Selection Guide	**B•1200**
Filters, Power, Product Selection Guide	**A•1584**
Filters, Signal, Product Selection Guide	**A•1617**
Instruments, Test & Measuring, Product Selection Guide	**D•1215**
Interconnection Systems, Product Selection Guide	**C•1670**
Keyboards & Keypads, Product Selection Guide	**B•1818**
Lamps, Lights, & Indicators, Product Selection Guide	**B•1131**
Microwave Components, Product Selection Guide	**A•1719**
Military Qualified Products List	**B•1002**
Motors, Drives, & Rotating Components, Product Selection Guide	**B•1231**
Oscilloscopes, Product Selection Guide	**D•1402**
Panel Hardware, Product Selection Guide	**C•1522**
Panel Meters, Analog & Digital, Product Selection Guide	**D•1336**
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**A•2053**
Power Supplies, AC, Product Selection Guide	**D•2221**
Power Supplies, DC, Product Selection Guide	**D•1488**
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**B•1341**
Relays, Product Selection Guide	**B•1401**
Resistors, Product Selection Guide	**A•1859**
Solenoids, Product Selection Guide	**B•1626**
Switches, Product Selection Guide	**B•1658**
Thermal Components, Product Selection Guide	**B•1857**
Transducers & Encoders, Product Selection Guide	**B•1911**
Transformers, Product Selection Guide	**A•2229**
Wire & Cable, Product Selection Guide	**C•1701**

LEACH®

SUBMINIATURE RELAYS

Quick Reference Guide

Leach products have been setting the standards in both technology and reliability for more than 70 years. Our products are aboard virtually every major U.S. airborne and commercial program involving aircraft, missiles, satellites and space launch vehicles as well as submarines, ships, tanks, and ground vehicles. This guide describes our relay product line ranging from 5 amp dry circuit subminiatures to 400 amp power contactors, time delay relays and solid state relays.

LEACH® CORPORATION P.O. Box 5032 6900 Orangethorpe Ave. Buena Park, CA 90622-5032 Phone: (714) 739-0770 FAX: 739-1713					
LEACH SERIES:	**X, XL, XA** **SERIES III DESIGN** Low level to 5 Amp 2 PDT Non-Latch & Latch	**Y, YL, YA** **SERIES III DESIGN** Low level to 5 Amp 4 PDT Non-Latch & Latch	**XC, XCL** **SERIES III DESIGN** Low level to 10 Amp 1 PDT Non-Latch & Latch	**YC, YCL, YCA** **SERIES III DESIGN** Low level to 10 Amp 3 PDT Non-Latch & Latch	**J, JA, JL** **BALANCED FORCE DESIGN** Low level to 12 Amp 2 PDT Non-Latch & Latch
DESIGNED TO: APPLICABLE MS NUMBER(S):	MIL-R-6106 M6106/21, 27, 38, 54	MIL-R-6106 M6106/22, 28, 39, 55	MIL-R-6106 N/A	MIL-R-6106 M6106/24, 29, 40	MIL-R-6106 Non-Latch: MS27401 Latch: M6106/50
ELECTRICAL DATA					
Contact Rating (Amps): 28 VDC: Resistive Inductive Motor Lamp	 5 3 2 1	 5 3 2 1	 10 6 4 2	 10 6 4 2	 12 8 4 2
115/200 VAC, 400 Hz, 3Ø, (Case Grounded)	Same as DC except inductive is 5 amp and motor is 3 amp	Same as DC except inductive is 5 amp and motor is 3 amp	Same as DC except inductive is 10 amp	Same as DC except inductive is 8 amp	Same as DC rating except resistive is 10 amp
Nominal Coil Voltage(s): DC Non-Latch DC Latch AC Coil	 6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28 VDC	 6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz
Coil Resistance(s) Ohms: DC Non-Latch DC Latch AC Coil, Current, I Max.	 30/125/500/1600 43/182/730 .100/.040/.024	 25/100/400/1275 37/148/600 .120/.040/.028	 25/125/500/1600 730	 25/100/400/1275 600 .120/.040/.028	 20/80/320/1000 38/150/600/1600 .240/.040/.024
Operate Time, Maximum (MS): DC Non-Latch DC Latch AC Coil	 4 4 4	 6 6 5	 6 6 N/A	 6 15 15	 10 10 15
Release Time, Maximum (MS): DC Non-Latch DC Latch AC Coil	 4 N/A 4	 6 N/A 25	 6 N/A N/A	 6 N/A 25	 10 N/A 50
Bounce Time, Maximum (MS)	0.5	0.5	1.0	1.0	1.0
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz
Shock, Minimum G	200	200	200	200	200
MECHANICAL DATA					
Weight, oz./grams, Max.	.56 oz. (16 g.)	1.06 oz. (30 g.)	.56 oz. (16 g.)	1.09 oz. (31 g.)	1.40 oz. (40 g.)
Dimensions, In., Max. L × W × H	0.810 × 0.410 × 0.640	0.810 × 0.810 × 0.640	0.810 × 0.410 × 0.640	0.810 × 0.810 × 0.640	DC: 1.015 × 0.515 × 1.000 AC: 1.015 × 0.515 × 1.125
Sockets Available: Non-Latch DC Coil Latch DC Coil Non-Latch AC Coil 28 VAC Coil	 SO-1064-001 SO-1064-003 SO-1064-10444 SO-1064-10445	 SO-1066-001 SO-1066-003 SO-1066-10385 SO-1066-10386	 SO-1064-10425 SO-1064-10534 N/A N/A	 SO-1065-001 SO-1065-003 SO-1065-10392 SO-1065-10393	 SO-1049-8309 SO-1055-8690 SO-1049-8772 SO-1055-8774
NOTES:	5 mounting styles 4 terminal types	5 mounting styles 3 terminal types	5 mounting styles 4 terminal types	5 mounting styles 3 terminal types	5 mounting styles 4 terminal types

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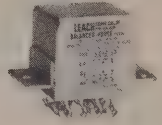
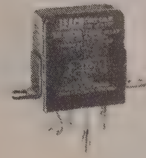
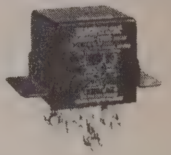
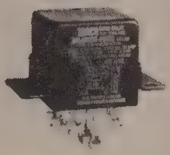
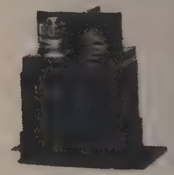
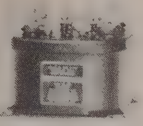
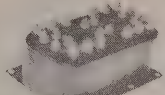
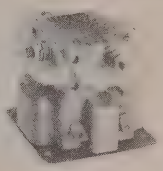
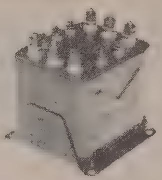
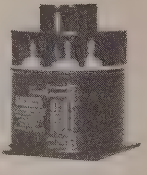
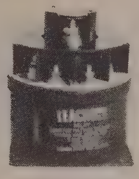
LEACH®CORPORATION P.O. Box 5032 6900 Orangethorpe Ave. Buena Park, CA 90622-5032 Phone: (714) 739-0770 FAX: 739-1713					
LEACH SERIES:	**K, KA, KL** **BALANCED FORCE DESIGN** Low level to 12 Amp 4 PDT Non-Latch & Latch	**JC, JCA, JCL; JS, JSA**[1] **BALANCED FORCE DESIGN** Low level to 25 Amp 1 PDT Non-Latch & Latch	**KC, KCA, KCL** **BALANCED FORCE DESIGN** Low level to 25 Amp 3 PDT Non-Latch & Latch	**KD, KDA, KDL** **BALANCED FORCE DESIGN** Low level to 25 Amp 3 PST/NO, 2 amp 1 PDT Aux Non-Latch & Latch	**KM** **BALANCED FORCE DESIGN** 50 Amp 1 PST/DB Non-Latch & Latch
DESIGNED TO: APPLICABLE MS NUMBER(S):	MIL-R-6106 Non-Latch: MS27400 Latch: M6106/51	MIL-R-6106 Non-Latch: M6106/19 Latch: M6106/20	MIL-R-6106 Non-Latch: MS27743 Latch: MS27742	MIL-R-6106 Non-Latch: M6106/13 Latch: M6106/12	MIL-R-6106 N/A
ELECTRICAL DATA					
Contact Rating (Amps): 28 VDC: Resistive Inductive Motor Lamp 115/200 VAC, 400 Hz, 3Ø, (Case Grounded)	 12 8 4 2 Same as DC rating except resistive is 10 amp	JC, JCA, JCL[1] JS, JSA[2] 25 10 12 10 10 4 5 4 Same as DC rating N/A See Note[2]	 25 12 10 5 Same as DC except inductive is 15 amp	 25 12 10 5 Same as DC except inductive is 15 amp	 50 15 30 15 N/A (see notes)
Nominal Coil Voltage(s): DC Non-Latch DC Latch AC Coil	 6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	 6/12/28 VDC 6/12/28 VDC N/A
Coil Resistance(s) Ohms: DC Non-Latch DC Latch AC Coil Current, I Max.	 18/70/290/890 28/112/450/1500 .120/.040/.028	 20/80/320/1000 38/150/600/1600 .100/.040/.024	 18/70/290/890 28/112/450/1500 .120/.040/.028	 18/70/290/890 28/112/450/1500 .120/.040/.028	 18/70/290 28/112/450 N/A
Operate Time, Maximum (MS): DC Non-Latch DC Latch AC Coil	 15 15 20	 10 10 15	 15 15 20	 15 15 20	 15 15 N/A
Release Time, Maximum (MS): DC Non-Latch DC Latch AC Coil	 15 N/A 50	 10 N/A 50	 15 N/A 50	 15 N/A 50	 15 N/A N/A
Bounce Time, Maximum (MS)	1.0	1.0	1.0	1.0 (Aux 4)	1.0
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz
Shock, Minimum G	200	200	200	200	50
MECHANICAL DATA					
Weight, oz./grams, Max.	DC: 2.5 oz. (71 g.) AC: 2.7 oz. (77 g.)	1.6 oz. (45 g.)	3.0 oz. (85 g.)	3.0 oz. (85 g.)	3.0 oz. (85 g.)
Dimensions, in., Max. L × W × H	1.015 × 0.015 × 1.000	DC: 1.015 × 0.515 × 1.000 AC: 1.015 × 0.515 × 1.125	1.015 × 1.015 × 1.000	1.015 × 1.015 × 1.000	
Sockets Available: Non-Latch DC Coil Latch DC Coil Non-Latch AC Coil 28 VAC Coil	 SO-1048-8308 SO-1056-8691 SO-1048-8776 SO-1048-8779	 SO-1063-9033 SO-1063-9036 SO-1063-9034 N/A	 SO-1057-8912 SO-1058-8913 SO-1062-8917 N/A	 SO-1059-8914 SO-1060-8915 SO-1061-8916 N/A	 N/A N/A N/A N/A

NOTES:	5 mounting styles 3 terminal types	4 mounting styles 4 terminal types Special models available. [1] JS, JCA & JCL @ 50 ADC & 80 amp 400 Hz overload. [2] JS/JSA only designed to switch 115 VAC, 60 Hz case grounded; JS has 20 amp overload capabilities	5 mounting styles 3 terminal types	5 mounting styles 3 terminal types Same design as KC series with added auxiliary pole	Special models available; contact factory for auxiliary contacts, and additional information

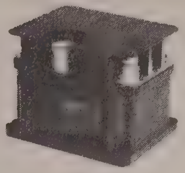
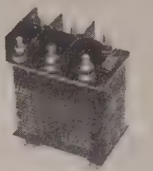
POWER CONTACTORS

LEACH®CORPORATION P.O. Box 5032 6900 Orangethorpe Ave. Buena Park, CA 90622-5032 Phone: (714) 739-0770 FAX: 739-1713					
LEACH SERIES:	**9123** 25 Amp 3 PST/NO DB	**9124** 50 Amp 3 PST/NO DB	**9125** 50 Amp 3 PDT-CO DB 6 PST/NO DB	**9207** 25 to 100 Amp 3 PST/NO DB, 4 PST/NO DB, 2 P/NO, 2 P/NC DB	**9213** 25 to 100 Amp 3 PST/NO, 4 PST/NO, 2 P/NO, 2 P/NC DB
DESIGNED TO:	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106 DESC Spec 84192	MIL-R-6106
APPLICABLE MS NUMBER(S):	MS27997	MS27222			
ELECTRICAL DATA					
Contact Rating (Amps):					
28 VDC:					
Resistive	25	50	50	25-100	25-100
Inductive	25	50	50	25-100	25-100
Motor	25	50	50	25-100	25-100
Lamp	N/A	N/A	N/A	N/A	N/A
115 VAC, 400 Hz, 3Ø:					
Resistive	25	50	50	25-100	25-100
Inductive	25	50	50	25-100	25-100
Motor	25	50	50	25-100	25-100
Lamp	N/A	N/A	N/A	N/A	N/A
115 VAC, 50/60 Hz, 3Ø:					
Resistive	15	30	30	50	50
Inductive	15	30	30	50	50
Motor	7	15	15	50	50
Lamp	N/A	N/A	N/A	N/A	N/A
	[1]	[1] 50	[1]	[1]	[1]
Resistance, Ohms ±10% @ 25°C for 28 VDC	50Ω	50Ω	50Ω	44.5Ω	44.5Ω
Nominal Coil Voltage(s)	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz
Operate Time, Maximum (MS):					
AC Coils	30	30	30	40	40
DC Coils	25	25	25	30	30
Release Time, Maximum (MS):					
AC Coils	50	50	50	50	60
DC Coils	10	10	10	20	20
Bounce Time, Maximum (MS)	2	2	2	10	10
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	15 G 55 to 1500 Hz	15 G 55 to 1500 Hz	15 G 70 to 1500 Hz	10 G 55 to 500 Hz	10 G 55 to 1500 Hz
Shock, Minimum G	50	50	50	50	50
MECHANICAL DATA					
Weight, oz./grams, Max.	20 oz.	20 oz.	46.4 oz.	28 oz.	44.8 oz.
Dimensions, in., Max. L × W × H	3.73 × 3.305 × 2.50	3.73 × 3.305 × 2.50	6.21 × 3.80 × 2.70	3.63 × 3.62 × 2.875	4.22 × 4.23 × 4.53
NOTES:	Auxiliary 5 amp contacts available. [1] 440 Vac 60 Hz delta ratings available	Auxiliary 5 amp contacts available. [1] 440 Vac 60 Hz delta ratings available	Auxiliary 5 amp contacts available. [1] 440 Vac delta 60 Hz ratings available	Unsealed rotary, 1, 2, 3 and 4 pole; auxiliary contacts from 5 to 25 amps available [1] 440 Vac 60Hz wye/delta rated	Sealed rotary, 1, 2, 3 and 4 pole; auxiliary contacts from 5 to 25 amps available [1] 440 Vac 60 Hz wye/delta rated

POWER CONTACTORS

LEACH®CORPORATION P.O. Box 5032 6900 Orangethorpe Ave. Buena Park, CA 90622-5032 Phone: (714) 739-0770 FAX: 739-1713					
LEACH SERIES:	**H, HT SERIES** 60 Amp 3 PST, 3 PDT, 1 PDT-DB Magnetic Latch	**HC, CENTER-OFF SERIES** 50 Amp 3 PDT-NO 1 PDT-NO DB	**HL, HLT** 60 Amp 3 PST, 3 PDT, 1 PDT-DB	**ZC, CENTER-OFF** 100 Amp 3 PDT-NO, 1 PDT/NO DB	**Z, ZG, ZJ SERIES** 120-200 Amp 3 PDT, 3 PST/NO, SPDT-DB SPST/NO-DB, SPST/NC-DB
DESIGNED TO:	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106
APPLICABLE MS NUMBER(S):	MS27751 M6106/26 and 43	MS27750	MS27749		
ELECTRICAL DATA					
Contact Rating (Amps):					
28 VDC:					
Resistive	50	25	50	50	50
Inductive	20	15	20	30	30
Motor	20	15	20	30	30
Lamp	10	10	10	N/A	N/A
115 VAC, 400 Hz, 3Ø:					
Resistive	60	50	60	100	120-200
Inductive	60	50 ①	60	100	120-200
Motor	40	30	40	60	80-120
Lamp	15	15	15	N/A	N/A
115 VAC, 50/60 Hz, Δ:					
Resistive	30	30	30	60	60
Inductive	30	30	30	60	60
Motor	30	30	30	40	60
Lamp	N/A	N/A	N/A	N/A	N/A
Resistance, Ohms ±10% @ 25°C for 28 VDC	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω; 115 VAC, .090 Amp	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω ② 115 VAC, .100 Amps	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω	6 VDC, 9.3Ω; 12 VDC, 38Ω; 28 VDC, 150Ω ①, 115 VAC, 0.9 Amp	6 VDC, 7Ω; 12 VDC, 28Ω; 28 VDC, 113Ω; 115 VAC, .12 Amp
Nominal Coil Voltage(s)	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz
Operate Time, Maximum (MS):					
AC Coils	50	35	35	60	60
DC Coils	50	35	35	60	60
Release Time, Maximum (MS):					
AC Coils	80	80	—	80	40
DC Coils	25	25	—	40	40
Bounce Time, Maximum (MS)	3	3	3	4	4
ENVIRONMENTAL DATA					
Sinusoidal Vibration, Maximum G	10 G 70 to 1000 Hz	10 G 70 to 1000 Hz	10 G 70 to 1000 Hz	5 G 70 to 500 Hz	10 G 70 to 1000 Hz
Shock, Minimum G	50	50	50	15	50
MECHANICAL DATA					
Weight, oz./grams, Max.	14 oz.	15 oz.	15 oz.	32 oz. to 43.2 oz.	32 oz. to 43.2 oz.
Dimensions, in., Max.	2.5 diameter × 3.13	2.50 diameter × 3.13	2.50 diameter × 3.13	3.65 diameter × 4.28	3.65 diameter × 4.28
NOTES:	HT (power transfer model); auxiliary 5 amp contacts and gasket sealed models available	Gasket sealed models available ① 30 amps for AC coil ② ±20% @ 25°C	HLT (power transfer model); auxiliary 5 amp contacts and gasket sealed models available	Gasket sealed and magnetically latched versions available ① ±20% @ 25°C	Auxiliary 5 amp contacts and other configurations available; gasket sealed models available

POWER CONTACTORS

LEACH®CORPORATION P.O. Box 5032 6900 Orangethorpe Ave. Buena Park, CA 90622-5032 Phone: (714) 739-0770 FAX: 739-1713				
LEACH SERIES:	**ZL SERIES** 120 to 200 Amp 3 PST, 3 PDT, 1 PDT-DB Magnetic Latch	**A, AJ SERIES** 300 to 400 Amp 1 PST/NO DB	**W, WC, WL SERIES** [1] 250 to 275 Amp 1 PDT-DB, 3 PST/NO 1 PST/NO-DB, 1 PST/NC-DB	**REHL SERIES** [1] 15 to 65 Amp 1 PST-DB, 3 PST, 3 PDT
DESIGNED TO:	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106/MIL-C-83883
APPLICABLE MS NUMBER(S):		MIL-R-6106/33		
ELECTRICAL DATA				
Contact Rating (Amps):				
28 VDC:				
Resistive	50	300/400	125	15-50
Inductive	30	100/150	75	12-50
Motor	30	250/250	75	5-20
Lamp	N/A	N/A	N/A	N/A
115 VAC, 400 Hz, 3 Ø:				
Resistive	120	N/A	275	15-65
Inductive	120	N/A	275	15-60
Motor	80	N/A	175	15-40
Lamp	N/A	N/A	N/A	N/A
115 VAC, 50/60 Hz, Δ:				
Resistive	60	N/A	N/A	30
Inductive	60	N/A	N/A	30
Motor	60	N/A	N/A	30
Lamp	N/A	N/A	N/A	N/A
Resistance, Ohms ±10% @ 25°C for 28 VDC	6 VDC, 10Ω; 12 VDC, 40Ω; 28 VDC, 163Ω [1]	6 VDC, 4Ω; 12 VDC, 15Ω; 28 VDC, 60Ω	(W) 8-90Ω; (WL) 9.8Ω; (WC) 100Ω [2]	N/A
Nominal Coil Voltage(s)	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC	28 VDC 115 VAC, 400 HC (W/WC) 28 VDC Suppressed (W/WC)	28 VDC 115 VAC, 400 Hz
Operate Time, Maximum (MS):				
AC Coils	60	N/A	60	N/A
DC Coils	60	35	60	N/A
Release Time, Maximum (MS):				
AC Coils	N/A	N/A	125	N/A
DC Coils	N/A	15	40	N/A
Bounce Time, Maximum (MS)	4	4	4	4
ENVIRONMENTAL DATA				
Sinusoidal Vibration, Maximum G	10 G 55 to 500 Hz	10 G, 70 to 500 Hz 5 G, 500 to 2000 Hz	20 G 60 to 2000 Hz	10 G 55 to 2000 Hz
Shock, Minimum G	15	25	20	25
MECHANICAL DATA				
Weight, Max.	2.0 to 2.75 lbs.	1.75 lbs.	4.5 lbs.	2.0 lbs.
Dimensions, in., Max. L × W × H	3.65 diameter × 4.28	3.90 × 3.64 × 2.80	4.625 × 5.56 × 4.10	3.69 × 3.25 × 4.26

NOTES:	[1] ±20% @ 25°C. Auxiliary 5 amp contacts available	Auxiliary 5 amp contacts available	Auxiliary 8 amp contacts available [1] WL Magnetic Latch, WC Center-Off versions [2] ±20% @ 25°C	Auxiliary 5 amp contacts available. [1] Current sensing with remote control capability

LEACH®CORPORATION

TIME DELAY RELAYS

6900 ORANGETHORPE AVE., P.O. BOX 5032, BUENA PARK, CA 90622-5032 • (714) 739-0770 • TWX 910-596-2867 • FAX (714) 739-1713

SPECIFYING A FIXED TIME DELAY PERIOD

LEACH and the Military identify the time delay period in the same manner. A four-digit dash number specifies the delay period in milliseconds. The first three numbers are significant figures while the fourth indicates the number of zeroes to follow the first three.

Examples:
–1001 = 1,000 milliseconds (1 second)
–2502 = 25,000 milliseconds (25 seconds)
–5000 = 500 milliseconds (0.5 seconds)

In the case of a repeat cycle timer (flasher), a similar method is used. The dash number indicates the length of each cycle. (Note: each cycle is 50% on, 50% off).

Examples:
–2500 = 250 milliseconds cycle or 4 cycles/sec.
–1001 = 1,000 milliseconds cycle or 1 cycle/sec.
–6002 = 60,000 milliseconds cycle or 1 cycle/min.

USE AND SELECTION OF ADJUSTABLE TIMERS

Adjustable timers are useful in system prototyping or breadboard circuits where the precise time delay period is unknown. By the use of an external resistor, these devices are adjustable over a specific DECADE RANGE. Although any decade range within the overall timing range can be supplied, the following ranges are offered as standards:

0.1 to 1 seconds	(Specify –1001)
1.0 to 10 seconds	(Specify –1002)
5 to 50 seconds	(Specify –5002)
50 to 500 seconds	(Specify –5003)

Note from the above that in specifying a decade range, the four-digit dash number indicates the high or upper limit of the desired decade range.

The formula below provides the proper resistance value to achieve the desired time delay:

$$R_{ext} = \left(\frac{T_1}{T_0} - 1\right) 100{,}000 \text{ Ohms}$$

Where: R_{ext} = External resistance value (Ohms)
T_1 = Desired time in seconds
T_0 = Minimum time (low end of the decade range) in seconds

As an example, if using a 5 to 50 second adjustable timer and a 30 second delay is desired, the calculation is:

$$R_{ext} = \left(\frac{30}{5} - 1\right) 100{,}000 \text{ or } R_{ext} = 500 \text{ K Ohms}$$

Recommended resistors IAW MIL-R-55182 ⅛ WATT, 1% (RNC6OHXXXXFS).

QPL CROSS REFERENCE — MILITARY P/N TO LEACH P/N

Military P/N	Leach P/N	Operation Mode	Output	Timing Range (seconds)
M83726/3[1]	TD-1150/1151	Delay On Operate – Fixed Time	10A, 2PDT	0.1 to 300
M83726/4[1]	TD-1160/1161	Delay On Release – Fixed Time	10A, 2PDT	0.1 to 300
M83726/12	TD-1369	Delay On Release – Fixed Time	10A, 4PDT	0.1 to 300
M83726/14	TD-1370	Delay On Operate – Fixed Time	10A, 4PDT	0.1 to 300
M83726/20	TD-1435	Delay On Operate – Fixed Time	250MA, SPST	0.05 to 500
M83726/21	TD-1436	Delay On Operate – Adjustable[2]	250MA, SPST	0.05 to 500
M83726/22	TD-1412	Repeat Cycle Timer (Flasher)	250MA, SPST	1-600 cycles/min.[3]
M83726/23	TD-1505	"True" Delay On Release – Fixed[4]	10A, 4PDT	0.1 to 75
M83726/24	TDH-1609	Delay On Operate – Fixed Time	150MA, SPST	0.05 to 500
M83726/25	TDH-1610	Delay On Release – Fixed Time	150MA, SPST	0.05 to 500
M83726/28	TDH-8050/8051	Delay On Operate – Fixed Time	10A, 2PDT	0.1 to 600[5]
M83726/29	TDH-8070/8071	Delay On Release – Fixed Time	10A, 2PDT	0.1 to 600[5]
M83726/30	TDH-8060/8061	Delay On Operate – Adjustable	10A, 2PDT	0.1 to 600[5]
M83726/31	TDH-8080/8081	Delay On Release – Adjustable	10A, 2PDT	0.1 to 600[5]

[1] Slash sheets 1, 2, 3 & 4 to MIL-R-83726 have been officially cancelled. DLA specified replacements: /28 replaces /1 and /3 and /29 replaces /2 and /4. Replacement units are smaller and lighter but are electrically and physically compatible with inactivated units.

[2] All adjustable timers use external resistor (not supplied) to adjust timing range.

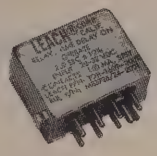
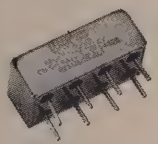
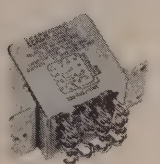
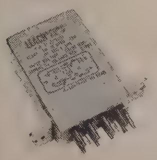
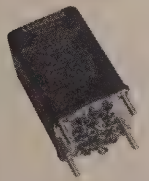
[3] Each cycle 50% on, 50% off.

[4] "True" time delay on release requires no external power during timing period.

[5] Timing ranges above 500 seconds not MIL qualified.

LEACH®

TIME DELAY RELAYS

LEACH® CORPORATION 6900 Orangethorpe Ave. Buena Park, CA 90620 (714) 739-0770 FAX: (714) 739-1713 ■ TWX: 910-596-2867		CONTACT RATING—AMPS	OUTPUT CONFIGURATION	METHOD OF TIMING				TIMING RANGE IN SECONDS	DIMENSIONS (L×W×H) WEIGHT MAX OZ.
				ON OPERATE FIXED TIME	ON OPERATE ADJUSTABLE	ON RELEASE FIXED TIME	ON RELEASE ADJUSTABLE		
	TDH-1609	.150	SPST	✓				.05 TO 500	.810 × .410 × .640 0.56 oz.
	TDH-1610					✓			
	TD-1435	.250	SPST	✓				.05 TO 500	.810 × .410 × .310 0.5 oz.
	TD-1436				✓				
	TD-1412			REPEAT CYCLE (FLASHER)				1 TO 600 CYCLES/MIN	
	TDH-8050	10	2PDT	✓				0.1 TO 600	1.025 × 1.025 × 1.010 2.5 oz.
	TDH-8060				✓				
	TDH-8070					✓			
	TDH-8080						✓		
	TDH-6050	10	2PDT	✓				0.1 TO 600	1.025 × .525 × 1.520 1.9 oz.
	TDH-6060				✓				
	TDH-6070					✓			
	TDH-7050	10	4PDT	✓				0.1 TO 600	1.025 × 1.025 × 1.500 3.0 oz.
	TDH-7060				✓				
	TDH-7070					✓			
	TD-1370	10	4PDT	✓				0.1 TO 300	1.531 × 1.531 × 2.340 10.0 oz.
	TD-1369					✓			
	TD-1505	10	4PDT			✓ "TRUE"		0.1 TO 75	2.062 × 2.062 × 1.810 12.0 oz.

LEACH®CORPORATION

INTELLIGENT SWITCHING DEVICES

6900 ORANGETHORPE AVE., P.O. BOX 5032, BUENA PARK, CA 90622-5032 • (714) 739-0770 • TWX 910-596-2867 • FAX (714) 739-1713

SOLID STATE RELAY DESCRIPTIONS

LEACH Solid State Relays utilizes state-of-the-art custom integration and power MOSFET technology to provide sophisticated features plus optimized power output switching.

In both the Solid State Relay (LS06051B) and Solid State, True Current Sensing Relay (LS06102C), an isolated status pin is provided which acts as a trip indicator. A low status indicates the output has tripped off due to an over-current condition.

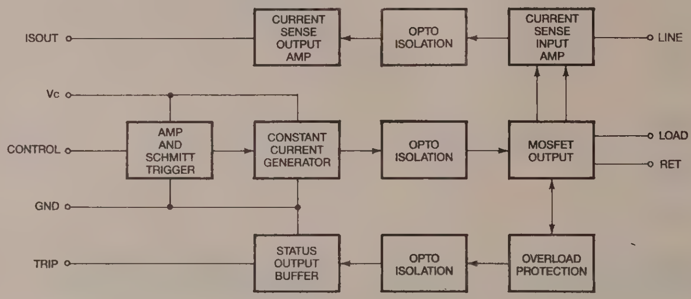
In the Solid State, True Current Sensing Relay (LS06102C), unique and proprietary circuit is used to provide an isolated, analog load current signal. After proper scaling, this signal gives the true load current value.

Both the LS06051B and LS06102C feature integrated short circuit, current overload, and thermal overload protection to protect both the unit and the system wiring. Optical isolation between input and output, while reducing size and cost, helps eliminate EMI and RFI usually present in transformer type isolation circuits. Buffered inputs enable the relay to be driven directly by standard CMOS or open collector TTL Logic. The LS06051B and the LS06102C are housed in a hermetic metal package to maximize heat dissipation.

These are two products from a family of products utilizing LEACH's functional block design concept. Additional features and isolated input/output pins are available.

Solid State Relay
True Current Sensing

BLOCK DIAGRAM


ISOUT
CURRENT SENSE OUTPUT AMP
OPTO ISOLATION
CURRENT SENSE INPUT AMP
LINE
Vc
CONTROL
AMP AND SCHMITT TRIGGER
CONSTANT CURRENT GENERATOR
OPTO ISOLATION
MOSFET OUTPUT
LOAD
RET
GND
TRIP
STATUS OUTPUT BUFFER
OPTO ISOLATION
OVERLOAD PROTECTION

SOLID STATE POWER CONTROLLER DESCRIPTIONS

LEACH Solid State Power Controllers feature reliable, troublefree switching together with short circuit and overload protection. Load current is continuously monitored, and the devices will shutdown within microseconds reacting to an overload condition.

In both Solid State Power Controller Products (LR06014N family and LR06025Q family), the status signal is derived from the load current and is reported via an optically isolated status output.

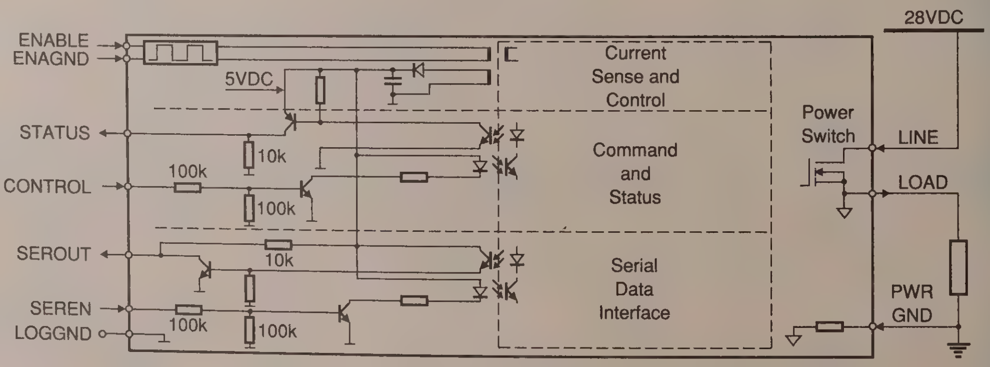
The LR06014N family is designed for operation in 28 VDC power systems with ratings from 1 to 4 amperes.

The LR06025Q family is designed for operation in 28 VDC power systems with ratings from 2 through 10 amperes.

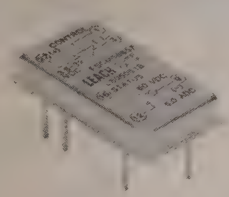
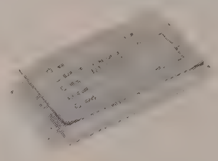
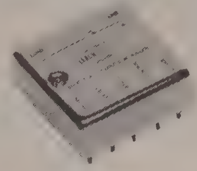
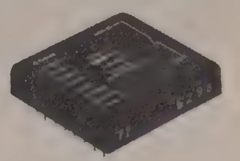
Both the LR06014N family and LR0625Q family are enclosed in a hermetically sealed metal package to maximize heat dissipation.

Solid State Power Controller
Serial Data Word Output

BLOCK DIAGRAM


ENABLE
ENAGND
5VDC
Current Sense and Control
28VDC
STATUS
10k
Command and Status
Power Switch
LINE
100k
CONTROL
100k
LOAD
SEROUT
10k
Serial Data Interface
SEREN
100k
100k
PWR GND
LOGGND

INTELLIGENT SWITCHING DEVICES

LEACH® CORPORATION 6900 Orangethorpe Ave. P.O. Box 5032 Buena Park, CA 90622-5032 (714) 739-0770 TWX: 910-596-2867				
DESCRIPTION:	SOLID-STATE RELAY	SOLID-STATE RELAY	SOLID-STATE POWER CONTROLLER	SOLID-STATE POWER CONTROLLER
LEACH SERIES/PART NUMBER:	LS / LS06051B	LS / LS06102C	LR / LR06014N, LR06024N, LR06044N	LR / LR06025Q, LR06055Q, LR06105Q
FUNCTIONS / FEATURES				
	— Power output switching — Short circuit, current overload and thermal overload protection — Trip status indication — Optical isolation	— Power output switching — Short circuit, current overload and thermal overload protection — True current sense — Trip status indication — Current sense indication — Optical isolation	— Power output switching — Short circuit and current loverload protection — On/off status indication — Optical and transformer isolation	— Power output switching — Short circuit, current overload and thermal overload proptection — On/off status indication — Serial data word including load current information, bit and trip status — Optical and transformer isolation

ELECTRICAL DATA

	LS06051B				LS06102C				LR06014N…				LR06025Q…			
INPUT (CONTROL) CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	MIN.	TYP.	MAX.	UNITS	MIN.	TYP.	MAX.	UNITS	MIN.	TYP.	MAX.	UNITS
Bias Supply Range, V_C	3.8		32	V_{DC}	3.8		32	V_{DC}	5 V_{DC} Bias 4.5 28 V_{DC} Bias 18		5.5 32	V_{DC}	Bias Derived From Output			
Bias Supply Current		13	16	mA		13	16	mA			20	mA	Bias Derived From Output			
Control Input	TTL, CMOS Compatible				TTL, CMOS Compatible				TTL, CMOS Compatible				TTL, CMOS Compatible			
Control Input Hysteresis (CMOS Mode)		1.2		V_{DC}		1.2		V_{DC}		N/A				N/A		
Serial Enable Control		N/A				N/A				N/A			TTL, CMOS Compatible			
Enable Voltage		N/A				N/A				N/A			14		32	V_{DC}
Enable Current		N/A				N/A				N/A				15	30	mA
OUTPUT (LOAD) CHARACTERISTICS																
Continuous Load Current			5.0	Amps			10.0	Amps			1.0, 2.0, 4.0	Amps			2.0, 5.0, 10.0	Amps
Continuous Operating Output Voltage (Line Voltage)			60	V_{DC}			32	V_{DC}			32	V_{DC}			32	V_{DC}
Output Voltage Drop @ Rated Current			0.5	V_{DC}			0.5	V_{DC}			0.2	V_{DC}			0.22	V_{DC}
Leakage Current @ Max. Output Voltage			1.0	mA			15 @ 32 V_{DC}	mA			.1 @ 28 V_{DC}	mA			1.0 @ 28 V_{DC}	mA
Transient Blocking Voltage			80	V_{DC}			80	V_{DC}			50	V_{DC}				
Turn-On Time			1.0	mSec			2.0	mSec			.125	mSec				
Turn-Off Time			1.0	mSec			2.0	mSec			.185	mSec				
OUTPUT (LOAD) INDICATIONS, ISOLATED																
Status	TTL, CMOS Compatible				TTL, CMOS Compatible				TTL, CMOS Compatible				TTL, CMOS Compatible			
Serial Data Word Out		N/A				N/A				N/A						
Serout Voltage "Low"													0	0.8		V_{DC}
Serout Impedance "High"													8.0	10	12	KΩ
Current Sense Output (ISOUT)		N/A								N/A				N/A		
Scale					$I_{LOAD} = 2.244 (V_{ISOUT} + 0.1227)$											
Accuracy						±5		%								

ENVIRONMENTAL DATA

	LS / LS06051B	LS / LS06102C	LR / LR06014N, LR06024N, LR06044N	LR / LR06025Q, LR06055Q, LR06105Q
Operating Temperature Range	−55°C to +105°C	−55°C to +105°C	−55°C to +105°C	−55°C to +105°C
Storage Temperature Range	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C
Thermal Impedance	7°C/Watt (Junction to Case)	10°C/Watt (Junction to Case)	20°C/Watt (Junction to Ambient)	15°C/Watt (Junction to Ambient)
Maximum Output Junction Temperature	125°C	125°C	150°C	150°C
Vibration	100 g, 10 to 3000 Hz	100 g, 10 to 3000 Hz	30 g, 10 to 3000 Hz	30 g, 10 to 3000 Hz
Acceleration	5000 g	5000 g	100 g	100 g
Shock	50 g, 11 mSec	50 g, 11 mSec	50 g, 11 mSec	50 g, 11 mSec
MTBF			880,000 hrs.	300,000 hrs.
Altitude			80,000 ft.	80,000 ft.
PHYSICAL DATA				
Enclosure	Hermetically Sealed	Hermetically Sealed	Hermetically Sealed	Hermetically Sealed
Material	Header & Can = Cold Rolled Steel Nickel Plated, Pins = Cu Alloy #52 Gold Plated	Header & Lid = Kovar, Pins = Cu Alloy #52 Gold Plated	Case Finish & Pins = Tin Plated	Case Finish = Matte Black, Pins = Tin Plated
Weight	20 grams max.	50 grams max.	20 grams max.	37 grams max.

NOTES:

[1] See respective Leach Engineering Data Sheets for further details.
[2] All specifications subject to change without notice.
[3] Leach manufactures the M85C-2AS & M33C-1NS under license from Teledyne Solid State, a Division of Teledyne Relay.

POWER PRODUCTS MIL-SPEC POWER MONITORS

Time Delay Relays, Flashers, Voltage, Frequency, Phase Monitors

POWER AND VOLTAGE MONITORS

EQUIPMENT TYPES – Individual units monitor AC or DC voltage and line frequency for both high and low limits, and phase rotation for reversal/loss. Power monitors are also available incorporating any combination of these functions into a single unit. This equipment is available with factory set limits or as field adjustable.

FREQUENCY AND PHASE MONITORS

Logitek Frequency Monitors are used in applications where electrical systems must be de-energized or alarm devices activated when the power line frequency departs from the predetermined normal range of operations.

Logitek Phase Monitors are used to protect three-phase loads, particularly rotating components, from damage resulting from phase reversals or the absence of phase. Contacts may be used to disconnect the load, to operate an alarm, or both.

TIME DELAY RELAYS, SOLID STATE FLASHERS

The design of complex electrical distribution systems often requires certain operations be delayed or sustained for a precise interval of time. Combinations of various timing devices can be used for sequential startup or shutdown, load transfer or shedding, or delayed transfer to avoid race conditions. In addition, pulsers, interval timers, and flashers are used in applications, such as operating instrument panel warning lights or other annunciator devices, landing gear, door open indicators and navigation lights.

QUALITY ASSURANCE

Logitek's products are designed and manufactured in accordance with MIL-Q-9858A and MIL-I-45208. Our standard production 100-hour factory burn-in contributes to reliable, long-term performance, as demonstrated by an incredibly low 0.1% field reject rate.

CUSTOM & SPECIAL APPLCATIONS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

MIL-SPEC & RUGGED INDUSTRIAL APPLICATIONS

TYPICAL ELECTRICAL SPECIFICATIONS

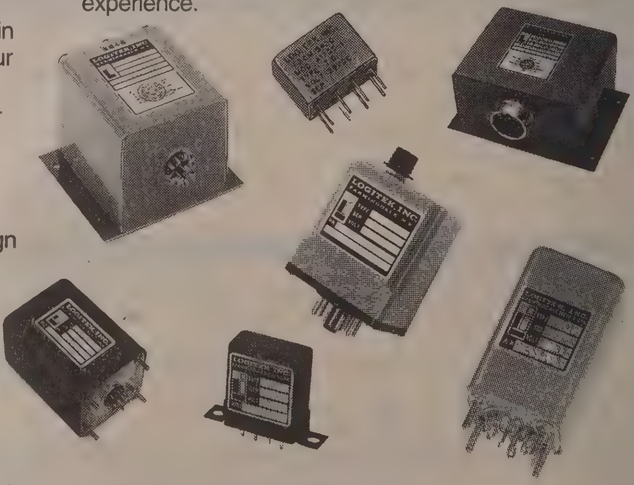
• **Input Voltage:**	115 VAC/208 VAC/230 VAC
• **Voltage:**	MIL-STD-704, Limits
• **Transients:**	1, 2, 3
• **Input Frequency:**	50 / 60 / 400 Hz
• **Sense Voltage:**	As required
• **Sense:**	As required
• **Frequency Accuracy:**	±1%
• **Phase Sequence:**	ABC
• **Time Delay (Pick-Up & Drop Out):**	250 milliseconds to 10 seconds factory set or field adjustable
• **Relay Contacts:**	DPDT, 3PDT
• **Contact Rating:**	2 amp, 10 amp
• **Contact Life:**	50,000 operations minimum

TYPICAL ENVIRONMENTAL SPECIFICATIONS

• **Temperature:**	-55°C to +125°C, -40°C to +85°C, -10°C to +70°C
• **Vibration:**	Per MIL-STD-810C, Method 514.2, Procedure 1, 50g's 11±1 millisecond any axis
• **Acceleration:**	Per MIL-STD-810C, Method 513.2, Procedure 1 & II, 10g's
• **Humidity:**	Per MIL-STD-810C, Method 507.1, Procedure 1
• **Altitude:**	Per MIL-STD-810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

WARRANTY

We are proud to offer an industry leading 3-year warranty and have over 30 years of successful experience.



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- **SOLID STATE SWITCHMASTER®**

SOLID STATE RELAYS

SS SERIES
SSA — SCR's back to back with A.C. control.
SSD — SCR's back to back with D.C. control.

ST SERIES:
STA — TRIAC with A.C. control.
STD — TRIAC with D.C. control.

SPECIFICATIONS

1. Current Rating: 8 to 90 Amps.
2. Minimum load current: 50 ma.
3. Temperature Range:
   a. Operating: −30°C to +80°C
   b. Storage: −28°C to +100°C
4. Duty: Continuous
5. Contacts: 1 Form A (SPNO)
6. Input control: A.C. Models
   a. Control voltage range: 90 — 280 VAC
   b. Must operate voltage: 90 VAC Max.
   c. Must release voltage: 10 VAC Min.
   d. Input impedance: 40,000 OHMS Min.
   e. Input current: 2mA max @ 120 VAC
7. Input control: D.C. Models
   a. Control voltage range: 3-32 VDC
   b. Must operate voltage: 3 VDC Max.
   c. Must release voltage: 1 VDC Min.
   d. Input impedance: 1,500 OHMS Min.
   e. Input current: 4mA max @ 5 VDC
8. Standard: Zero voltage turn on.
9. UL listed and certified.

ORDERING INFORMATION

SCR OUTPUT - SS SERIES

PART NUMBER		Line V ac (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
AC Input	DC Input			
SSA1210	SSD1210	24-140	10	120
SSA1225	SSD1225	24-140	25	250
SSA1240	SSD1240	24-140	40	625
SSA2410	SSD2410	48-280	10	120
SSA2425	SSD2425	48-280	25	250
SSA2440	SSD2440	48-280	40	625
SSA2450	SSD2450	48-280	50	625
SSA2475	SSD2475	48-280	75	1000
SSA4808	SSD4808	80-530	8	72
SSA4812	SSD4812	80-530	12	140
SSA4825	SSD4825	80-530	25	250
SSA4840	SSD4840	80-530	40	400
SSA4875	SSD4875	80-530	75	1000
SSA4890	SSD4890	80-530	90	1200
TRIAC OUTPUT - ST SERIES				
STA1210	STD1210	24-140	10	100
STA1225	STD1225	24-140	25	250
STA2410	STD2410	48-280	10	100
STA2425	STD2425	48-280	25	250
STA4825	STD4825	80-530	25	250

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GENERAL PURPOSE RELAYS

IMMEDIATE DELIVERY					
SERIES	**GV**	**GQ**	**GQ-F**	**GB**	**GF**
Features	• Exceptionally reliable power relay • Octal type plug-in terminations • AC & DC coils • Optional indicator lamp • Ⓢ ЯU	• Power relay for use in control panels • Optional indicator lamp and push-to-test button • High dielectric strength (2000VAC) • Ⓢ ЯU	• GQ package with 15 amp rating • Plain or bracket mount dust cover • Ideally suited for many diverse applications • Ⓢ ЯU	• Enclosed relay with magnetic blow outs • Switches DC currents • Optional flange-top case for panel mounting • Ⓢ ЯU	• Magnetic latching relay • Single or dual coil input • Low power requirement • Good memory stability • Ⓢ ЯU
Contact Arrangement	SPDT DPDT TPDT	SPDT DPDT TPDT	1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 3C, 1X, 1Y, 1Z	1X, 2A, 2C	SPDT DPDT
Contact Rating	10A @ 28 VDC or 230 VAC	10A @ 28 VDC or 240 VAC	15A @ 277 VAC 1/3 HP @ 120 VAC 1/2 HP @ 250-600 VAC 3A @ 600 VAC	(1X) 10A @ 150 VDC (2A) 5A @ 150 VDC (2C) 3A @ 150 VDC	10A @ 28 VDC or 240 VAC
Contact Material	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O
Coil Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	5-110 VDC 6-277 VAC	6-110 VDC 6-277 VAC	6-110 VDC 6-240 VAC
Nominal Coil Power	(DC) 1.5W (AC) 2.3VA	(DC) 1.2-1.8W (AC) 2.0-2.75VA	(DC) 1.2W (AC) 2.74 VA	(DC) 1.2W (AC) 2.0VA	(DC single coil) 1.2W (DC dual coil) 2.4W
Mechanical Life	5,000,000 operations min.	10,000,000 operations	10,000,000 operations	10,000,000 operations	10,000,000 operations
Approximate Dimensions (inches)	2.07″H x 1.36″L x 1.36″W	1.91″H x 1.53″L x 1.41″W	1.91″H x 1.53″L x 1.41″W	1.91″H x 1.53″L x 1.41″W	2.16″H x 1.53″L x 1.41″W
Mounting	Socket mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount
Sockets	Screw terminal P.C. terminal	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect

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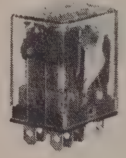
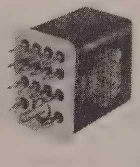
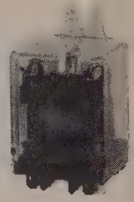
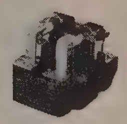
	GENERAL PURPOSE RELAYS			POWER RELAYS		
IMMEDIATE DELIVERY						
SERIES	**GL**	**GM**	**GMH**	**GT**	**GH**	**GW**
Features	• Compact general purpose relay • Wide range of applications • Optional indicator lamp and push-to-test button • SP ЯU	• Versatile relay • Optional indicator lamp and push-to-test button • Ideal for power and sequence control applications • SP ЯU	• Hermetically sealed steel case • Excellent for adverse environments • SP ЯU	• 20A and 30A switching • Bracket mount package • 3,750 VRMS coil-to-contact breakdown • SP ЯU	• 30 amp contact rating • High in rush capacity • Optional magnetic blowouts and auxiliary switch • 50A unit available • SP ЯU	• Mercury displacement relay • 35A and 60A switching • Hermetically sealed • Ideal for adverse environments • SP ЯU
Contact Arrangement	DPDT TPDT 4PDT	DPDT TPDT 4PDT	2C, 4C, 5C	SPDT DPDT	1A, 1B, 1C, 2A, 2B, 2C, 1X, 1Y	1A, 2A, 3A 1B, 2B, 3B
Contact Rating	10A @ 24 VDC or 110 VAC	• DPDT, TPDT 5A @ 24 VDC or 220 VAC • 4PDT 3A @ 24 VDC or 220 VAC	Up to 5A @ 120 VAC/28 VDC	• SPDT 30A @ 120/240 VAC 25A @ 28 VDC • DPDT 20A @ 120/240 VAC or 28 VDC	30 Amps @ 300 VAC	• 35A model 35A @ 480 VAC • 60A model 60A @ 480 VAC
Contact Material	Ag Cd O	• DPDT, TPDT Ag • 4PDT Ag (Au Flash)	Ag or Ag Cd O	Ag Cd O	Ag or Ag Cd O	Liquid Mercury
Coil Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-120 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-220 VDC 6-480 VAC	5-250 VDC 6-480 VAC
Nominal Coil Power	• DPDT (DC) 0.9W (AC) 1.2VA • TPDT, 4PDT (DC) 1.4W (AC) 1.6-2.5VA	(DC) 0.9W (AC) 1.2VA	(DC) 0.90W (AC) 1.20VA	(DC) 1.2W (AC) 2.7VA	(DC) 2.0W (AC) 10.0VA	N.O. / N.C. AC (VA) 1 Pole 8.0 / 13.0 2 Pole 18.6 / 20.5 3 Pole 33.0 / 33.0 DC (W) 1 Pole 6.5 / 8.0 2 Pole 7.5 / 10.5 3 Pole 12.0 / 12.0
Mechanical Life	AC-50,000,000 operations DC-100,000,000 operations	AC-50,000,000 operations DC-100,000,000 operations	10,000,000 operations	10,000,000 operations	3,000,000 operations	3,000,000 operations
Approximate Dimensions (inches)	1.40″H x 1.10″L x 0.85″W (DPDT Unit)	1.42″H x 1.10″L x 0.85″W	1.42″H x 1.10″L x 0.85″W	1.97″H x 1.53″L x 1.41″W	2.3″H x 3.125″L x 2.5″W (DPDT Unit)	5.06″H x 3.365″L x 3.125″W (TPDT Unit)
Mounting	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Panel mount Track mount	Screws	Box Collar
Sockets	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminals Solder terminals P.C. terminals	—	—	—

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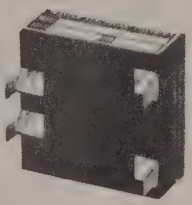
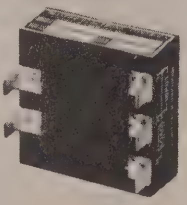
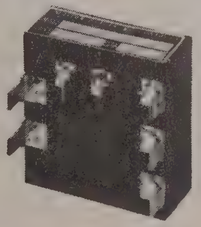
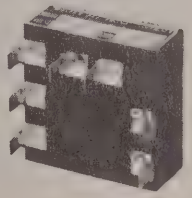
TIME DELAY RELAYS

IMMEDIATE DELIVERY					
SERIES	**DM**	**DI**	**DB**	**DS**	**RC**
Features	• Reliable and accurate • Indicator lamp available in all voltages	• Precise timing cycles • Indicator lamp available in all voltages	• Wide range of industrial applications • Indicator lamp available in all voltages	• Reliable and accurate • Indicator lamp available in all voltages	• Independent on and off delays • Indicator lamp available in all voltages
Mode of Operation	Delay on make	Delay on interval	Delay on break	Delay on single-shot	Recycling timer
Contact Arrangement	DPDT TPDT	DPDT TPDT	SPDT DPDT	SPDT DPDT	DPDT TPDT
Contact Rating	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC
Input Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC
Delay Time (in seconds)	0.1-3600	0.1-3600	0.1-3600	0.1-3600	0.1-3600 on 0.1-3600 off
Type of Control	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Knob Remote
Maximum Repeatability	±1%	±1%	±1%	±1%	±1%
Mechanical Life	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations
Approximate Dimensions (in.)	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W	2.75″H x 2.00″L x 1.56″W

SOLID STATE TIMERS

IMMEDIATE DELIVERY				
SERIES	**SDM**	**SDI**	**SDB**	**SDS**
Features	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL	• Totally solid state output • Fixed or remote adjustable delays • Transient protected • Completely encapsulated • CSA, UL
Mode of Operation	Delay on make	Delay on interval	Delay on break	Delay on single shot
Output Type	Solid state	Solid state	Solid state	Solid state
Form	Normally open	Closed during timing	Normally open	Normally open
Rating: Steady State	1 Amp	1 Amp	1 Amp	1 Amp
Rating: Inrush	10 Amps	10 Amps	10 Amps	10 Amps
Input Voltage	12, 24, 48, 120 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC
Delay Time (in seconds)	0.05–720	0.05–720	0.05–720	0.05–720
Approximate Dimensions (in.)	0.75″H x 2.0″L x 2.0″W	0.75″H x 2.0″L x 2.0″W	0.75″H x 2.0″L x 2.0″W	0.75″H x 2.0″L x 2.0″W
Mounting	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw
Termination	.250″ Male Quick connect terminals	.250″ Male Quick connect terminals	.250″ Male Quick connect terminals	.250″ Male Quick connect terminals

MASTER ELECTRONIC CONTROLS
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Phone: (310) 452-1336 FAX: (310) 392-9585 Telex: 182041 MASTER SNM

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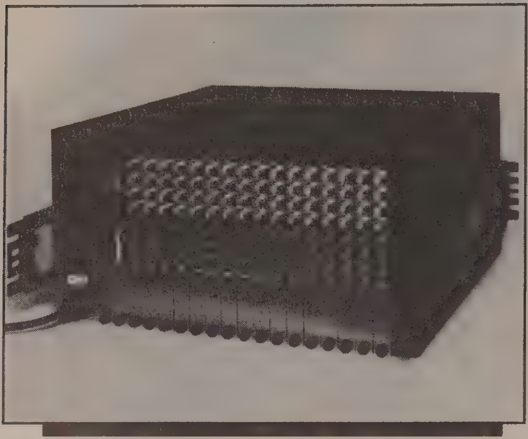
MATRIX SYSTEMS

MATRICES

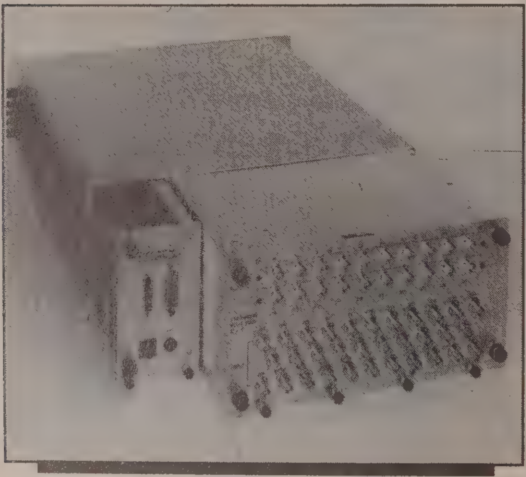


Model 10693
DC to 100MHz: Coaxial 32x32 Matrix

The 10693 is a programmable 32 in x 32 out blocking type coaxial matrix. Its special 3-Stage switching architecture allows full input to output crosspoint connections while reducing the number of actual crosspoints, increasing system performance, and lowering costs. Highly reliable reed switch contacts provide long life. The 10693 is also available in non-blocking versions for multiple output connections to a single input without loading.

- Wide bandwidth: DC to 100MHz
- Front panel LCD display and keypad
- Both RS-232C and IEEE-488 control ports included
- Simple input/output control commands
- Store/recall up to 99 matrix configurations (battery backed RAM)
- Standard BNC connectors (others available as options)
- Field replaceable plug-in modules

Price: $17,876

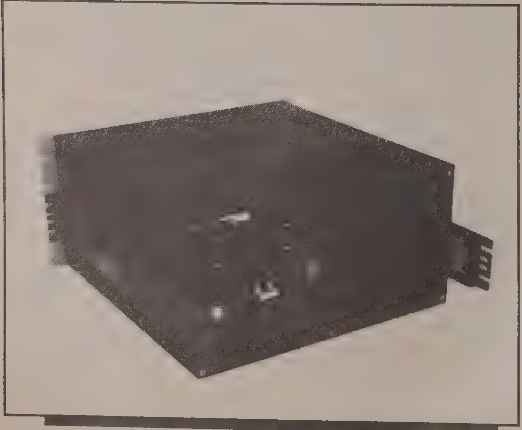


Model 10990 and 10991
DC to 250MHz: 16x16 and 32x20 Plug-in Matrix

These "fixed size" matrix plug-ins combine the latest advancements in switching technology into a compact, rugged, and high performance matrix configuration. Non-blocking and unity gain are built-in features providing the capability to connect one, or up to all outputs to a single input. The 16 x 16 matrix (Model 10991) is ideal for RF applications in the 5 to 250MHz range with a 50 ohm impedance. The 32 x 20 matrix (Model 10990) is designed for video or RF applications (75 ohm) up to 110Mhz. Additionally, the 10991 is DC coupled and can deliver +/-6 volts into a 75 ohm load. The plug-ins slide into the rear of the Model 11000 Mainframe which incorporates front panel keypad and LCD display, CPU, DC power supplies, and both RS-232C and IEEE-488 interfaces. Other sizes are available. Call the factory.

- Field replaceable plug-in design
- Front panel LCD display and keypad
- Both RS-232C and IEEE-488 control ports with simple control commands
- Store/recall up to 99 matrix configurations (battery backed RAM)
- Standard BNC connectors (others available as options)
- Lightweight and compact; cost effective

Price: Call factory



Model 10046
Digital/Analog: 12x24 (up to 25 wire) Bi-directional Matrix

Multi-wire switching is easily accomplished using the Model 10046 digital / analog switching system. Maximum switching capacity is 12 x 24 x 25-wire for switching twelve DB-25 type connectors to any of twenty-four DB-25 connectors. All twenty-five pins on the connectors switch together; or with a different dip switch setting on the boards, they may be switched as individual pairs. Maximum signal level is +/- 7volts. Other configurations are available too. Call the factory.

- Analog or digital signal routing (up to 5MHz)
- RS-232C, IEEE-488, or TTL control ports
- Simple input/output control commands
- Solid-State crosspoint elements
- Various connector types available
- Lightweight and compact

Price: $24,341 (for full configuration)

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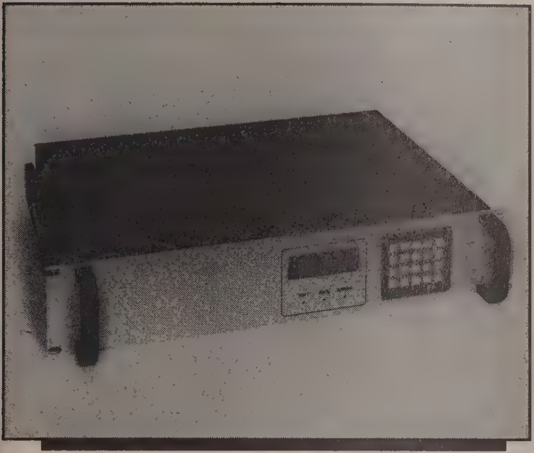
MATRICES

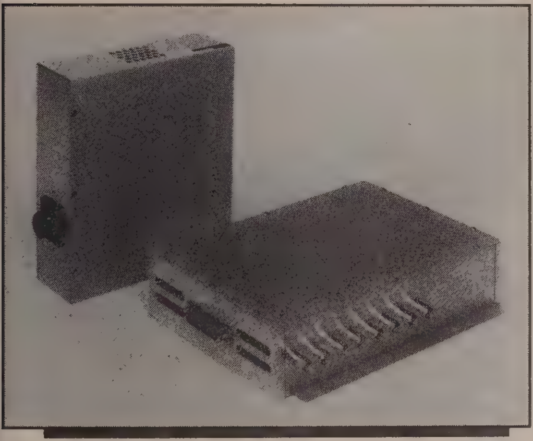


Model 10980
DC to 150KHz: 48x48 (2-wire) Matrix

The 10980 combines the latest advancements in switching technology into a compact, high density 48 in x 48 out two wire matrix configuration. Non-blocking and unity gain are built-in features providing the capability to connect one, or up to all outputs to a single input. True balanced 600 ohm inputs and outputs make it ideal for high performance audio applications, and the solid state matrix array yields ultra-high reliability and long life.

- Wide bandwidth: DC to 150KHz
- Front panel LCD display and keypad RS-232C or IEEE-488 control ports
- Simple input/output control commands
- Store/recall up to 99 matrix configurations (battery backed RAM)
- Standard "Telecon" connectors (others available as options)
- Lightweight and compact

Price: $9,950



Models B-4108 and 4108
DC to 600Mhz: 8x8 Coaxial Blocking Matrix Modules

Extremely wide bandwidth and compact size are the major features of the B-4108 and 4108 modules. With a frequency response of DC to 600MHz and DC to 500MHz (respectively), these modules lend themselves to a number of applications such as ATE, antenna switching, high resolution video, IF signals, or high speed ECL data. The B-4108 is a self-contained 8 x 8 blocking matrix requiring only DC power and a parallel TTL control input on the DB-25P connector. The unit is highly ruggedized for harsh environments. The Model 4108 is packaged in a lighter enclosure than the B4108 for plug-in integration into a larger matrix system. The maximum configuration using eight of the 4108 modules is a bi-directional 8 x 64 matrix, ideal for ATE applications.

- Compact and rugged construction
- Contains control logic and requires only TTL control input & DC power
- High reliability reed switch technology
- Industry standard BNC signal connectors (B-4108)

Price: $3,564 (B-4108-5V) or $2,700 (4108)

Models 10081A-50 and 10081A-75
DC to 900MHz: VXIbus 4x8 Coaxial Blocking Matrix

The 10081A module is a C-size message based VXIbus module with a very high performance 4 x 8 coaxial blocking matrix configuration. Ideal for automated test stations, it conforms to the VXIbus standard (version 1.3) to operate smoothly with other vendors' equipment. The 4 x 8 matrix configuration allows the user to connect up to four crosspoints at the same time with interlocking on the eight (8) axis to prevent accidental shorting. Seven segment displays indicate any closures within the matrix array.

- High performance SMA connectors (SMB's are optional)
- 50 & 75 Ohm versions
- User-friendly software commands
- Store / Recall up to 10 set-ups
- Message based control format
- Crosspoint status confirmation

Price: $2750

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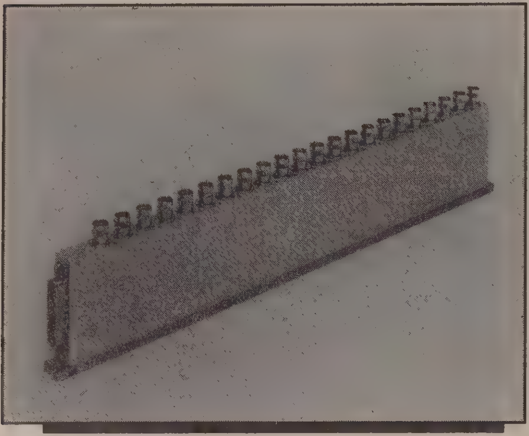
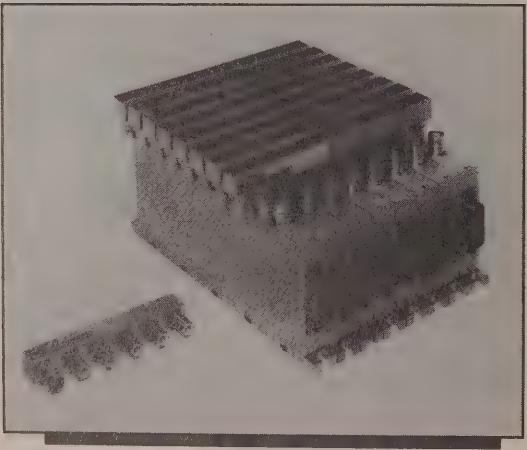
MODULES



7000 Series
DC to 800MHz: Coaxial Relay Modules (1xN)

Versatility and modularity are key features of the 7000 Series Coaxial Relay Modules. These 1xN type relays are available in sizes from 1x2 to 1x24. The 7000 Series is designed to maintain coaxial switching continuity over a wide range of environmental and electrical applications. Nine different types of contacts are available to choose from to tailor the module's configuration. The switching elements are constructed utilizing highly reliable reed switch technology.

- 7100 Standard Isolation (65dB @ 10MHz)
- 7200 Self-terminating (50, 75, or 93 ohm)
- 7300 High Isolation (65dB @ 100MHz)
- 7400 Highest Isolation (110dB @ 100MHz)
- 7500 High Power
- 7600 Self-terminating, High Isolation (50, 75, or 93 ohm)
- 7700 Mercury Wetted
- 7800 Twinaxial (shielded twisted pair - polarized)
- 7900 Triaxial (AKA: concentric twinaxial)



The frequency range of the 7000 Series is dependent on the size (number of throws) of the module. The smaller the number of throws, the larger the frequency range. The -1dB and -3dB points of a specific size may be approximated by the following formulas:

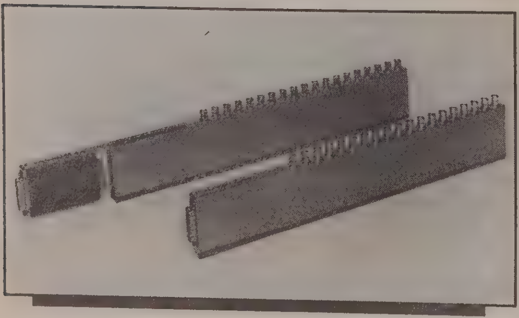
$$1320 \div (n - .13) = -1\text{dB point in MHz}$$
$$1760 \div (n + .20) = -3\text{dB point in MHz}$$

(where "n" is the number of throws)

Various switching systems are easily constructed by using the 9000 Series cross straps, or the 5100A Series power dividers. For example: to form a crosspoint matrix with 10 inputs and 5 outputs, five 7110 relay modules (1x10) and ten 9105 cross straps (5 position) are required. An example eight by eight matrix is shown in the photograph to the left, and a single 9105 cross strap.

Features:

- Rugged machined aluminum housing
- Low return loss (VSWR)
- Crosstalk is always better than Isolation
- Signal circuitry is isolated from control circuitry
- Specials (such as multiples in a single module) are easily accomplished
- Various signal connector types: BNC (std), SMA, TNC, F-Type
- Insulated shield (-I option), or insulated and switched shield (-IS option)
- Various coil voltages available from 5v to 48v (24v std)
- Coil suppression diodes are optional



L7000 Series
Same as above except with Built-in Control Logic

The 7000 Series is now available with built-in control logic to easily interface to system control equipment. The built-in control card provides a binary control input to twenty-four latches that control the relay coils. LED status indicators are visible from the top of the module to verify active positions. A unique status circuit provides a logical status feedback to the controlling device. The module requires both +5v (logic) and +24v (relay coils) which may be provided when installed into one of our systems.

Price: Call factory or representative

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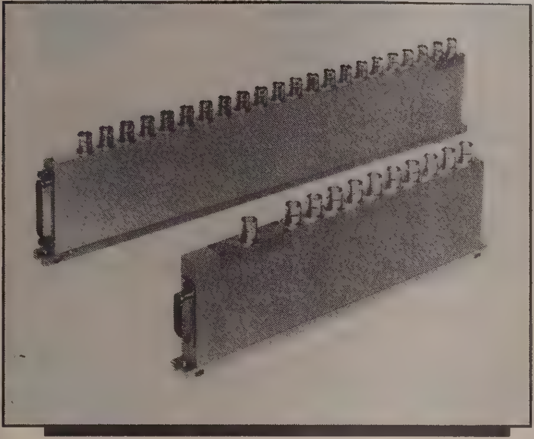
MATRIX SYSTEMS

MODULES

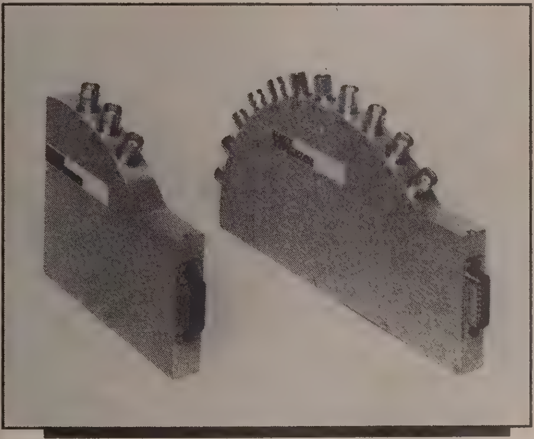


DC to 500MHz: Relay Modules with Built-in Amplifiers

Signal losses can be incurred in a switching system by power divider modules, attenuators, or even cabling. Non-blocking matrices incorporate power dividers and therefore have signal loss. Many applications require the switched signal to amplified to its original signal level (or even higher). To meet this need, amplifiers may be integrated within the 7000 Series relay modules. Gain of the amplifier is set at the factory, however a minor gain adjustment (±1dB) is available on most units. MSC engineers will help choose the proper amplifier for your specific application. The amplifier is connected to where the "common" signal output would normally be, allowing the relay to pick one of multiple inputs to connect to the built-in amplifier. The following amplifier types are available (50 or 75 ohm):

- DC to 65MHz amplifier (7000A)
- DC to 200MHz amplifier (7000B)
- DC to 200MHz driver amp (7000RFB)
- Various RF amplifiers 5 to 500MHz: Low noise figure types
  High intercept types

Consult Factory

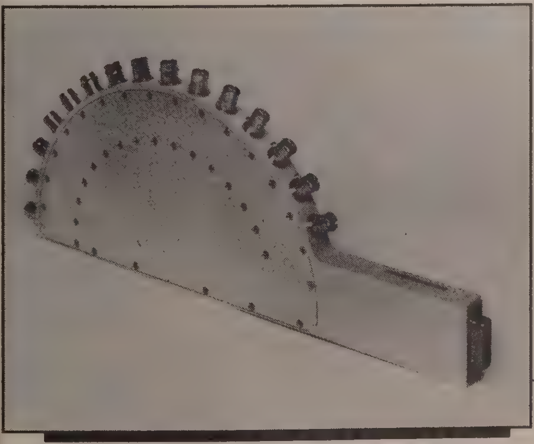


R7000 Series
DC to 1.5GHz: Radial Coaxial Relay Modules (1xN)

The unique construction of these high reliability reed switch technology relay modules gives them extra *wide* bandwidth which is required for some applications. The R7000 series is available in even sizes from 1x2, up to 1x12. Each of the six sizes have a different -3dB point, with the 1x2 having a -3dB point at 1.5GHz, and the 1x12 at 575MHz. Multiple modules may be configured together with either cross straps or power dividers (9000 Series or 5100A Series) to form a matrix. The series is available with many options to tailor the module to the specific needs such as connector types, coil voltages, non-terminating or self-terminating contacts, or coil suppression diodes.

- Rugged machined aluminum housing
- 50 and 75 ohm versions
- Standard signal connector types: BNC (std), SMA, F-Type, TNC
- IEEE-488 or RS-232C controllable (with additional modules)

Price: $380 Qty 1-9 Model R7402 (1x2)



RP7000 Series (PIN Diode)
5MHz to 1GHz: Solid-State Coaxial Relay Modules (1xN)

The new RP7000 Series combines the latest in PIN diode switch technology with built-in intelligence for maximum performance. A design approach similar to the R7000 has been utilized to maximize bandwidth of the RP7000 Series. The unique radial construction reduces *"un-used"* stubs of the signal path. Available in sizes up to 1x14, PIN diode elements are used to provide ultra-high reliability, however the upper bandwidth is dependent the number of throws. Multiple modules can be coupled with power dividers to form non-blocking matrices. Modules must be installed into a rack mountable chassis assembly to provide DC power and control. The chassis also provides IEEE-488 and RS-232C interfaces, plus front panel keypad (with LCD display).

- Various signal connector types (BNC standard)
- Solid-state PIN diode reliability
- Built-in status monitoring by RISC uProcessor

Price: Call factory or representative

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World Products Inc. (North America Distributor)
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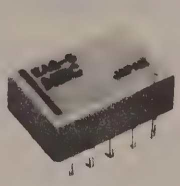
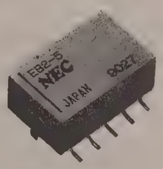
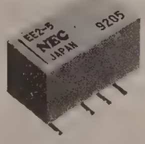
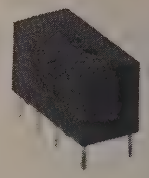
Miniature Relay–Signal

		EA2	EB2	EC2	EE2	MR62
Type of relay					 UNDER DEVELOPMENT	
Features		• low power consumption • low magnetic interference • 1500V FCC surge 1000V AC FCC • compact, light weight • latching type available	• surface mount • low power consumption • low magnetic interference •1500V FCC surge 1000V AC FCC • compact, light weight • latching type available	• low power consumption • dual-inline leads (small mounting space) • 2500 V surge (2 x 10 µs*) coil to contacts • latching type available	• low power consumption • surface mount (reduced mounting space) • 2500 V surge (2 x 10 µs*) coil to contacts • latching type available	• DIP terminal • sealed package for flow soldering • stable contact resistance at high temperature • 1500V FCC surge
Contact arrangement		2C	2C	2C	2C	2C
Contact material (standard)		silver alloy with gold overlay		silver alloy with gold overlay		silver alloy with gold overlay
Contact rating (resistive) (switching)	3A 2A 1A	30W/62.5VA 1.0A	30W/62.5VA 1.0A	60W/62.5VA 2.0A	60W/62.5VA 2.0A	60W/125VA 2.0A
Coil voltage		3, 4.5, 5, 6, 9, 12, 24 V. DC		3, 4.5, 5, 6, 9, 12, 24 V. DC		5, 6, 9, 12, 24, 48 V. DC
Nominal operating power		140mW (single coil latch type 100mW)		140mW (single coil latch type 100mW)		550mW
Must operate voltage		75%		75%		62 to 72%
Must release voltage		10%		10%		5%
Operate time (typ.) (Excluding bounce)		2ms		2ms		3ms
Release time (typ.) (Excluding bounce)		1ms		1ms		2ms
Life (operations)	**Electrical**	0.2 x 10^6 30V. DC, 1A (resistive) 0.1 x 10^6 125V. AC, 0.5A (resistive)		0.2 x 10^6 30V. DC, 1A (resistive) 0.1 x 10^6 125V. AC, 0.5A (resistive)		1 x 10^6 24V. DC, 1A 3 x 10^6 24V. DC, 0.5A
	Mechanical	100 x 10^6		100 x 10^6		10 x 10^6
Breakdown voltage	Between open contacts	1000V. AC		1000V. AC		500V. AC
	Between adjacent contacts	1000V. AC		1000V. AC		1000V. AC
	Between contact and coil	1000V. AC		1500V. AC or 1000V. AC**		1000V. AC
Surge withstand voltage		1500V FCC		1500V (FCC), 2500V*** (2 x 10 µs, coil to contact)		1500V FCC #
Safety standard		UL, CSA	UL, CSA	UL, CSA	UL, CSA under application	UL, CSA
Option		latching type		latching type		—
Height (mm)		5.4	7.5	9.8	11.5	11.4
Mounting space (mm)		9 x 14	9.3 x 14.3	7.5 x 15	9.5 x 15	9.8 x 20.2

* 2 µs of rise time and 10 µs of decay time to half crest.

** for double coil latch type

*** 1500V for double coil latch type

See NECEL's other products in Sections 1500, 2450 and 3700.

NEC

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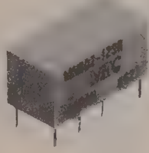
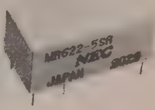
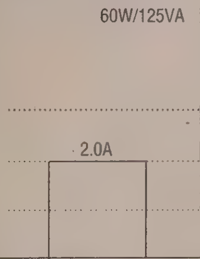
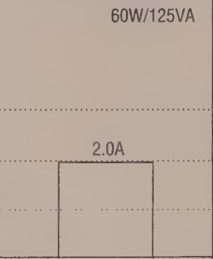
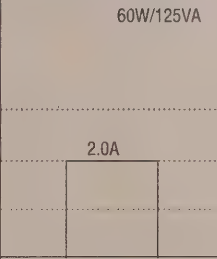
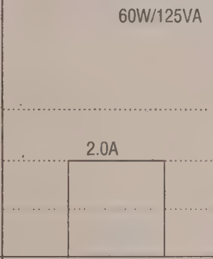
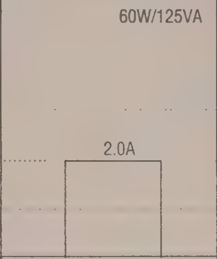
Miniature Relay–Signal

		MR62-Y	MR62-K	MR602	MR612	MR622
Type of relay						
Features		•DIP terminal • sealed package • low power consumption (400mW) • stable contact resistance at high temperature •1500V FCC surge	• DIP terminal • sealed package for flow soldering • stable contact resistance at high temperature • 1500V FCC surge	• low power consumption • 1500V FCC surge 1000V AC FCC breakdown voltage • latching type available	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available	• high-breakdown voltage • low power consumption •1500V FCC surge
				Polarized Type		
Contact arrangement		2C	2C	2C or 2D	2C or 2D	2C or 2D
Contact material (standard)		silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay
Contact rating (resistive) (switching)	**3A** **2A** **1A**					
Coil voltage		5, 6, 9,12, 24, 48 V. DC	5, 6, 9,12, 24, 48 V. DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48 V. DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48 V. DC	1.5, 3, 4.5, 5, 6, 9, 12, 24 V. DC
Nominal operating power		400mW	400mW or 550mW	200mW (latching type-single wound coil 100mW)	400mW (latching type-single wound coil 200mW)	400mW
Must operate voltage		70%	70% 48V...80%	70% (From D type 80%)	70%	70%
Must release voltage		5%	5%	10%	10%	10%
Operate time (typ.) (Excluding bounce)		4ms	3ms (KY type 4ms)	3.5ms	3.5ms	3.5ms
Release time (typ.) (Excluding bounce)		2ms	2ms	1.5ms	2.0ms	2.0ms
Life (operations)	**Electrical**	10 x 10^6 24V. DC, 1A 3 x 10^6 24V. DC, 0.5A	1 x 10^6 24V. DC, 1A 3x 10^6 24V. DC, 0.5A	1.5 x 10^6 24V. DC, 1A 3 x 10^6 24V. DC, 0.5A	1.5 x 10^6 24V. DC, 1A 3 x 10^6 24V. DC, 0.5A	1.5 x 10^6 24V. DC, 1A 3 x 10^6 24V. DC, 0.5A
	Mechanical	10 x 10^6	10 x 10^6	10 x 10^6	10 x 10^6	10 x 10^6
Break-down voltage	Between open contacts	500V. AC	1000V. AC	1000V. AC or 500V. AC*	1000V. AC or 500V. AC*	1000V. AC or 500V. AC*
	Between adjacent contacts	1000V. AC	1000V. AC	1000V. AC	1500V. AC	1500V. AC
	Between contact and coil	1000V. AC	1000V. AC	1000V. AC	1500V. AC or 2000V. AC**	4000V. AC
Surge withstand voltage		1500V FCC #	1500V FCC #	1500V FCC	1500V FCC	1500V FCC
Safety standard		UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL, CSA
Option		—	—	latching type	latching type	—
Height (mm)		11.4	11.4	10.1	10.1	10.1
Mounting space (mm)		9.8 x 20.2	9.8 x 20.2	10.1 x 20.3	10.1 x 20.3	10.1 x 20.3

#1500V FCC surge between coil and contacts and between adjacent contacts. * Form D type * Form D type ** K type * Form D type

See NECEL's other products in Sections 1500, 2450 and 3700.

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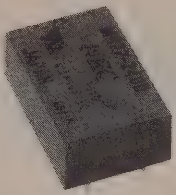
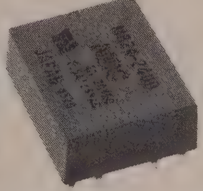
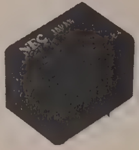
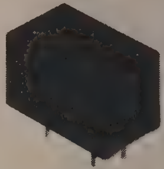
Miniature Relay–Signal

Type of relay		MR22	MR24	MR301	MR301-H	MR321A
						
Features		• long life • automatic wave soldering possible • latching type available	• long life • automatic wave soldering possible • latching type available	• low profile • specialty for automotive • flux tight	• low profile • high power switching • flux tight • specialty for automotive	• electric heater switching (up to 1KW/100V AC) • low profile • compact • flux tight
Contact arrangement		2C or 2D	4C, 4D or 2C + 2D	1C	1C	1A
Contact material (standard)		silver alloy with gold overlay	silver alloy with gold overlay	silver nickel alloy	silver oxide complex alloy	silver oxide complex alloy
Contact rating (resistive) (switching)	15A 10A 5A	60W/125VA 2.0A	60W/125VA 2.0A	150W/600VA 5A	300W/1200VA 10A	1200VA 12A
Coil voltage		5, 6,12, 24, 48, 60 V. DC	5, 6,12, 24, 48, 60 V. DC	3, 5, 6, 9, 12, 24, 48 V. DC	3, 5, 6, 9, 12, 24, 48 V. DC	3, 5, 6, 9, 12, 24, 48 V. DC
Nominal operating power		Approx. 470mW	Approx. 470mW	360mW	360mW	360mW
Must operate voltage		80% (Y type 70%)	80% (Y type 70%)	70%	70%	70% (48V. DC: 80%)
Must release voltage		10%	10%	10%	10%	10%
Operate time (typ.) (Excluding bounce)		10ms	10ms	10ms	10ms	10ms
Release time (typ.) (Excluding bounce)		3ms	3ms	10ms	10ms	10ms
Life (opera-tions)	Electrical	1 x 10^6 30V. DC, 1A	1 x 10^6 30V. DC, 1A	0.1 x 10^6 120V. AC, 5A	0.1 x 10^6 120V. AC, 10A	0.5 x 10^6 100V. AC, 10A
	Mechanical	100 x 10^6	100 x 10^6	10 x 10^6	10 x 10^6	10 x 10^6
Break-down voltage	Between open contacts	1000V. AC or 750V. AC*	1000V. AC or 750V. AC*	750V. AC	750V. AC	750V. AC
	Between adja-cent contacts	1000V. AC	1000V. AC	—	—	—
	Between con-tact and coil	1000V. AC	1000V. AC	1500V. AC	1500V. AC	1500V. AC
Surge withstand voltage		1500V FCC (Form C)	1500V FCC (Form C)			
Safety standard		UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL
Option		latching type	latching type			
Height (mm)		11.5	11.5	17.0	17.0	16.5
Mounting space (mm)		24.3 x 29.7	24.3 x 29.7	16.5 x 22.5	16.5 x 22.5	16.5 x 26.0

* Y type (Form D type: 500V. AC)

See NECEL's other products in Sections 1500, 2450 and 3700.

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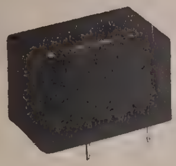
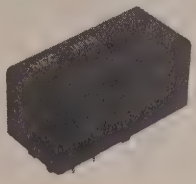
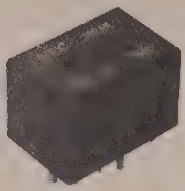
Miniature Relay–Power

		MR321A-H	EN2	EP2
Type of relay				
Features		• electric heater switching (up to 1.5KW/100V AC) • low profile • compact • flux tight	• twin relay • motor and solenoid reversible control • 30% less relay space than 2 conventional relays • symmetrical structure • flux tight housing	• twin relay • motor and solenoid reversible control • 50% less relay space than 2 conventional relays • symmetrical structure • flux tight housing
Contact arrangement		1A	1C x 2	1C x 2
Contact material (standard)		silver oxide complex alloy	silver oxide complex alloy	silver oxide complex alloy
Contact rating (resistive) (switching)	**30A** **25A** **20A** **15A** **10A** **5A**	1600VA 15A	35A (16V. DC)	25A (16V. DC)
Coil voltage		3, 5, 6, 9, 12, 24, 48 V. DC	12 V. DC	12 V. DC
Nominal operating power		360mW	0.64W/0.8W/1.15W	0.48W/0.64W
Must operate voltage		70% (48 V. DC: 80%)	6.5 to 8.5 V. DC	6.5 to 8.5 V. DC
Must release voltage		10%	0.6 to 0.9 V. DC	0.9 V. DC
Operate time (max.) (Excluding bounce)		10ms	10ms	10ms
Release time (max.) (Excluding bounce)		10ms	10ms	10ms
Life (operations)	**Electrical**	0.5 x 10^6 100V.AC, 15A	0.1 x 10^6 motor load 14 V.DC, 25A/7A	0.1 x 10^6 motor load 14 V.DC, 20A/3A
	Mechanical	10 x 10^6	1 x 10^6	1 x 10^6
Breakdown voltage	Between open contacts	750V. AC	500V. DC	500V. DC
	Between adjacent contacts	—		
	Between contact and coil	1500V. AC	500V. DC	500V. DC
Surge withstand voltage				
Safety standard		UL		
Option			Separate type	Separate type
Height (mm)		16.5	17.0	16.5
Mounting space (mm)		16.5 x 26.0	16.5 x 33.5	16.7 x 24.3

See NECEL's other products in Sections 1500, 2450 and 3700.

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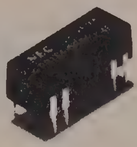
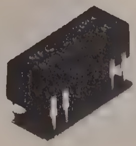
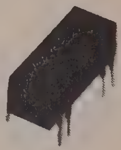
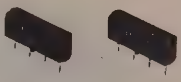
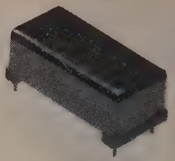
Reed Relay–Dry

		PG1A	PG2A	PG1C	PU	URA
Type of relay						
Features		• DIP terminal • high speed • glass encapsulated reed switch • 1 Form A	• DIP terminal • high speed • glass encapsulated reed switch • 2 Form A	• DIP terminal • high speed • glass encapsulated reed switch • 1 Form C	• single-in-line pin configuration (SIP) • high speed • 5.08mm pitch terminal	• high sensitivity (only 2mW) • high dielectric withstanding voltage
Contact arrangement		1A	2A	1C	1A	1A
Contact rating (resistive) (switching)	**3A** **2A** **1A**	10W/100V. DC 0.5A	10W/100V. DC 0.5A	3W/30V. DC 0.2A	10W/100V. DC 0.5A	10W/100V. DC 0.5A
Coil voltage		5, 12, 24 V. DC	5, 12, 24 V. DC	5, 12, 24 V. DC	5, 12, 24 V. DC	(10 to 16mA)
Nominal operating power		50 to 270mW	180 to 290mW	180 to 385mW	50 to 290mW	1.5 to 2.0mW
Must operate voltage		75%	75%	75%	75 to 80%	(9 to 14.4mA)
Must release voltage		8 to 16%	8 to 16%	8 to 10%	8 to 16%	(2 to 3.2mA)
Operate time (typ.)		0.1 to 0.3ms	0.1 to 0.3ms	0.2 to 0.5ms	0.1 to 0.3ms	3.0ms
Release time (typ.)		0.05ms (0.65ms with diode)	0.05ms (0.65ms with diode)	0.25ms (1.25ms with diode)	0.03ms (0.65ms with diode)	1.0ms
Life (operations)	**Electrical**	100 x 10^6 5 V. DC, 5µA 10 x 10^6 24 V. DC, 5mA 1 x 10^6 30 V. DC, 0.1A	100 x 10^6 5 V. DC, 5µA 10 x 10^6 24 V. DC, 5mA 1 x 10^6 30 V. DC, 0.1A	1 x 10^6 24 V. DC, 50mA	100 x 10^6 5 V. DC, 5µA 10 x 10^6 24 V. DC, 5mA 1 x 10^6 30 V. DC, 0.1A	10 x 10^6 12 V. DC, 5mA 1 x 10^6 24 V. DC, 0.5A
	Mechanical	100 x 10^6	100 x 10^6	50 x 10^6	100 x 10^6	100 x 10^6
Breakdown voltage	Between open contacts	250 V. DC	250 V. DC	200 V. DC	250 V. DC	250 V. DC
	Between adjacent contacts	—	500 V. DC	—	—	—
	Between contact and coil	500 V. DC	500 V. DC	500 V. DC	1000 V. DC	1500 or 3500 V. AC
Surge withstand voltage						
Insulation resistance		10^4 MΩ (at 100 V. DC)	10^4 MΩ (at 100 V. DC)	10^3 MΩ (at 100 V. DC)	10^4 MΩ (at 100 V. DC)	10^3 MΩ (at 100 V. DC)
Safety standard						
Option		electrostatic shield (1A type) magnetic shield (1A and 2A type) with a diode		with a diode	with a diode	
Height (mm)		7.0	7.0	7.0	8.0	11.5 to 16
Mounting space (mm)		7.9 x 19.5	7.9 x 19.5	7.9 x 19.5	5.0 x 19.0	(14.0 to 16.0) x 29.0

See NECEL's other products in Sections 1500, 2450 and 3700.

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm^3
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.

[b] Based on fuel consumption only.

[c] Weight of air not considered in computation of watt hours.

[d] Water-activated

[e] Automatically activated; high rate discharge; 2- to 10-min rate.

[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.

[g] Four-minute discharge rate.

[h] β-alumina electrolyte, 300°C operation.

[i] Fused salt; 350°C operation.

[j] Solid $RbAg_4I_5$ electrolyte.

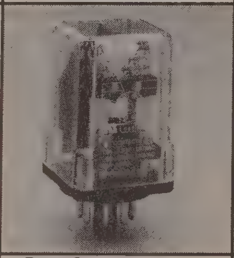
[k] Several different cathode materials used.

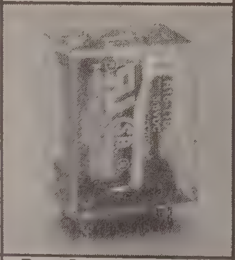
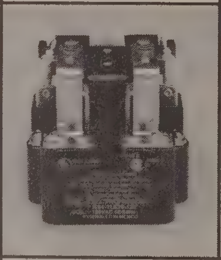
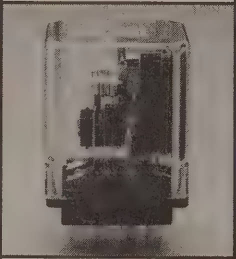
[l] Fuel consumption is based on source of H_2.

[m] Based on methanol battery-fuel supply in situ.

RELAYS

General Purpose Relays

Series	R02	R06	R10	R12	R14
					
Features	• Dust Cover • Octal–Type Plug	• Open Frame • Solder Terminals • Multi–pole Switching	• Dust Cover • .187" Quick Connect Terminals	• Dust Cover • Slightly larger than one cubic inch	• Dust Cover • .187" Quick Connect Terminals
Contact Arrangement	SPDT, DPDT, 3PDT	SPDT, DPDT, 3PDT	DPDT, 3PDT	4PDT	SPDT, DPDT
Contact Ratings	10A @ 28VDC/120VAC	10A @ 28VDC 12A @ 120VAC	10A, 11A, 12A @ 28VDC/120VAC	3A @ 28VDC/120VAC	10A, 15A @ 28VDC/120VAC
Coil Voltage	6, 12, 24, 120, 240VAC 6, 12, 24, 110VDC	24, 120VAC 6, 12, 24, 48, 110VDC	24, 120, 240VAC 12, 24, 110VDC	12, 24, 120VAC 6, 12, 24VDC	12, 24, 120, 240VAC 6, 12, 24VDC
Nominal Coil Power AC Types DC Types	2.0, 2.75, 3.0, 3.9VA 1.0, 1.2, 1.5W	2.0, 2.75VA 1.0W	2.0, 2.75VA 1.2mW	1.2VA 0.9mW	1.2VA 0.9mW
Options ( ) Suffix	Indicator Lamp (N) Push–to–Test Button (B) Hermetically Sealed (H)		Indicator Lamp (N) Push–to–Test Button (B) Flange Mount (F)	PC Board Mount (P)	PC Board Mount (P)

Gen Purp (Cont'd)		Power Relays			
Series	R16	R04	R18	R54	R55
					
Features	•Dust Cover	•Open Frame •Screw Terminals •Heavy Duty	•Dust Cover •Jones Plug Terminals •Switches Tungsten Lamp Loads	•Open Frame •.250" Quick Connect Terminals •Heavy Duty •10A Tungsten Rating	•Dust Cover •Flange Mount •.250" Quick Connect Terminals
Contact Arrangement	DPDT, 4PDT	SPST, DPST–NO, DPDT	DPDT	SPST–NO DM	DPDT
Contact Ratings	3A, 5A @ 28VDC/120VAC	30A @ 28VDC/120VAC	20A @ 28VDC 30A @ 120VAC	30A @ 28VDC/120VDC	20A, 25A @ 28VDC/300VAC
Coil Voltage	120VAC 5/6, 12, 24VDC	12, 24, 120, 240VAC 12, 24, 110VDC	120VAC	24, 120, 240VAC 12, 24, 110VDC	24, 120, 240VAC 12, 24VDC
Nominal Coil Power AC Types DC Types	1.5, 2.5VA 0.5, 0.75, 1.0W	10VA 2.0W	8.0VA –	3VA 1.5W	2.75VA 1.5W
Options ( ) Suffix	PC Mount (P)				

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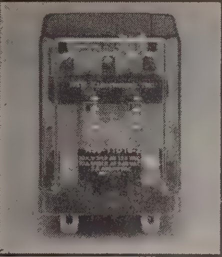
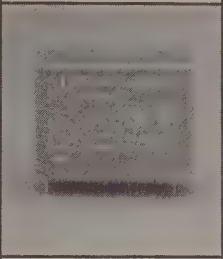
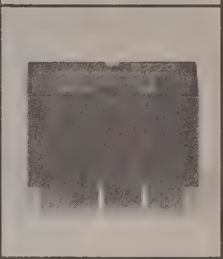
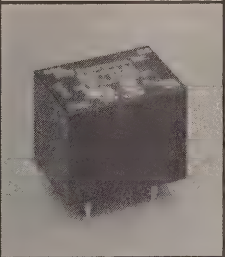
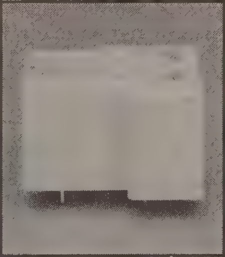
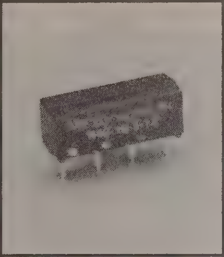
RELAYS

Latching		PC Mount			
Series	**R50**	**R20**	**R22**	**R24**	**R40**
					
Features	• Dust Cover • Magnetic Latching • .187" Quick Connect Terminals	• Dust Cover • Low Coil Power • Minimal PC Board Area Required	• Dust Cover • Low Coil Power • Small Size • TV–5 Type	• Epoxy Sealed for Wave Soldering and Immersion Cleaning • Upright	• Epoxy Sealed • Standard .100" DIP Terminal Spacing • Ultra–Sensitive Coil
Contact Arrangement	SPDT, DPDT	DPDT	SPST–NO, SPDT	SPDT	DPDT
Contact Ratings	10A @ 28VDC/120VAC	8A @ 28VDC/120VAC	16A @ 30VDC/240VAC	10A @ 28VDC/120VAC	2A @ 28VDC/120VAC
Coil Voltage	120VAC 12, 24VDC	4.5/5, 12, 24VDC	5/6, 12, 24, 48VDC	5, 12, 24VDC	5/6, 12, 24VDC
Nominal Coil Power AC Types DC Types	1.7VA 1.2W	– 800mW	– 540mW	– 600mW	– 150, 200mW
Options ( ) Suffix	Dual Coil Version (C)				

PC Mount (Cont'd)				Reed Relays	
Series	**R46**	**R48**	**R53**	**R42**	**R44**
					
Features	• Epoxy Sealed for Wave Soldering and Immersion Cleaning • Small Size	• Dust Cover • Small Size	• Epoxy Sealed for Wave Soldering and Immersion Cleaning • Vented Cover–Fully Enclosed • Small Size	• .200" SIP Terminal Spacing • TTL Compatible • Internal Clamping Diode	• Standard .100" PC Board Spacing • TTL Compatible
Contact Arrangement	SPDT	SPDT	SPST–NO, SPDT	SPST–NO	SPST–NO, DPST–NO
Contact Ratings	5A @ 30VDC/120VDC	5A, 10A @ 28VDC/120VAC	20A, 30A @ 28VDC/120VAC	500mA @ 28VDC	5A Switching 2A Carry @ 200VDC
Coil Voltage	6, 12, 24VDC	120VAC 5, 12, 24VDC	6, 12, 24, 48, 110VDC	5/6, 12, 24VDC	5/6, 12, 24VDC
Nominal Coil Power AC Types DC Types	– 400mW	1VA 250mW	– 900mW		
Operate Time				330µs	500µs

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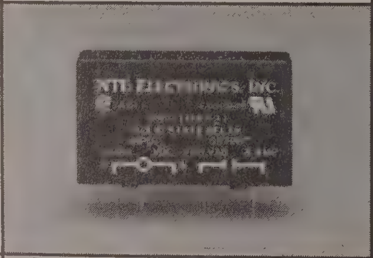
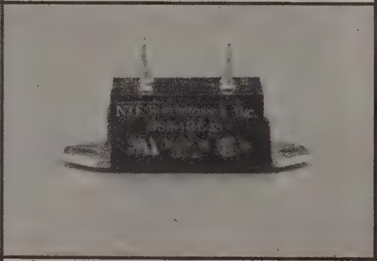
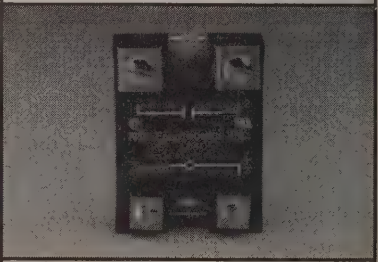
RELAYS

Programmable Time Delay Relays

Series	**R60**	**R61**	**R62**	**R63**
Features	• Knob/Flip Switches Adjustable • AC or DC Operation • 8–Pin Octal Base • 16 Timing Ranges • ±0.5% Repeatability	• Knob/Flip Switches Adjustable • AC or DC Operation • 11–Pin Octal Base • 16 Timing Ranges • ±0.5% Repeatability	• Knob/Flip Switches Adjustable • AC or DC Operation • 11–Pin Octal Base • 16 Timing Ranges • ±0.5% Repeatability	• Knob/Flip Switches Adjustable • AC or DC Operation • 8–Pin Octal Base • 16 Timing Ranges • ±0.5% Repeatability
Mode of Operation	Delay on Operate	Delay on Release	Single Shot	Interval On
Contact Arrangement	DPDT	DPDT	DPDT	DPDT
Contact Ratings	10A @ 28VDC/128VAC	10A @ 28VDC/128VAC	10A @ 28VDC/128VAC	10A @ 28VDC/128VAC
Input Voltage	12, 24, 120VAC/DC	12, 24, 120VAC/DC	12, 24, 120VAC/DC	12, 24, 120VAC/DC
Delay Time Range AC Types DC Types	0.1sec to 120min AC & DC Types	0.1sec to 120min AC & DC Types	0.1sec to 120min AC & DC Types	0.1sec to 120min AC & DC Types

Solid State Relays

Series	**RS1**	**RS2**	**RS3**
			
Features	• Opto Isolated • Upright • Industry Standard Package	• Compatible with TTL Gates • Push–on Connector Terminals • Mounts on a TO3 Transistor Heat Sink	• AC and DC Models • Internal Snubber on AC Models
Contact Arrangement	SPST	SPST	SPST
Input Ratings	3 to 24VDC	5 to 12VDC	90 to 280VAC 3 to 32VDC
Output Voltage	280VAC	20 to 260VAC	24 to 530VAC 0 to 100VDC
Output Current	4A	7A	10 to 75A (AC Types) 12 to 40A (DC Types)
Options ( ) Suffix			TRIAC Output (T) Random Switching (R) MOSFET DC Version (M)

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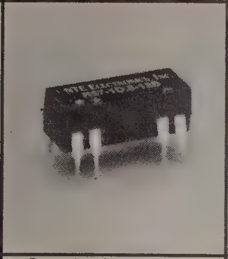
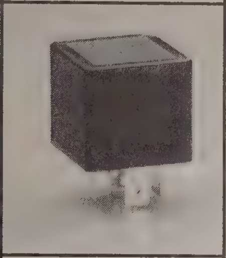
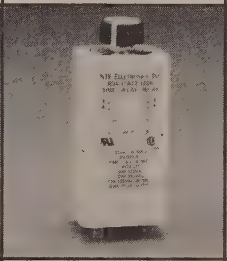
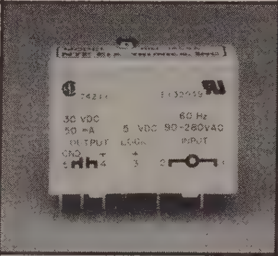
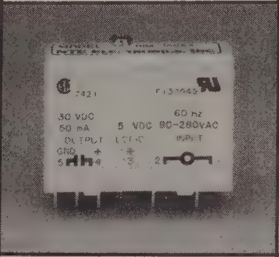
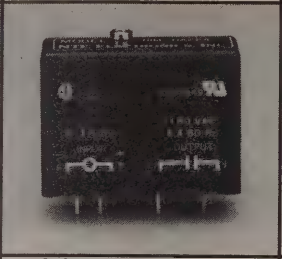
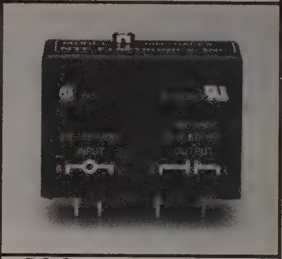
RELAYS

	Reed Relays (Cont'd)		Automotive
Series	**R56**	**R57**	**R51**
			
Features	• Standard .100" DIP Terminal Spacing • TTL Compatible	• Standard .100" DIP Terminal Spacing • TTL Compatible	• Dust Cover • .250" Quick Connect Terminals • Industry Standard Pinout
Contact Arrangement	SPST–NO, SPDT, DPST–NO	SPST–NO, SPST–NC, SPDT	SPST–NO, SPDT
Contact Ratings	500mA @ 28VDC	250mA, 500mA @ 28VDC	40A, 70A @ 14VDC
Coil Voltage	5, 6, 12, 24VDC	5/6, 12, 24VDC	12VDC
Nominal Coil Power AC Types DC Types			– 1.6W (40A), 2W (70A)
Options ( ) Suffix	Diode Protection (D)	Diode Protection (D)	Flange Mount (F) PC Board Mount (P)

	Time Delay Relays
Series	**R28**
Features	• Knob Adjustable • 8–Pin Octal Base • 3 Timing Ranges • ±0.1% Repeatability
Mode of Operation	Delay on Operate
Contact Arrangement	DPDT
Contact Ratings	10A @ 28VDC/120VAC
Input Voltage	120VAC, 24VDC
Delay Time Range AC Types DC Types	0.1 to 300sec 0.1 to 180sec

	Time Delay Relays (Cont'd)				
Series	**R30**	**R32**	**R34**	**R36**	**R38**
					
Features	• Knob Adjustable • 8–Pin Octal base • 3 Timing Ranges • ±0.1% Repeatability	• Knob Adjustable • 11–Pin Octal base • 3 Timing Ranges • ±0.1% Repeatability	• Knob Adjustable • .187" Quick Connect Terminals • 2 Timing Ranges • ±0.1% Repeatability	• Knob Adjustable • .187" Quick Connect Terminals • 2 Timing Ranges • ±0.1% Repeatability	• Knob Adjustable • 8–Pin Octal base • 2 Timing Ranges • ±0.1% Repeatability
Mode of Operation	Interval Time	Delay on Release (Slow Release)	Delay on Operate	Delay on Release	Repeat Cycle Timer
Contact Arrangement	DPDT	DPDT	DPDT	DPDT	DPDT
Contact Ratings	10A @ 28VDC/120VAC	10A @ 28VDC/120VAC	12A @ 28VDC/120VAC	12A @ 28VDC/120VAC	10A @ 28VDC/120VAC
Input Voltage	120VAC, 24VDC	120VAC, 24VDC	120VAC	120VAC	120VAC
Delay Time Range AC Types DC Types	0.1 to 300sec 0.1 to 180sec	0.1 to 300sec 0.1 to 300sec	0.1 to 180sec –	0.1 to 180sec –	0.1 to 300sec –

I/O MODULES

Input/Output Modules				
Series	**IAC**	**IDC**	**OAC**	**ODC**
				
Features	• AC Input Module • Optically Isolated • Industry Standard Package	• DC Input Module • Optically Isolated • Industry Standard Package	• AC Output Module • Optically Isolated • Industry Standard Package	• DC Output Module • Optically Isolated • Industry Standard Package
Contact Arrangement				
Input Ratings	120, 240VAC	3.3 to 32VDC	5, 15, 24VDC	5, 15, 24VDC
Output Voltage	30VDC	30VDC	12 to 280VAC	3 to 60VDC
Output Current	50mA	50mA	3.5A	3A

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Printed Circuit Board Relays

Series	**T81**	**T82**	**T85**	**T83**	**T84**	**R50**	**T74**
Features	• Miniature, high density package • Tape sealed, immersion cleanable case • Sensitive coil & high dielectric options • Meets FCC Part 68 isolation	• Miniature, low profile package • Sealed, immersion cleanable case • DIP terminal arrangement • Meets FCC Part 68 isolation	• Miniature, DIP relay • High sensitivity coil • Sealed, immersion cleanable case • DIP terminal arrangement • Meets FCC Part 68 isolation	• Miniature, telecom relay • Meets FCC Part 68 isolation • Latching & non-latching • Sealed, immersion cleanable case • Sensitive coil types	• Miniature, telecom relay • Meets FCC Part 68 isolation • Latching & non-latching • Sealed, immersion cleanable case • Sensitive coil types	• Switches to 5 amps • Low profile package • Tape sealed, immersion cleanable case	• Requires only .33 in^2 (2.15cm^2) • High sensitivity coil • Sealed, immersion cleanable case • 4kV surge strength
Approximate Dimensions	.61" x .45" x .43"h (15.4 x 11.4 x 11.0h)	.83" x .42" x .47"h (21.1 x 10.7 x 11.9h)	.79" x .39" x .49"h (20.1 x 10.0 x 12.4h)	.79" x .39" x .42"h (20.1 x 10.0 x 10.6h)	1.4" x .40" x .40"h (35.4 x 10.1 x 10.1h)	1.09" x .60" x .46"h (27.7 x 15.7 x 11.7h)	.81" x .41" x .81"h (20.6 x 10.4 x 20.6h)
Contact Arrangements	1 Form C	2 Form C	2 Form C	2 Form C	4 Form C	1 Form C, 2 Form C	1 Form A, 1 Form C
Contact Material	Au overlay, PdAg	Au overlay, PdAg	Au overlay, PdAg & PdAg	Au overlay, Ag & PdAg	Au overlay, PdAg	Ag AgCdO	AgCdO
Maximum Contact Rating	1A @ 24VDC or 0.5A @ 120VAC, resistive	(single contact) 2A, AC or DC 125VAC or VDC 30W or 60VA (bifurcated) 1.25A, AC or DC 100VDC or 90VAC 30W or 50VA	1.25A, AC or DC 150VDC, 200VAC 24W or 60VA, resistive	2A, AC or DC 250VDC, 220VAC 50-150W or 250VA, resistive	1A, AC or DC 120VAC or VDC 24W or 60VA, resistive	2A @ 28VDC or 1A @ 120VAC 5A @ 28VDC or 2.5A @ 120VAC, resistive	2 to 5A @ 250VAC or 28VDC, resistive
Expected Mechanical Life	5 x 10^6 Ops.	2 x 10^7 Ops.	2 x 10^7 Ops.	2 x 10^7 Ops.	2 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.
Expected Electrical Life at Rated Load	1.5 x 10^5 @ 1A, 24VDC 1 x 10^5 @ 0.5A, 120VAC	(single contact) 1.5 x 10^5 @ 1.25A, 24VDC 5 x 10^5 @ 0.4A, 120VAC	5 x 10^5 @ 1A, 24VDC 2 x 10^5 @ 0.5A, 120VAC	3 x 10^5 @ 1.5A, 24VDC 1 x 10^5 @ 1A, 120VAC	5 x 10^5 @ 1A, 24VDC 2 x 10^5 @ 0.5A, 120VAC	1 x 10^5 @ 2A, 28VDC and 1A, 120VAC 6 x 10^5 @ 5A, 28VDC and 2.5A, 120VAC	1 x 10^5
Nominal Coil Voltage	1.5-24VDC	3-48VDC	4.5-48VDC	5-48VDC	3-48VDC	5-48VDC	5-48VDC
Nominal Coil Power	(standard) 450mW (sensitive) 200mW	516-560mW	150-300mW	75-400mW	90-400mW	0.75-1.3W	360mW
Mounting Options	PC board, Socket	PC board, Socket	PC board, Socket	PC board, Socket	PC board, Socket	PC board	PC board
Sockets / Connectors	Fits 12-pin IC socket	Fits 16-pin IC socket	Fits 16-pin IC socket	Fits 16-pin C socket	Fits 28-pin IC socket	—	—

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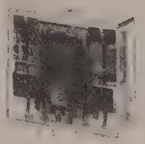
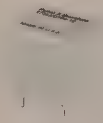
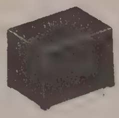
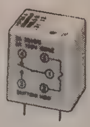
Printed Circuit Board Relays

		NEW					
							
Series	**R40**	**T72**	**T73**	**T70**	**T75**	**RKA**	**RKS**
Features	• Flat pack case style • 0.045" (11.43mm) max. thickness • Compatible with TTL, HTL and CMOS buffers/ drivers UL CSA	• Low-profile • Sealed case • Ratings to 20A @ 16VDC • UL478 & UL508 • Sensitive coil available • Class A or B coil insulation UL	• Low-profile relay • Sealed case • Ratings to 10A • UL478 & UL508 • Sensitive coil available • Class A or B coil insulation UL CSA	• Low cost • Load switching to 10 A • TV5 contact rating • 1,500 Vrms coil-to-contact breakdown • Immersion cleanable case UL CSA	• Switch loads to 14A • Meets international specifications • Sensitive coil • Low profile design • Immersion cleanable case UL CSA VDE S	• 0.6 in³ (10cm³) package • Immersion cleanable case • Meets 8mm spacing and 4kV isolation • TV-3 and TV-5 ratings UL CSA VDE	• 0.6 in³ (10cm³) package • Tape sealed, immersion cleanable case • Meets 8mm spacing and 4kV isolation • DC coils UL CSA VDE
Approximate Dimensions	1.42" x .45" x 1.25"h (36.1 x 11.4 x 31.6h)	.89" x .65" x .67"h (22.6 x 16.5 x 17h)	.84" x .65" x .58"h (21.3 x 10.7 x 14.7h)	.88" x .65" x .95"h (22.4 x 16.4 x 24.0h)	1.18" x .39" x .59"h (30 x 10 x 15h)	1.15" x 51" x 1.03"h (29.2 x 13 x 26.2h)	1.15" x .51" x 1.03"h (30 x 13 x 27h)
Contact Arrangements	2 Form C, 4 Form C	1 Form C, 1 Form U	1 Form A, 1 Form C	1 Form C	1 Form A, 1 Form C	1 Form A, 2 Form A, 1 Form C, 2 Form C	1 Form A, 2 Form A, 1 Form C, 2 Form C
Contact Material	Ag AgCdO AuAgPt	Au flashed Ag AgCdO	Au overlay PdAg Au overlay AgNi AgSn	Au flashed Ag AgCdO	AgCdO	AgNi AgCdO	AgCdO
Maximum Contact Rating	Dry circuit to 7.5A @ 28VDC or 115VAC, resistive	20A @ 16VDC 10A @ 28VDC or 120VAC 5A @ 240VAC	1A @ 30VDC or 120 VAC 5A @ 24VDC or 120VAC 10A @ 24VDC or 120VAC	5A @ 28VDC or 120VAC 10A @ 28VDC or 120VAC 5A tungsten @ 120VAC 1/4 HP @ 120 VAC	14A @ 120VAC, resistive 10A @ 240 VAC 8A @ 24VDC	5 to 10A @ 24VDC or 240VAC UL TV-3 and TV-5	10A @ 30VDC or 277VAC 20A @ 24VDC or 277VAC UL TV-5
Expected Mechanical Life	5 x 10^7 Ops.	1 x 10^7 Ops.	2 x 10^7 Ops.	1 x 10^7 Ops.	2 x 10^7 Ops.	5 x 10^6 Ops.	1 x 10^6 Ops.
Expected Electrical Life at Rated Load	7.5 x 10^4 to 1 x 10^5	1 x 10^5	1 x 10^5	7.5 x 10^4 @ 5A, 28VDC or 120VAC 5 x 10^4 @ 10A, 28VDC or 120VAC	5 x 10^4	1 x 10^5	1 x 10^5 @ 10 A, 30VDC or 277VAC 2 x 10^4 @ 20 A, 277VAC
Nominal Coil Voltage	3-115VDC	3-48VDC	3-48VDC	3-48VDC	3-60VDC	3-48VDC	5-48VDC 12-240VAC
Nominal Coil Power	450-720mW	360-400mW	330-650mW	360mW	230mW	530-720mW	(DC) 520mW (AC) 1.6VA
Mounting Options	PC board, Socket	PC board	PC board	PC board	PC board	PC board	PC board
Sockets / Connectors	Solder terminal, PC terminal	—	—	—	—	—	—

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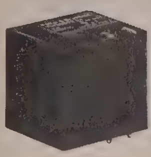
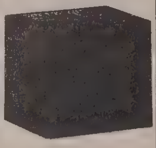
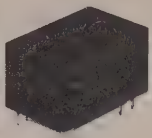
	Printed Circuit Board Relays				General Purpose Relays		
				NEW 			
Series	**T90**	**T91**	**T91E**	**T92**	**R10**	**KH/KHA**	**K10**
Features	• 30A load switching • Less than 1W coil power requirement • Class F insulation • Open, dust cover or tape sealed, immersion cleanable case	• QC and PC terms. • Meets UL 873 and UL 508 spacings • Optional flanged case for panel mounting • Safety wells accept insulated female quick connects	• Magnetic blowout aids arc quenching when switching high voltage DC • Sealed case for immersion cleaning • PC terminals • Class F insulation	• Two pole unit can break both sides of the AC line • 30A switching • PC board or panel mount • Ideal for HVAC and appliance apps. • Designed to meet VDE requirenents	• Up to 8 poles • Highly sensitive coils available • Many contact options • Various case, terminal and mounting styles	• Compact package • 4PDT, 5A switching • Smoked dust cover • Various mounting configurations • Indicator lamp available • Hermetically sealed case option	• Compact package • DPDT, 5A switching • Smoked dust cover • Various mounting configurations • Indicator lamp available • AC and DC coils
Approximate Dimensions	1.20" x .95" x .67"h (30.5 x 24.1 x 16.9h)	1.27" x 1.07" x 1.10"h (32.1 x 27.2 x 27.9h)	1.27" x 1.07" x 1.10"h (32.1 x 27.2 x 27.9h)	2.03" x 1.33" x 1.20"h (51.6 x 33.8 x 30.5h)	1.17" x .74" x 1.18"h (29.6 x 18.7 x 30.2h)	1.11" x .86" x 1.38"h (28.2 x 21.8 x 34.9h)	1.11" x .86" x 1.38"h (28.2 x 21.8 x 34.9h)
Contact Arrangements	1 Form A, 1 Form C	1 Form A, 1 Form B, 1 Form C	1 Form A	2 Form A, 2 Form C	1 Form C to 8 Form C	2 Form C, 4 Form C	2 Form C
Contact Material	Ag AgCdO	Ag AgCdO	AgCdO	AgCdO	AgCdO, Ag, Au overlay Ag, AuPtAg	Ag, AgCdO, AuAgNi, Pd, Au overlay Ag, Au diffused Ag	Ag AgCdO
Maximum Contact Rating	30A @ 28VDC or 240VAC 6A @ 277VAC 2 HP @ 240VAC	30A @ 28VDC or 240VAC 6A @ 277VAC 2 HP @ 240VAC	20A @ 75VDC	30A @ 277VAC 20A @ 28VDC TV10A @ 120VAC 2.5 HP @ 240VAC 1 HP @ 120VAC	Dry circuit to 7.5A @ 28VDC or 115VAC 1/8HP @ 110-120VAC 1/6HP @ 220-240VAC	Dry circuit to 5A @ 28VDC or 240VAC 1/10HP @ 120-240VAC	15A @ 30VDC or 120VAC 10A @ 277VAC 1/3HP @ 120VAC 1/2HP @ 240VAC
Expected Mechanical Life	1×10^7 Ops.	1×10^7 Ops.	1×10^6 Ops.	5×10^6 Ops.	1×10^8 Ops.	1×10^7 Ops.	1×10^7 Ops.
Expected Electrical Life at Rated Load	1×10^5	1×10^5	5×10^5 Ops.	1×10^5 Ops.	2×10^4 to 6×10^5	1×10^5	1×10^5
Nominal Coil Voltage	5-110VDC	5-110VDC 12-240VAC	4.5-110VDC	5-110VDC 24-277VAC	3-115VDC 24-115VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC
Nominal Coil Power	870-930mW	870-930mW (DC) 2.0VA (AC)	1.5W	1.7W (DC) 4.0VA (AC)	36mW to 1.6W (DC) 1.5VA (AC)	900mW(DC) 1.2VA (AC)	900mW (DC) 1.2VA (AC)
Mounting Options	PC board	PC board, Panel mount	PC board	PC board Panel mount	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board
Sockets / Connectors	—	—	—	—	Screw terminal, Solder terminal, PC terminal	Screw terminal, Solder terminal, PC terminal	Screw terminal, Solder terminal, PC terminal

Specifications are subject to change without notice. Specifications and/or agency recognitions do not necessarily apply to all models within a particular series.

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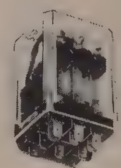
General Purpose Relays

							
Series	**KUP**	**KUEP**	**KUIP**	**KUGP**	**KUMP**	**KUP93**	**KRPA**
Features	• Open or enclosed • Plain or bracket mount dust covers • Optional indicator lamp and push-to-test button • Several socket styles UL CSA	• Switches DC currents. • Magnetic blowout • Open or enclosed • Plain or bracket mount dust covers • Optional indicator lamp UL CSA	• 8mm coil-to-contact spacing • VDE approved design • Plain or bracket mount dust covers • Several socket styles UL CSA VDE	• 3mm contact gap • 8mm coil-to-contact spacing • VDE approved design • Plain or bracket mount dust covers • Several socket styles UL CSA VDE	• 15A contacts • Open or enclosed • Plain or bracket mount dust covers • Optional indicator lamp and push-to-test button • Several socket styles UL CSA	• Designed primarily for HVAC industry • Accepted pin pattern for HVAC • Dust cover • Optional indicator lamp and push-to-test button UL CSA	• Octal-type plug • Dust cover • Optional indicator lamp and push-to-test button UL CSA
Approximate Dimensions	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)	1.41" x 1.41" x 2.00"h (35.7 x 35.7 x 50.8h)
Contact Arrangements	1 Form A to 4 Form C	1 Form X, 2 Form A, 2 Form C	1 Form A to 3 Form C	1 Form A, 2 Form A, 3 Form A, 1 Form X	1 Form A to 3 Form C	1 Form A to 3 Form C	1 Form A to 3 Form C
Contact Material	Ag AgCdO	AgCdO	Ag AgCdO	Ag AgCdO	AgCdO	Ag AgCdO	Ag AgCdO
Maximum Contact Rating	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC	10A @ 150VDC (1X) 5A @ 150VDC (2A) 3A @ 150VDC (2C)	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC	15A @ 277VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC	3A @ 32VDC or 250VAC 5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC	5A @ 28VDC or 120VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 240VAC
Expected Mechanical Life	1 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.
Expected Electrical Life at Rated Load	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5
Nominal Coil Voltage	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC
Nominal Coil Power	1.2-1.8W (DC) 2.0-2.7VA (AC)	1.2-1.8W (DC) 2.0-2.7VA (AC)	1.2W (DC) 2.0-2.7VA (AC)	1.8W (DC 2.7VA (AC)	1.2W (DC) 2.7VA (AC)	1.2W (DC) 2.0-2.7VA (AC)	1.2W (DC) 2.0VA (AC)
Mounting Options	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket	Socket
Sockets / Connectors	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Crimp terminal, Solder terminal, PC terminal	Screw terminal

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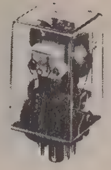
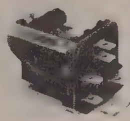
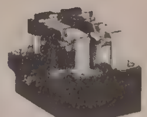
	General Purpose Relays			Power Relays			
							
Series	**KR–E**	**KR–3H**	**KA**	**KUH**	**S86/S87**	**PM**	**PRD**
Features	• Hermetically sealed steel case for use in hazardous locations • Octal-type plug UL	• 20A contacts • Available with dust cover and octal-type plug or as an open-style relay UL	• Compact, open-style relay • Ruggedly constructed • Cost effective • Highly efficient for switching light power loads UL CSA	• 20A and 30A contact ratings • Open or enclosed • Various mounting options • 3,750Vrms coil-to-contact breakdown UL CSA	• Economical • 20A switching in a compact package • Sensitive DC coil version available • Choice of two mounting brackets UL CSA	• 4PDT, 25A contacts • High dielectric strength • Screw or quick connect terminals • Dust cover available UL CSA	• Ratings to 50A • High inrush capacity • Available with magnetic blowouts • Optional auxiliary switch UL CSA
Approximate Dimensions	1.44" x 1.66" x 2.12"h (36.6 x 42.2 x 53.8h)	1.53" x 1.41" x 2.28"h (38.9 x 35.7 x 57.9h)	1.92" x 1.47" x 1.38"h (48.8 x 37.3 x 34.9h)	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)	2.42" x 2.07" x 1.31"h (61.5 x 52.6 x 33.3h)	3.39" x 2.66" x 2.72"h (86.2 x 67.5 x 69.1h)	3.38" x 2.51" x 2.50"h (85.7 x 63.8 x 63.5h)
Contact Arrangements	1 Form A to 3 Form C	1 Form X	1 Form A to 3 Form C	1 Form A to 2 Form C	1 Form C, 2 Form C	4 Form C	1 Form A to 2 Form C
Contact Material	Ag AgCdO	AgCdO	Ag AgCdO	AgCdO	Ag & AgCdO	AgCdO	Ag AgCdO
Maximum Contact Rating	5A @ 28VDC or 120VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 240VAC	20A @ 120VAC 1 HP @ 120/240VAC	5A @ 120VAC 10A @ 120VAC 6A @ 240VAC 1/6HP @ 120VAC 1/3HP @ 240VAC	(1C) 30A @ 240VAC 25A @ 28VDC 1HP @ 120VAC (2C) 20A @ 240VAC or 28VDC 3/4HP @ 120VAC	20A @ 277VAC 1HP @ 125VAC 2HP @ 250VAC	25A @ 277VAC 10A @ 28VDC 1HP @ 240VAC	50A @ 277VAC 20A @ 125VDC 1.5HP @ 120VAC 2HP @ 250VAC
Expected Mechanical Life	1×10^7 Ops.	2.5×10^6 Ops.	1×10^7 Ops.	1×10^7 Ops.	1×10^6 Ops.	1×10^7 Ops.	2×10^6 Ops.
Expected Electrical Life at Rated Load	1×10^5	1×10^5	1×10^5	1×10^5	5×10^4	1×10^7	1×10^5
Nominal Coil Voltage	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-125VDC 6-277VAC	6-125VDC 6-480VAC	6-110VDC 6-480VAC
Nominal Coil Power	1.2W (DC) 2.0VA (AC)	1.2W (DC) 2.0VA (AC)	1.2W (DC) 2.0VA (AC)	1.2W (DC) 2.7VA (AC)	1.13-4.5W (DC) 4.0VA (AC)	4.4W (DC) 14VA (AC)	2.0W (DC) 8.0VA (AC)
Mounting Options	Socket	Socket, Panel mount	Panel mount	Panel mount, PC board	Panel mount	Panel mount	Panel mount
Sockets / Connectors	Screw terminal	Screw terminal	—	—	—	—	—

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	Contactors			Latching & Rotary Relays			
Series	**P25**	**P30/P40**	**P31/P41**	**KUL**	**KBP**	**S89/S90**	**MDR**
Features	• 25A contactor • Control 3Ø loads • Field replaceable contacts • Optional auxiliary switch • Universal mounting plate	• P30 switches 30A • P40 switches 40A • Field replaceable contacts • Optional auxiliary switch • Universal mounting plate	• P31 is 3 pole • P41 is 4 pole • Ratings to 40FLA • Optional auxiliary switch • Universal mounting plate • Various terminals	• Magentic latching relay • Single or dual coil • Good memory stability • Low power requirement • Various sockets available	• Dual coil, mechanical latching relay • Clear dust cover with plug-in base • Up to 5 poles • Sockets available	• Low cost, bistable, impulse relay • Optional dust cover with plug-in base • Up to 4 poles • Ratings to 20A	• Rotary relay • Withstands high-impact shock blows with no contact chatter • Latching & non-latching types • Up to 24 poles
Approximate Dimensions	2.55" x 3.80" x 3.47"h (64.8 x 96.5 x 63.5h)	2.65" x 3.80" x3.98"h (67.3 x 96.5 x 101.1h)	2.55" x 3.80" x 2.87"h (64.8 x 96.5 x 72.9h)	1.53" x 1.41" x 2.16"h (38.9 x 35.7 x 54.8h)	1.78" x 2.41" x 3.56"h (45.2 x 61.1 x 90.4h)	2.70" x 2.00" x 2.42"h (68.6 x 50.8 x 61.5h)	4.19" x 4.19" x 5.75"h (106 x 106 x 146h)
Contact Arrangements	2 Form X to 3 Form X	2 Form X to 4 Form Y	2 Form X to 4 Form X	1 Form C, 2 Form C, 3 Form C	1 Form A to 5 Form C	1 Form A to 4 Form C	4 Form C to 24 Form C
Contact Material	AgCdO	AgCdO	AgCdO	Ag AgCdO	Ag AgCdO	Ag AgCdO	Ag AgCdO
Maximum Contact Rating	25FLA, 100LRA @ 600VAC 30A res. @ 600VAC	(P30) 30FLA, 120LRA @ 600VAC 40A res. @ 600VAC (P40) 40FLA, 160LRA @ 600VAC 50A res. @ 600VAC	40FLA, 160LRA @ 600VAC 50A res. @ 600VAC	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/4HP @ 120VAC 1/3HP @ 250-600VAC	5A @ 120VAC 10A @ 120VAC	(S89) 15A @ 250VAC 1/2 HP @ 125VAC (S90) 20A @ 277VAC 2 HP @ 250VAC	10A @ 115VAC 3A @ 28VDC 800mA @ 125VDC
Expected Mechanical Life	2 x 10^6 Ops. (DC coil) 5 x 10^6 Ops. (AC coil)	2 x 10^6 Ops. (DC coil) 1 x 10^7 Ops. (AC coil)	5 x 10^5 Ops.	1 x 10^7 Ops.	5 x 10^5 Ops.	1 x 10^5 Ops.	—
Expected Electrical Life at Rated Load	5 x 10^5	2 x 10^5	2 x 10^5	1 x 10^5	5 x 10^4	5 x 10^4	—
Nominal Coil Voltage	6-240VDC 24-600VAC	6-240VDC 24-600VAC	12-120VDC 12-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-120VDC 6-277VAC	28-125VDC 115-440VAC
Nominal Coil Power	4-8W (DC) 10VA (AC)	4-8W (DC) 10VA (AC)	8W (DC) 10VA (AC)	1.2W (DC dual coil) 2.4W (DC single coil)	2.7W (DC) 5.3-7.8VA (AC)	6.33W (DC) 9VA (AC)	5.1-21.8W
Mounting Options	Panel mount	Panel mount	Panel mount	Socket, Panel mount	Socket	Panel mount, Socket	Panel mount
Sockets / Connectors	—	—	—	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal	Screw terminal	—

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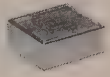
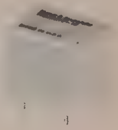
	Reed Relays				Automotive Relays		
							NEW 
Series	**JWD/JWS**	**JRE**	**JR/JRM**	**JM**	Series	**VKM**	**T72J/K**
Features	• Low cost dry reed • DIP and SIP configurations • Molded package • Wave solderable and immersion cleanable • Optional coil suppression diode	• Dry reed relay • Molded package • PC terminals are arranged on a 1" (25.4mm) x 0.1" (2.54mm) grid • Wave solderable and immersion cleanable	• PC board mount dry reed relay has protective metal cover • Standard (JR) and miniature (JRM) versions • Latching model (JRL) available	• Hg -wetted reed relays potted in steel cases • Various mountings • Bridging and non-bridging types • Single-side stable, bi-stable and chopper operation	Features	• Miniature PC board relay • Available open or with sealed case • Various contact arrangements • Minimum PCB real estate	• Miniature PC board relay • Sealed case • Various contact arrangements
Approximate Dimensions	.77" x .30" x .315"h (19.6 x 7.62 x 8.0h)	.95" x.75" x .36"h (24.1 x 19.1 x 9.14h)	1.12" x .969" x .468"h (28.4x 24.6 x 11.9h)	1.31" x 1.31" x 2.64"h (33.3 x 33.3 x 67.1h)	Approximate Dimensions	.689" x .591" x .768"h (17.5 x 15.0 x 19.5h) (Sealed model)	.89" x .65" x .67"h (22.5 x 16.5 x 17h)
Contact Arrangements	1 Form A, 1 Form B, 1 Form C, 2 Form A	1-4 Form A, 1-2 Form B, 1 Form C	1 Form A to 5 Form C	1 Form C to 4 Form D	Contact Arrangements	1 Form A, 1 Form C, 1 Form U, 1 Form V	1 Form A, 1 Form C
Contact Material	Ru	Rh	Diffused Au	Hg film over Pt	Contact Material	AgNi 20 AgNi 0.15	AgNi 0.15
Maximum Contact Rating	10W (Form A & B) 3W (Form C)	10W or 10VA (Form A & B) 3W or 3VA (Form C)	(JR/JRL) 50W (W) 10W (Form C) 15W (Other forms) (JRM) 3W (Form C) 10W (Other forms)	100VA (JML, JMS, JMF, JMF2) 250VA (JM-1, JM-2, JM-3 & JM-4)	Contact Rating @ 85°C (Form A contacts with nominal coil voltage)	10A @ 14VDC	10A @ 14VDC
Expected Mechanical Life	1 x 10^8 Ops.	—	—	—	Expected Mechanical Life	1 x 10^7 Ops.	1 x 10^7 Ops.
Expected Electrical Life at Rated Load	1 x 10^6	—	—	—	Expected Electrical Life at Rated Load	1 x 10^5	1 x 10^5
Nominal Coil Voltage	5-24VDC	5-24VDC	6-48VDC	—	Nominal Coil Voltage	6, 12 & 24VDC	6, 12 & 24VDC
Nominal Coil Power	50-480mW	125-833mW	180mW-1.5W	—	Nominal Coil Power	1.11W	.36W (T72J) .64W (T72K)
Mounting Options	PC board	PC board	PC board	Octal Socket, PC board	Mounting Options	PC board	PC board
Sockets / Connectors	Fits 14-pin IC socket	—	—	Screw terminal	Sockets / Connectors	—	—

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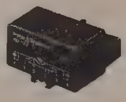
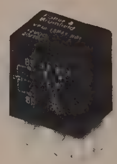
Automotive Relays

	NEW			*NEW*			
Series	**T72M**	**T90H/T90R**	**VKP**	**V2R**	**VBA**	**VFM**	**VF4**
Features	• Miniature PC board relay • Sealed case • Various contact arrangements • High current version • 105℃ ambient	• PC board relay • Available open or with sealed case • Various contact arrangements • Optional snap-on dust cover for open models	• PC board relay • Available open or with sealed case • Various contact arrangements • Minimum PCB real estate	• Motor reversing contact arragement • Sealed case • Miniature PC board relay • 105℃ ambient	• Motor reversing relay module • Plug-in connections • Various mounting options	• Miniature relay for plug-in or PC board mounting • Plastic enclosure • Various contact arrangements	• Plug-in or PC board mountable relay • Several enclosure options • Various contact arrangements • Optional mounting brackets
Approximate Dimensions	.89" x .65" x .67"h (22.5 x 16.5 x 17h)	1.20" x .95" x .67"h (30.5 x 24.1 x 16.9h) (Open model)	.911" x .748" x .715"h (23.1 x 19.0 x 18.2h) (Open model)	1.46" x .65" x .67"h (37.1 x 16.5 x 17h)	1.01" x 2.02" x 1.91"h (25.6 x 51.3 x 48.5h)	.610" x .906" x 1.02"h (15.5 x 23 x 26h)	1.12" x 1.12" x .987"h (28.5 x 28.5 x 25.1h)
Contact Arrangements	1 Form A, 1 Form C 1 Form U	1 Form A, 1 Form C	1 Form A, 1 Form C	2 x 1 Form C (H-Bridge)	2 x 1 Form C (H-Bridge)	1 Form A, 1 Form C	1 Form A, 1 Form C
Contact Material	AgNi 0.15	AgCdO AgCuNi	AgNi 0.15 PdCu	AgNi 0.15	AgNi 0.15	AgNi 20 AgNi 0.15	AgNi 0.15
Contact Rating @ 85℃ (Form A contacts with nominal coil voltage)	20A @ 14VDC	30A @ 14VDC	40A @ 14VDC	20A @ 14VDC	20A @ 14VDC	15A @ 14VDC	40A @ 14VDC
Expected Mechanical Life	1 x 10^7 Ops.	1 x 10^7 Ops.	5 x 10^6 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.	1 x 10^7 Ops.
Expected Electrical Life at Rated Load	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5	1 x 10^5
Nominal Coil Voltage	6, 12 & 24VDC	6, 12 & 24VDC	6, 12 & 24VDC	12VDC	12VDC	6, 12 & 24VDC	6, 12 & 24VDC
Nominal Coil Power	.8W	1.5W	1.6W	.64W .91W	1.81W	1.2W (Form A) 1.5W (Form C)	1.6W
Mounting Options	PC board	PC board	PC board	PC board	Bracket, Spring-clip, Push-in fastener	PC board, Plug-in	PC board, Plug-in, Bracket
Sockets / Connectors	—	—	—	—	Wiring harness style connector	PC terminal socket	PC terminal socket, Wiring harness style connector with or without bracket

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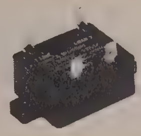
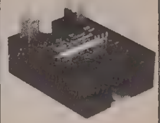
Automotive Relays

		NEW
Series	**VF7**	**VTF**
Features	• Plug-in or PC board mountable relay • 1 Form A contact arrangement • Optional mounting bracket	• Turn signal, hazard, or combination versions • Flash rate not sensitive to load current • Electronic timing with relay output • Meets applicable U.S. safety standards
Approximate Dimensions	1.04" x 1.04" x .992"h (26.5 x 26.5 x 25.2h)	1.12" x 1.12" x 1.6"h (28.5 x 28.5 x 40.5h)
Contact Arrangements	1 Form A	1 Form A
Contact Material	AgNi 0.15	PdCu AgCu
Contact Rating @ 85°C (Form A contacts with nominal coil voltage)	70A @ 14VDC	55W to 275W (Lamp)
Expected Mechanical Life	1 x 10^7 Ops.	5 x 10^6 Ops.
Expected Electrical Life at Rated Load	1 x 10^5	1 x 10^6 - 3 x 10^6 (Load dependent)
Nominal Coil Voltage	6, 12 & 24VDC	12VDC
Nominal Coil Power	2.0W	1.6W
Mounting Options	PC board, Plug-in, Bracket	Plug-in
Sockets / Connectors	Wiring harness style connector	PC terminal socket, wiring harness style connector with or without bracket

Solid State Relays

				
Series	**EOMZ/TZ**	**SSRT**	**SSR**	**SSRD**
Features	• Economically priced • Low profile, plastic base package • Triac output • DC input • Ratings to 25A	• "Hockey Puck" package • Triac output • AC & DC input • Ratings to 25A	• "Hockey Puck" package • Inverse parallel SCR output • AC & DC input • Ratings to 110A	• Two independent solid state relays in one "Hockey Puck" package • Inverse parallel SCR output • Ratings to 40A per output
Approximate Dimensions	1.81" x 1.50" x .66"h (46.0 x 38.1 x16.8h)	1.75" x 2.25" x .8"h (44.4 x 57.2 x 21h)	1.75" x 2.25" x .8"h (44.4 x 57.2 x 21h)	1.75" x 2.25" x .8"h (44.4 x 57.2 x 21h)
Switch Arrangement	1 Form A	1 Form A	1 Form A	(2) x 1 Form A
Coupling	Optical	Optical	Optical	Optical
Input	3-32VDC	3-32VDC 90-280VAC	3-32VDC 90-280VAC	4-15VDC
Output Switching	Zero, Random	Zero	Zero, Random	Zero, Random
Minimum Output Current	.02A	.05A	.05A	.05A
Maximum Output Current	25A	25A	110A	40A
Minimum Output Voltage	20V	24V	24V	24V
Maximum Output Voltage	280V	280V	530V	280V
Output Type	AC	AC	AC	AC
Terminals	Quick connect, Screw	Screw	Screw	Quick connect
Mounting	Chassis mount	Chassis mount	Chassis mount	Chassis mount

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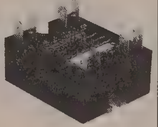
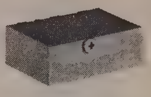
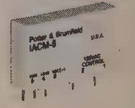
	Solid State Relays	Solid State Input/Output Modules					
							
Series	**SSRQ**	**IAC**	**OAC**	**IDC**	**ODC**	**IACM**	**OACM**
Features	• Four independent solid state relays in one "Hockey Puck" package • Triac output • Ratings to 20A per output	• AC input module • Industry standard 0.6" (15.2 mm) wide package • Series operation compatible	• AC output module • Industry standard 0.6" (15.2 mm) wide package • Series operation compatible • Output ratings to 6A	• DC input module • Industry standard 0.6" (15.2 mm) wide package • Series operation compatible	• DC output module • Industry standard 0.6" (15.2 mm) wide package • Series operation compatible • Output ratings to 5A	• Slim line AC input module • Only 0.37" (9.4 mm) wide package • Series operation compatible	• Slim line AC output module • Only 0.37" (9.4 mm) wide package • Series operation compatible • Output ratings to 6A
Approximate Dimensions	1.75" x 2.25" x .93"h (44.4 x 57.2 x 23.6h)	1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h)	1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h)	1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h)	1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h)	1.7" x .37" x 1.0"h (43.2 x 9.4 x 25.4h)	1.7" x .37" x 1.0"h (43.2 x 9.4 x 25.4h)
Switch Arrangement	(4) x 1 Form A	1 Form A (sinking)	1 Form A, 1 Form B	1 Form A (sinking)	1 Form A	1 Form A (sinking)	1 Form A
Coupling	Optical	Optical	Optical	Optical	Optical	Optical	Optical
Input	4-15VDC	10-36VAC/VDC 90-140VAC/VDC 180-280VAC/VDC	5VDC 15VDC 24VDC	3-32VDC 4-16VDC 10-36VDC 18-60VDC	5VDC 15VDC 24VDC	10-36VAC/VDC 90-140VAC/VDC 180-280VAC/VDC	5VDC 15VDC 24VDC 3-15VDC
Output Switching	Zero, Random	Random	Zero, Random	Random	Random	Random	Zero, Random
Minimum Output Current	.05A	>0	.02A to .05A	>0	.02A	>0	.02A to .05A
Maximum Output Current	20A	0.1A	3A to 6A	0.1A	1A @ 200V 5A @ 60V	0.1A	3A to 6A
Minimum Output Voltage	24V	>0	12V	>0	5V, 10V	>0	12V
Maximum Output Voltage	280V	30V	280V	30V	60V, 200V	30V	280V
Output Type	AC	DC	AC	DC	DC	DC	AC
Terminals	Quick connect	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting	Chassis mount	Mounting board	Mounting board	Mounting board	Mounting board	Mounting board	Mounting board

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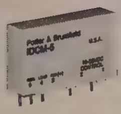
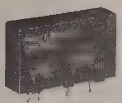
Solid State I/O Modules

		
Series	**IDCM**	**ODCM**
Features	• Slim line DC input module • Only 0.37" (9.4 mm) wide package • Series operation compatible	• Slim line DC output module • Only 0.37" (9.4 mm) wide package • Series operation compatible • Output ratings to 5A
Approximate Dimensions	1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h)	1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h)
Switch Arrangement	1 Form A (sinking)	1 Form A
Coupling	Optical	Optical
Input	4-16VDC 10-36VDC 18-60VDC	5VDC 15VDC 24VDC 3-15VDC
Output Switching	Random	Random
Minimum Output Current	>0	.02A
Maximum Output Current	0.1A	5A @ 60V 1A @ 200V
Minimum Output Voltage	>0	5V, 10V
Maximum Output Voltage	30V	60V, 200V
Output Type	DC	DC
Terminals	Printed circuit	Printed circuit
Mounting	Mounting board	Mounting board

Time Delay Relays

Series	**CNT**	**CNS**	**CNM5**	**CN1**
Features	• Programmable timer/counter • Digital display • Universal input voltage • 1/16 DIN style enclosure	• Programmable time delay relay • Universal input voltage • 1/16 DIN style enclosure	• Economical, programmable time delay relay • Digital accuracy • LED shows status • 1/16 DIN style enclosure	• Economical single function (on delay) time delay relay • Digital accuracy • LED shows status • 1/16 DIN style enclosure
Approximate Dimensions	1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h)	1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h)	1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h)	1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h)
Contact Arrang.	2 Form C	2 Form C	2 Form C	2 Form C
Contact Rating	10A @ 30VDC or 277VAC	10A @ 30VDC or 277VAC	10A @ 30VDC or 277VAC	10A @ 30VDC or 277VAC
Mode of Operation	Programmable: 10 timing functions 2 counting functions	Programmable: 8 functions (11-pin) 4 functions (8-pin)	Programmable: 5 timing functions	On Delay
Delay Time	0.1 sec. to 9,990 hr.	0.1 sec. to 100 min.	0.1 sec. to 9,990 hr.	0.1 sec. to 9,990 hr.
Type of Control	Thumbwheel switches	DIP switches & Potentiometer Adj.	Thumbwheel switches & Rotary switch	Thumbwheel switches
Maximum Repeatability	±0.1% ±0.05 sec.	±0.2%	±0.05% ±0.04 sec.	±0.05% ±0.04 sec.
Max. Delta Time	±0.1% ±0.05 sec.	±10%	—	—
Tolerance	±0.1% ±0.05 sec.	Min. spec. at min.; +20%, -0 at max.	±0.05% ±0.04 sec.	±0.05% ±0.04 sec.
Temp. Range	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C
Input Voltage	12VDC 24-240VAC/VDC	24-240VAC/VDC	120VAC	120VAC
Mounting	Plug-in	Plug-in	Plug-in	Plug-in

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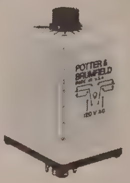
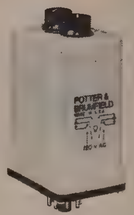
Time Delay Relays

							
Series	**CG**	**CD**	**CK**	**CH**	**CB**	**CR**	**CL/CU**
Features	• Top of the line non-programmable time delay relays • Extended timing ranges	• Ideal for many demanding applications • Broad temperature range	• Broad line • Wide choice of functions • Extremely versatile	• Wide range of industrial applications • Dependable timing cycles	• Economical for volume applications • Various timing ranges	• Recycle timer allows independent control of ON and OFF delays • Time as low as 0.1 sec.	• Compact package is well-suited for many OEM applications • Various mounting options
Approximate Dimensions	2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h)	2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h)	2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h)	2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h)	2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h)	2.41" x 1.78" x 3.56"h (61.1 x 45.2 x 90.4h)	1.53" x 1.41" x 1.91"h (38.9 x 35.7 x 48.4h)
Contact Arrang.	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C
Contact Rating	10A @ 240VAC	10A @ 240VAC	10A @ 240VAC	10A @ 240VAC	10A @ 240VAC	10A @ 240VAC	10A @ 28VDC or 240VAC
Mode of Operation	Delay on Operate Delay on Release Interval On	Delay on Operate Delay on Release	Delay on Operate Delay on Release Interval On Delay on Dropout	Delay on Operate Delay on Release Interval On	Delay on Operate Delay on Release Interval On	Recycle Timer	Delay on Operate
Delay Time	0.5 sec. to 100 min.	0.1 sec. to 180 sec.	0.1 sec. to 180 sec.	1 sec. to 180 sec.	0.1 sec. to 100 min.	0.1 sec. to 180 sec.	0.1 sec. to 120 sec.
Type of Control	Potentiometer Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.	Potentiometer Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.
Maximum Repeatability	±0.5% (AC) ±0.1% (DC)	±1%	±2%	±2%	±2%	±2%	±3%
Max. Delta Time	±5%	±5%	±10%	±10%	±10%	±10%	–
Tolerance	+0, -10% at min. +10%, -0 at max.	±5% (fixed only)	±5% (fixed only)	±5% (fixed only)	±10% (fixed only)	+0, -20% at min. +20%, -0 at max.	±5% (fixed only)
Temp. Range	-10°C to +55°C	-40°C to +55°C	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C	-10°C to +40°C
Input Voltage	12-24VDC 120-240VAC	12-110VDC 24-120VAC	12-110VDC 24-120VAC	24VDC 24-240VAC	12-110VDC 24-240VAC	12-110VDC 24-120VAC	12-24VDC 24-120VAC
Mounting	Plug-in	Plug-in	Plug-in	Plug-in	Plug-in	Plug-in	Plug-in

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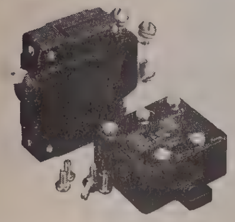
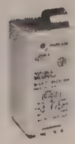
Sensors

					
Series	**ELM1**	**ELM2**	**CS**	**CZS-01**	**SDAS-01**
Function/Features	• Monitors status of a solid state or electromechanical relay • Determines if relay's output is "on" when the input is "off" • Generates trip signal which activates ELM2	• Disconnects AC line from load upon receiving a trip signal from ELM1 • Trip coil is matched to the output signal of the ELM1 • Contacts remain open until unit is manually reset	• Functions as either an overvoltage or an undervoltage sensor • Choice of fixed pick-up and knob adjustable drop-out or knob adjustable pick-up and drop-out	• Monitors integrity of ground line • Integral relay disconnects equipment from AC line should ground line open • Useful in applications which must adhere to UL-544	• AC current sensor is offered in both overcurrent and undercurrent types • Inductive coupling to power line • Potentiometer adjustable • Internal relay available with one or two poles
Approximate Dimensions	1.5" x 1.81" x .79"h (38.1 x 4.0 x 20.1h)	2.55" x .75" x 2.0"h (64.8 x 19.1 x 50.8h)	2.41" x 1.78" x 2.94"h (61.1 x 42.2 x 76.6h)	1.8" x 3.3" x 1.5"h (44.5 x 83.8 x 38.1h)	1.20" x .95" x .67"h (30.5 x 24.1 x 16.9h)
Contact/Switch Arrangements	–	1 Form A	2 Form C	2 Form C	1 Form C, 2 Form C
Contact/Switch Rating @	–	50A @ 120-240VAC	10A @ 28VDC or 120VAC	10A or 15A @ 120 or 240VAC	(1C) 5A @ 28VDC or 2.5A @ 120VAC (2C) 2A @ 28VDC or 1A @ 120VAC
Monitor/Sense Range or Threshold	3 to 40mA DC; 90-277VAC	–	16 to 140VAC or VDC in various ranges	Ground line resistance >10^6 Ohm; Ground-to-neutral fault 15Vrms	1.5 to 15A AC
Temp. Range	-30°C to +80°C	-30°C to +80°C	-10°C to +55°C	0°C to +55°C	-25°C to +70°C
Terminals	Screw	Screw	Octal plug	Quick connect	Quick connect, PC board
Mounting Options	Chassis mount	Panel mount	Socket	Chassis mount	Socket, Chassis mount, PC board
Sockets	—	—	Screw terminal	—	Screw terminal, Solder terminal, PC terminal, Quick connect terminal

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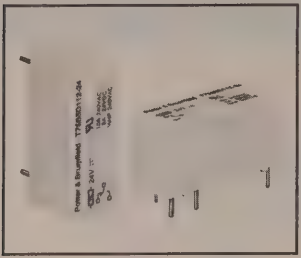
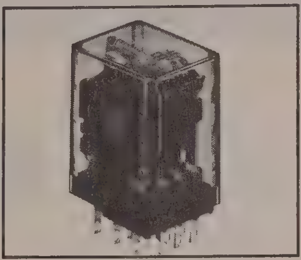


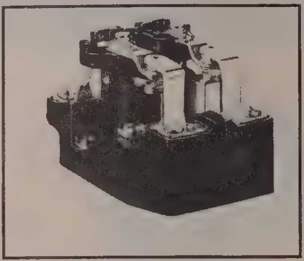
P.C. Board Relays

- Dry circuit to 30A ratings
- Up to 4PDT arrangements
- Open, dust cover and sealed units
- AC and DC coils
- Polarized types
- Latching models



General Purpose Relays

- Dry circuit to 30A ratings
- Up to 8PDT arrangements
- Open, dust cover and sealed units
- AC and DC coils
- P.C. board, socket and panel mount types

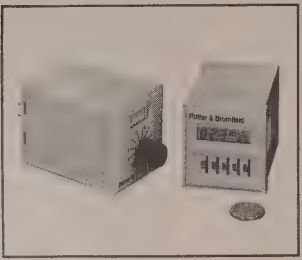


Power Relays

- Ratings to 60A
- Up to 4PDT arrangements
- Available as open relays or with dust covers
- AC and DC coils
- Socket and panel mount types

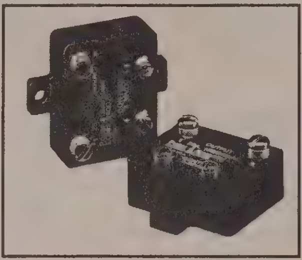
Contactors

- Ratings to 60A
- 1Ø and 3Ø switching
- Up to 4PST-NC-DM arrangements
- AC and DC coils
- Available with universal mounting plates



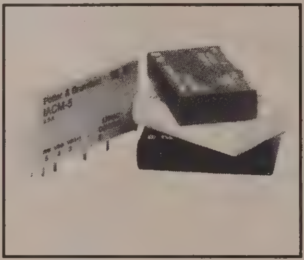
Time Delay Relays

- Ratings to 10A
- Time up to 9,990 hours
- Up to 10 timing modes
- Field programmable types
- AC and DC input
- Knob, resistor, switch and fixed adjustment types
- Socket and P.C. board mountings



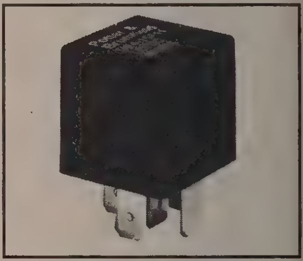
Solid State Relays

- Current ratings to 110A
- Switch voltage to 480VAC
- P.C. board and chassis mount types
- Single, dual and quad output
- AC and DC input
- Triac and inverse parallel SCR output types



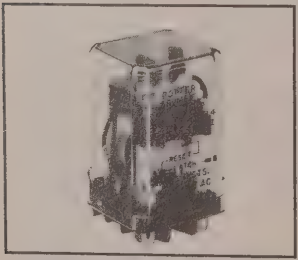
Input/Output Modules

- Standard and slim line package styles
- Output ratings to 6A
- Compatible for series operation
- Standard and slim line mounting boards available



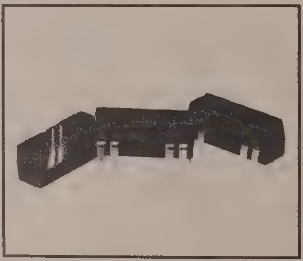
Automotive Relays

- Current ratings to 70A
- Standard and miniature varieties
- Choice of quick connect or PC terminals
- Various package styles and mounting options
- Coil suppression resistors available on some models



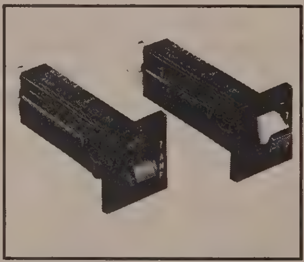
Impulse/Latching Relays

- Mechanical and magnetic latching types
- P.C. board, plug-in and chassis mount types
- Ratings to 20A
- Single and dual coil models
- Up to 16 poles



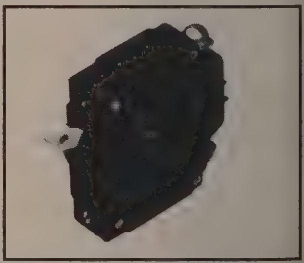
Reed Relays

- Dry and Hg-wetted types
- P.C. board, plug-in and chassis mount types
- Up to 5 poles
- Ratings to 250VA (with contact protection)
- Coil suppression diodes available on some models



Thermal Circuit Breakers

- Threaded bushing and snap-in mounting options
- Ratings to 50A
- Choice of quick connect or screw terminals
- Toggle, push/pull or push-to-reset actuators
- Series trip



Magnetic Circuit Breakers

- Choice of screw or snap-in mounting
- Ratings to 50A
- Up to 4 poles
- Actuator-per-unit and actuator-per-pole types
- Various circuit functions and time-trip curves

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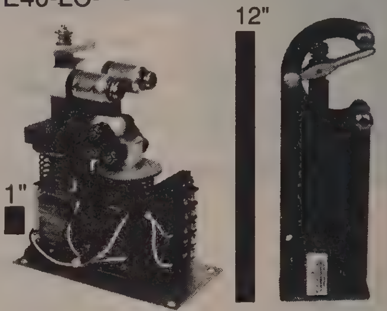
HIGH VOLTAGE RELAYS
1KV TO 300KV PK TEST

HV BASIC RELAYS

For transfer, safety grounding, tap selection, polarity selection. In the range of 1KV to 200KV DC or PK AC with PK test voltages up to 300KV PK. Most high voltage contacts have full insulation above ground. A higher insulation level to ground is optional. Some units are spring return and can mount in any position, or with gravity return by mounting in the proper position. Also usable in oil or insulating gas. Relays are available with replaceable tungsten alloy contacts for high current capacitor discharge use and with auxiliary contacts for holding, indicating or interlocking.

H.V. LATCHING RELAYS: Loss of control power will not cause an unwanted transfer. Power is not required to maintain position, reducing energy requirements and heat. Pulse actuation may be desirable in some applications.

E40-LC- -



40 KV PK TEST E40-DT-60- -

E60-NCP- -

60 KV PK TEST

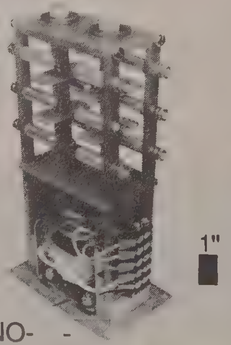
HV AIR OPERATED RELAYS

Air operated relays can be actuated with compressed air or other gas pressures of 80 to 120 PSI. Some can be operated at pressures as low as 30 PSI. Some units have spring return with loss of air. Auxiliary air valve type indicators can be provided in place of auxiliary electrical type contacts to provide complete isolation from high voltage, and provide answerback to indicate full open or closed, or other control. Units designed to be submerged in insulating fluid are also available with air exhaust outlets to exterior to avoid contaminating the insulating fluids.

HV DELAYED OPENING AND CLOSING RELAYS

For some high voltage control and safety applications, a delayed action but positive automatic closing (normally closed) or opening (normally open) of high voltage relays upon accidental loss or normal shut down of control power is desirable if not mandatory. These relays are designed for safety shorting and for use with HV power supplies having stored energy which must not be discharged before other control relays operate, or current flow which must not be interrupted too soon. Delay can be initiated either when control voltage is turned on or turned off, or both.

E40-NC- -ZA
40 KV PK TEST



14 KV PK TEST

ET6-14-6PNO- -

HIGH VOLTAGE MULTI-POLE RELAYS

The Multi-pole E series relays are designed for high voltage applications where 2 or more poles are required. These air insulated relays are constructed using fire retardant, moisture sealed anti-tracking epoxy glass laminate of the highest quality. Environmental resistant materials are standard throughout to assure long life and ruggedness. Applications for these relays include: 3 phase tap or load selection, transfer, polarity reversing, safety grounding, and shorting. These units can be used in air, oil, or other insulating mediums and are designed to be mounted base down. Contacts are available in normally open, normally closed and double throw configurations. Latching units are also available.

*See our additional products in **Volume B,** Fiber Optic Equipment & Accessories – Sect. 2475, Switches – Sect. 5100; and **Volume D,** Instruments, Test & Measuring – Sect. 2900.*

ROSS ENGINEERING CORP.

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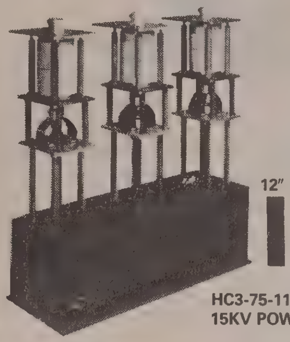
HIGH VOLTAGE DEVICES

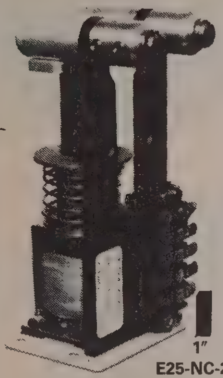
208V to 900KV and 0.01V to 1,000V Instrumentation



HV VACUUM CONTACTORS & 1 CYCLE CIRCUIT BREAKERS

Vacuum switches, single phase, three phase, upright or low profile, for high reliability sealed arc interrupting or crobar shorting. 208V to 200KV RMS operate. 50 to 4,000 amps continuous, 2,000 to 35,000 amps AC, 10 to 20,000 amps DC interrupt, 5,000 to 100,000 amps momentary and capicitor discharge.

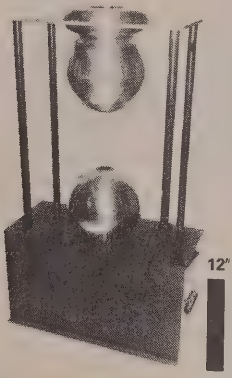
HC3-75-110-600-2-2
15KV POWER CLASS



E25-NC-25-1-0,
25KV PK TEST

HV RELAYS 1KV TO 300KV

HV relays of the air insulated type both for low and high current. This series has ratings from .1 to 200 amps continuous, 100 to 100,000 amps momentary and capacitor discharge. Peak test voltages from 5 to 300KV. Single or multipole. NO, NC and DT. Auxiliary contacts optional on all types. Latching extended life and tungsten contacts also available for high current closing. Also usable in oil or insulating gas.

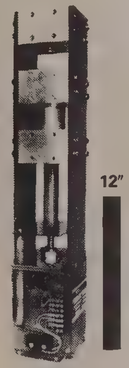


HV SPHERICAL RELAYS

Extra high voltage low corona, transfer, polarity reversing and grounding realys of the air insulated type. Ratings up to 600KV PK at 100 amps continuous. Solenoid, motor or air cylinder operated and spring or gravity return.

SPST, DT, 2PST, DT

DH-300-NC-40-2-0-1
300KV PK TEST



HIGH CURRENT SWITCHES

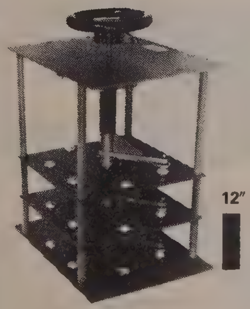
Models are available up to 20,000 amps continuous, and over 500,000 amps pulse, with voltage ratings of 6 volts to 300KV peak test. Many are air cylinder or motor operated for high contact force.

GD-27-DTP-40-1600-2-43,
27KV PK TEST

HIGH POWER HIGH SPEED HIGH VOLTAGE CONTROL AND STEP-START SYSTEMS

½ to 1 cycle sensing and interrupt vacuum circuit breakers. Metal enclosed for indoor or outdoor applications. 5KV-38KV.

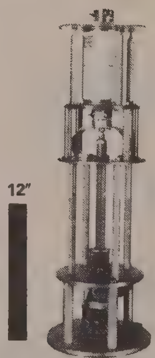
200-1200A CONTINUOUS
2000-28000A INTERRUPT
5-15KV CLASS



HV ROTARY SWITCHES

Ratings from 5 to 150KV, 1 to 200 amps. Either manual or electrical operators, depending upon requirements. Position detents and interlocks to prevent opening under load.

R-60-3P7T-60-1-0-H,
60KV PK TEST



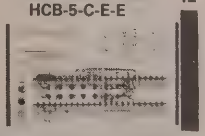
HA-73-NO-100-2-0
70KV PK TEST
CONTACTOR

HIGH SPEED HV CONTACTORS AND SOLENOID DRIVERS ENERGY STORAGE UNITS

One Millisecond Contact Opening

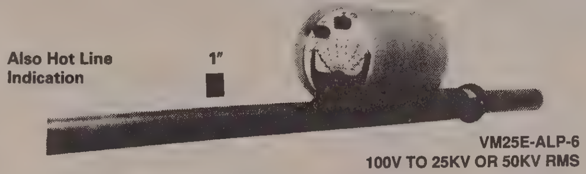
For high speed or loss of power automatic circuit breaker trip and for high speed activation of contactor or circuit breaker solenoids. Energy storage up to 400 joules or more at 150 to 700 volts or more, 100 to 4,000 microfarad or more. Instantaneous SCR control available.

ENERGY STORAGE
SCR CONTROL
HCB-5-C-E-E



*See our additional products in **Volume B,** Fiber Optic Equipment & Accessories – Sect. 2475, Switches – Sect. 5100; and **Volume D,** Instruments, Test & Measuring – Sect. 2900.*

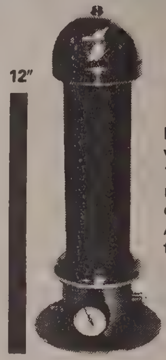
HIGH VOLTAGE DEVICES



VM25E-ALP-6
100V TO 25KV OR 50KV RMS

POWER CLASS
Hi-Z™ HV VOLTMETERS SAFE POWER LINE USE AC/DC FOR UTILITIES, CONTRACTORS & FIRE & SAFETY DEPARTMENTS

Fully safe, portable, all solid state, 2% to 5% accuracy. Taut band shielded high voltage measurement with minimum circuit loading. 0.001V to 50KV AC and DC. Ideal for use with Elbow capacitance tap voltage test points. For cable test point or direct line voltage and phasing, or differential measurement. Digital also available with 0.5%-1% accuracy.



WIDE BAND HV VOLTAGE DIVIDERS DC-10 MHz

Precision compensated resistance-capacitance voltage dividers for 1KV to 900KV, DC up to 10MHz or to 0.02μ Sec rise time pulse. 1,000/1 ratio matched to 1 megohm, 20 to 50 pf display or recorder. Other ratios and loads as required. Accuracy and stability: 0.01% to 0.1% DC. 0.2% to 1% AC 3% DC-1MHz. 3DB 10MHz.

VD60-6.2-B-LB-A
60KV PK OPERATE

WEATHER PROOF WIDEBAND HIGH VOLTAGE DIVIDERS For Power Line Use

High accuracy 5KV RMS to 345KV RMS power class. 30KV PK to 900KV PK operate. 60KV to 1350KV basic impulse level. DC to 1MHz frequency response. For DC, AC and transient measurement and recording.

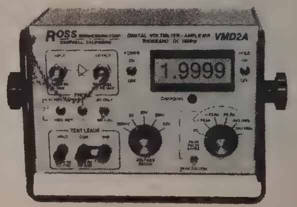
VD900-20-T-KB-E,
900KV PK OPERATE

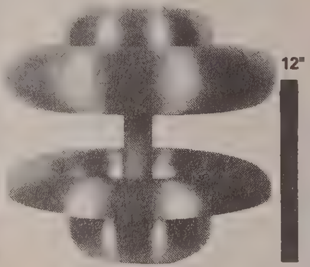
HV DIGITAL MULTIMETERS

Easy to read, 4½-digit display; 0.1% and 0.01% accuracy. 0.0001 volt to 900KV. Battery/AC with charger. Recorder and scope outputs. DC, AC RMS average, AC RMS true, AC PK Ripple & Wide Band DC – 1MHz.

VD30-8.3-A-LB-A,
30KV PK OPERATE

VMD2A





HIGH ACCURACY HV SHIELDED VOLTAGE DIVIDER 0.01% DC, 0.2%-3% AC

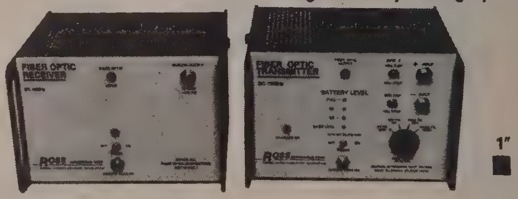
Special high accuracy, shielded, compensated resistance-capacitance voltage dividers up to 900KV wideband DC to 1MHz. Matched to 1 megohm, 50 PF or other load. Used for measurement of AC and DC, high frequency, line transients, and smalll differential pulse voltages.

VD150-10-CBD-KL-B,
150KV PK OPERATE

FIBER OPTICS FOR HV ISOLATION FIBER OPTIC TRANSMITTERS & RECEIVERS ANALOG
WIDE BAND FIBER OPTIC TRANSMISSION DC-1MHz

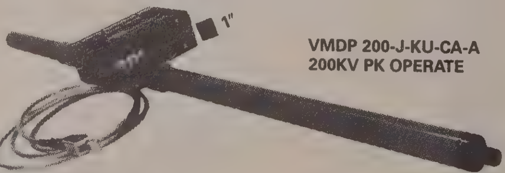
AC or rechargeable battery/AC operated. DC to 1MHz System has a maximum output of 10V PK (20V PK to PK) and maximum input of .1V to 1,000V PK direct from signal source. Useful from 0.01V and to over 900KV when used with Ross HV wide band dividers. Single or multiple ranges.

High Accuracy Analog Systems

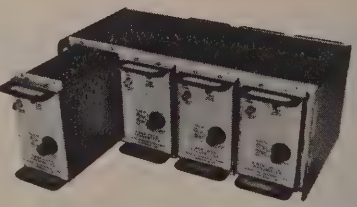


HV DIGITAL PROBES

HV DC, AC, & Wideband DC-1HMz Safety Probes for any scope or digital display or VTVM. Also available complete with large 4½-digit display 0.1% to 5% AC/DC accuracy, safety handle digital voltmeter. Battery/AC with charger. Removable Digital Display or Multimeter. 0.0001 volt to 200KV.



VMDP 200-J-KU-CA-A
200KV PK OPERATE



4 CHANNEL FIBER OPTIC SYSTEM ALSO AVAILABLE:

Each channel is independent, self-contained, and removable for separate operation. Powered by 115V/230V 50/60Hz.

*See our additional products in **Volume B,** Fiber Optic Equipment & Accessories – Sect. 2475, Switches – Sect. 5100; and **Volume D,** Instruments, Test & Measuring – Sect. 2900.*

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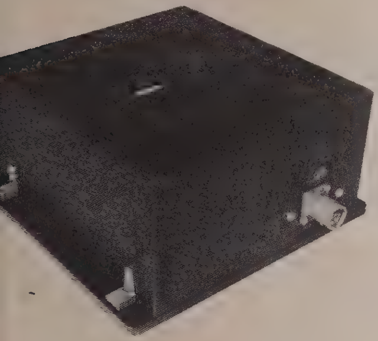
SCIENTIFIC TECHNOLOGIES INCORPORATED

ELECTRIC POWER MONITOR



SPECIFICATIONS

INPUT VOLTAGE: 115 VRMS line to neutral ± 5.8 VRMS, 400 Hz ± 20 Hz, 3 phases plus neutral, phase sequence A-B-C (pins 1, 2, 3 & 8)
NORMAL OUTPUT: 28 VDC ± 2.8V, 4.5 to 5.0 AMP max. (pin 5), voltage regulation and ripple: 10% and 1V peak-to-peak max.
ALARM OUTPUT: 28 VDC nominal, 1.8 to 2.0 AMP max. (pin 7)
RESET SWITCH: Customer will supply a momentary normally open switch to permit normal operation when the switch is activated providing none of the fault conditions exist and the input voltage is applied (switch across pins 6 & 4)
MATERIAL AND FINISH: Housing is aluminum with black anodized finish.
OPERATING TEMP. RANGE: 0°C to +85°C
DIELECTRIC STRENGTH: 1250V, 60 Hz between contacts and case and between isolated circuits
VIBRATION: 5 to 55 CPS with DA of .06 in along any axis.
SHOCK: 20G'S for 11 MS
FAULT CONDITIONS: The monitor will supply the alarm output when any of the following conditions exist:
OVER/UNDER VOLTAGE SENSOR; Voltage is above 126.5 VAC ± 1.5V or below 105.5 VAC ± 1.5V across any one or more of the phases with respect to neutral.
PHASE SENSOR: Improper phase sequence (C-B-A) or if any one phase is open with the remaining phases closed.
FREQUENCY SENSOR: Frequency is above 420 Hz +0 Hz/–5 Hz or below 380 Hz +5 Hz/–0 Hz
VOLTAGE DROP: Any one or more of the phases drop to 95 VAC, the voltage regulation and ripple will be 10% and 1 volt peak-to-peak max. Any one or more of the phases drop to 80 VAC, the voltage regulation and ripple will be 30% and 3 volt peak-to-peak max. Any one phase is open while these conditions exist, the voltage regulation and ripple will be 30% and 6 volt peak-to-peak max.

FLASHERS

FLASHER
PART NO
INPUT VOLTAGE D.C.
FLASHING RATE C.P.M. ±10%
DATE OF MFG.
CUST REF NO.

FEATURES:

- High reliability
- Rugged
- Hermetically sealed
- Compact and lightweight
- Solid state and relay outputs
- Long life

SPECIFICATIONS
SOLID STATE FLASHER
INPUT VOLTAGE: 18 to 32 VDC
POWER CONSUMPTION: 3 Watts (Not Including Lamp Power).
FLASHER OUTPUT: 200 ma, 500 ma, 2 AMP, or 5 AMP Lamp or Relay Load.
OUTPUT POLARITY: Positive or Negative Types.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON:OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 10,000 Hours Min.
SHOCK: 100 G's for 11 Milliseconds
VIBRATION: 10 G's at 10 to 500 CPS.
HERMETICALLY SEALED.
MOUNTING: Stud or Flange.
SOLDER HOOK TEMINALS.
WEIGHT: 4 Ounces Nominal.
VOLTAGE DROP: 1.5 Volts Maximum.

RELAY TYPE FLASHER
INPUT VOLTAGE: 18 to 32 VDC.
POWER CONSUMPTION: 4 watts (not including lamp power).
FLASHER OUTPUT: 500 ma, 2 AMP, 5 AMP, lamp or relay load.
CONTACTS ARE S.P.S.T. normally open.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON: OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 500,000 cycles minimum at rated load.
SHOCK: 15 G's for 11 milliseconds.
VIBRATION: 10 G's at 10 to 500 CPS
UNIT: Hermetically sealed.
MOUNTING: Studs or flange.
SOLDER HOOK TERMINALS.
WEIGHT: 8 ounces nominal.

PHASE SEQUENCE INDICATORS

430-530
VAC
FREQUENCY
54-66
HZ
PART NO

DESCRIPTION

A unique passive element circuit within the housing allows the indicator to illuminate only when the phase sequence of power being monitored is A-B-C. The phase sequence indicator will not illuminate when any one or more of the power inputs are opened or if the phase sequence is C-B-A.

The indicator will provide trouble-free instantaneous indication with no warm-up time required. The units are potted in an aluminum housing with no moving parts. Designed to meet severe environmental requirements of military applications.

SPECIFICATIONS
POWER CONSUMPTION: 2 watts
OPERATING TEMPERATURE: –55 to +125 C
WEIGHT: 2 ounces
MOUNTING: ⅝ inch dia. hole, panel thickness to ¾ inch
LEADS: 18 inches long, teflon insulated
HOUSING MATERIAL: aluminum, black anodized
FREQUENCY AND VOLTAGE: per customer specifications
INDICATOR: lights up when all input leads are energized and phase sequence is A-B-C

SCIENTIFIC TECHNOLOGIES INCORPORATED

PHASE SEQUENCE RELAYS

FEATURES

- Designed for use in severe environmental conditions
- Automatic monitoring of phase sequence
- Solid state sensing circuit
- Hermetically sealed
- Light weight, small size
- Many voltages and frequency combination available

SPECIFICATIONS

Relay picks up when all input terminals are energized and phase sequence is A-B-C. Relay drops out if one or more power leads are grounded, opened or if the phase sequence is C-B-A.

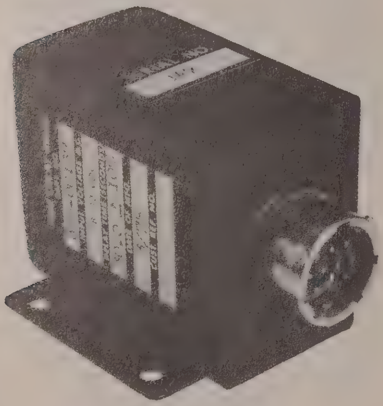
POWER CONSUMPTION: 10 watts maximum.
OPERATING TEMPERATURE: –55 C +71 C
CONTACT RATINGS: (Per MIL-C-5757)

28 VDC	Resistive (Form C)	Inductive
2 AMP	2.0 AMPS	1.0 AMPS
3 AMP	3.0 AMPS	1.0 AMPS
10 AMP	10.0 AMPS	5.0 AMPS

115 VAC	Resistive (Form A&B)	Resistive (Form C)
2 AMP	2.0 AMPS	0.2 AMPS
3 AMP	3.0 AMPS	0.2 AMPS
10 AMP	10.0 AMPS	2.0 AMPS

VIBRATION: 10 G's to 500 Hz.
SHOCK: 30 G's for 11 milliseconds stud mount.
100 G's for 11 milliseconds flange mount.
SEAL: Hermetically sealed.
CONTACT RESISTANCE: .08 ohm maximum.
INSULATION RESISTANCE: 100 megohms minimum between terminals and case, between open contacts.
DIELECTRIC STRENGTH: 1000 Vrms 60 Hz, between terminals and **CASE;** 500 Vrms 60 Hz, between open contacts.
LIFE: 100,000 operations minimum.
WEIGHT: 11 ounces maximum.
Relays per MIL-R-5757.
Environmental testing per MIL-E-5272.
Test methods per MIL-STD-202.
Marking per MIL-STD-130.

TIME DELAY RELAYS



FEATURES

- Solid state sensing circuit
- Transient protected
- 2 amp, 3 amp, and 10 amp relay contacts, dpdt.
- Hermetically sealed.
- Light weight (3.5 to 9 oz).
- Choice of 3 operating modes.
- Designed for use in severe environmental conditions.

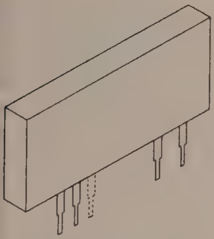
SPECIFICATIONS

INPUT VOLTAGE: 18 to 32 vdc
POWER REQUIREMENTS AT 28 VDC: 5 watts max, 2 amp relays
6.5 watts max, 10 amp relays
TEMPERATURE RANGE: –65 F to +185 F
VIBRATION: 20 G's, 10 to 2000 Hz
SHOCK: 100 G's for 11 milliseconds
CONTACTS: DPDT
LIFE: 100,000 cycles minimum at rated load
DROP-OUT TIME: 10 milliseconds max.
DROP-OUT VOLTAGE: 1 volt min.
PULL-IN VOLTAGE: 18 volts max.
INSULATION RESISTANCE: 100 megohms min.
DIELECTRIC STRENGTH: 500 volts 60 Hz case to terminals and across open contacts
CONTACT RATING:
2 amp & 3 amp unit: 2 amp & 3 amp resistive at 32 vdc
1 amp inductive at 32 vdc
10 amp unit: 10 amp resistive at 28 vdc or 115 vac
5 amp inductive at 28 vdc or 115 vac
CONTACT RESISTANCE: 0.050 ohms at rated current
RESET-TIME: 0.050 sec. max.
TRANSIENT PROTECTION: Will not be damaged by transients per Mil-Std-704
INTERNAL RELAYS: Per MIL-R-5757

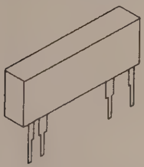
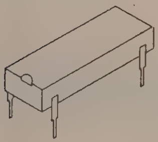
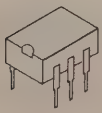
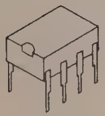
CONTROL COMPONENTS DIVISION 31069 Genstar Road, Hayward, CA 94544 USA
Phone 510/471-9717 FAX: 510/471-9752

Solid State Optronics, Inc.

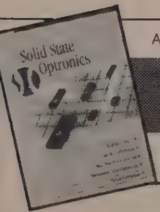
THE MOST EFFICIENT SOLID STATE RELAYS ON THE MARKET

CASE TYPE	PRODUCT	FUNCTION	MODEL NO.	FORM*	CURRENT	VOLTAGE
	Input/Output Modules rated for 3 AMP	AC Input Module	SSIA3		300 mA	90-140 V
			SDIA3	2A		90 - 200 V
		DC Input Module	SSID3		300 mA	90-140 V
			SDID3	2A		90 - 200 V
		AC Output Module	SSOA3	A	3.0 A	400 V
			SDOA3	2A	3.0 A	400 V
		DC Output Module	SSOD3	A	3.0 A	60 V
			SDOD3	2A	3.0 A	60 V

Dimensions of above are 1.25" x .56" x .14". Products rated at 3.0 A require NO HEAT SINK

CASE TYPE	PRODUCT	FUNCTION	MODEL NO.	FORM*	CURRENT	VOLTAGE
	Input/Output Modules rated for 1 AMP (SIP package)	Single-Pole Relay AC Outlet	SP646	A	1.3 A	400 V
			SP746	A	1.3 A	600 V
			SP647	A	1.6 A	400 V
			SP747	A	1.6 A	600 V
		DC Output	SP540	A	1.0 A	60 V
	Input/Output Modules rated for 1 AMP (DIP package)	AC Output	S642	A	1.0 A	400 V
			S742	A	1.0 A	600 V
		AC Input	SIA1		10 mA	90-140 V
		DC Input	SID1		200 mA	60 V
		AC Output	SOA1	A	1.0 A	400 V
		DC Output	SOD1	A	1.0 A	60 V
	AC/DC Telecom-munications	Single-Pole Relay AC/DC Output	AD6-C111	A	120 mA	400 V
			AD6-C211	A	300 mA	400 V
			AD6-C112	B	120 mA	250 V
			AD6-C250	A	25 mA	350 V
		AC Output	S106	A	0.8 A	400 V
			S107	A	0.8 A	600 V
	AC/DC Telecom-munications	AC/DC Output Single-Pole Relay	AD8-C111	A	120 mA	400 V
			AD8-C211	A	300 mA	400 V
			AD8-C112	B	120 mA	250 V
			AD8-C250	A	25 mA	350 V
		Double-Pole Relay	AD4-C111	2A	300 mA	400 V
			AD4-C211	2A	300 mA	400 V
			AD4-C112	2B	120 mA	250 V
			AD4-C113	C	120 mA	400 V
		DC Output, Single-Pole	DD8-H111	A	120 mA	900 V
		AC Output Single-Pole Relay	S110	A	0.8 A	400 V
			S111	A	0.8 A	600 V

A = 1 normally open contact • B = 1 normally closed contact • C = 1 normally open & 1 normally closed contact • 2A = 2 normally open contacts • 2B = 2 normally closed contacts



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Solid State Optronics, Inc.

AC Output Interface Module

3 A/400 V

THE MOST EFFICIENT SOLID STATE RELAYS ON THE MARKET

Model SSOA3

Standard Features

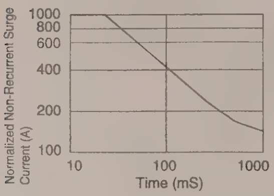
- Inverse parallel SCR output
- High transient immunity
- High input to output isolation voltage
- Very low turn-on current
- Very low leakage current
- High blocking voltage
- Rated for 3 A steady state
- SIP package, fits into a standard 16-pin IC socket
- No heat sink required

Applications

- Interface between computer and AC loads
- Switching lamps and small motors
- Driving small pumps
- Medical electronics

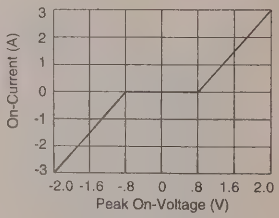
Absolute Maximum Ratings

Storage Temperature: -55°C to 125°C
Operating Temperature: -40°C to 100°C
Continuous Input Current: 4 mA
Transient Input Current: 400 mA
Reverse Input Control Voltage: 7 V
Output Voltage: ±400 V
Output Power Dissipation: 3.5 W

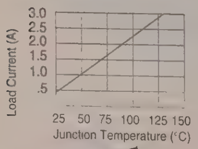


Maximum Allowable Non-recurrent Peak Surge Current Rated at Load Conditions

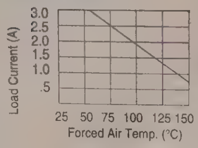
Maximum Peak Voltage Vs. On Current



Load Current Vs. Junction Temperature



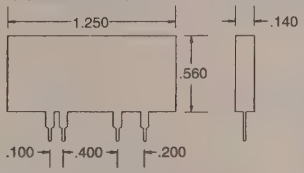
Maximum Current Derating Curve



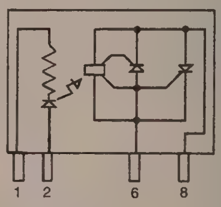
Description

The SSOA3 solid state relay is a highly advanced relay designed to eliminate false triggering upon applying AC voltage to the output. The input is composed of an LED driving a photo sensitive IC chip that controls the firing of two back-to-back SCRs connected to the output. The circuit is designed to work well with either inductive or resistive loads without the need for a snubber network. The relay is ideally suited for applications where high density packaging is desired.

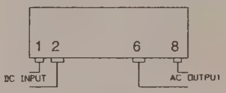
Outline Dimensions IN INCHES



Schematic Diagram



Connection Diagram



Electrical Characteristics (25°C Air)

INPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
LED Forward Voltage *	V		1.2	1.5	I_f = 10 mA
LED Reverse Voltage	V	6			I_r = 10 μA
Turn-On Current	mA		2.5	5.0	
Turn-Off Current	mA	0.5			

* Initial engineering runs may not have a resistor inside the package. The user needs to add the indicated value externally.

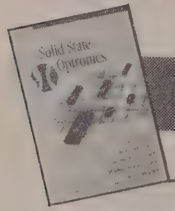
OUTPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Operating Voltage Range	V_{rms}	5		280	
Minimum Off-State dv/dt	V/μS	600			Berkeley noise generator
Maximum Load Current	A			3.0	Free Standing Air
**Max. Surge Current (one cycle)	A			30	
Maximum Over Current	A			10	1 second non-repetitive
Operating Temp. Range	°C	-20		85	
Thermal Impedance Juncture to Case	°C/A		5.6		
Max. On-State Voltage Drop	V			1.8	Load = 3 A RMS
Maximum Zero Volt Turn-On	V			4.0	Input Current = 10 mA
Max. Peak Repetitive Turn-On	V			1.5	Input Current = 10 mA
Max. Off-State Leakage Current	mA			0.1	Rated output voltage

** For higher surge capability, consult factory.

COUPLED SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Isolation Voltage	V_P	4000			T = 1 minute
Isolation Resistance	Ω	10^{11}			
Isolation Capacitance	pF			2.0	



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Solid State Optronics, Inc.

AC Input Module

90-140 V AC

THE MOST EFFICIENT SOLID STATE RELAYS ON THE MARKET

Model SIA1

Standard Features

- Exceeds VDE spacing and voltage requirements
- All solid state construction
- Auto insertable 16-lead DIP package outline
- Optically isolated
- Output rated to switch 200 mA
- High immunity to false triggering
- Open DMOS transistor output
- Surface mount option (SIA1-S)

Applications

- Robotics
- Process control
- Programmable controllers
- Energy management
- Automatic test equipment
- Medical electronics
- Reed relay replacement

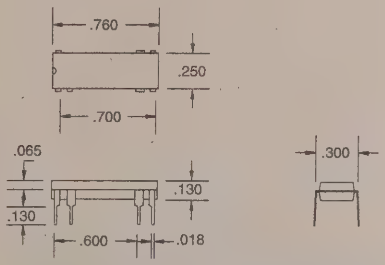
Absolute Maximum Ratings

Storage Temperature: -55°C to 125°C
Operating Temperature: -40°C to 85°C
Continuous Input Current: 40 mA
Transient Input Current: 400 mA
Reverse Input Control Voltage: 6 V
Output Voltage: 60 V
Output Power Dissipation: 1.2 W

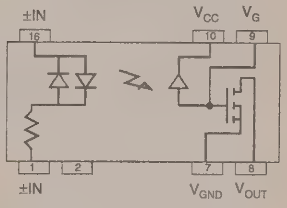
Description

The SIA1 circuit is a highly advanced optically coupled input/output module. It is designed to monitor the status of AC/DC loads and provide medium power switching capability. It is supplied in an epoxy molded package that fits into a standard 16-pin IC socket. The input circuit is composed of two back-to-back light emitting diodes connected in series with a limiting resistor. The output is an open MOS transistor controlled by photo sensitive circuitry.

Outline Dimensions IN INCHES



Schematic Diagram



Electrical Characteristics (25°C Air)

INPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Series Limiting Resistor *	kΩ		30	100	
Input Voltage	V_{ac}			160	
Turn-On Current	mA		0.2	1.0	
Turn-Off Current	mA	0.01			

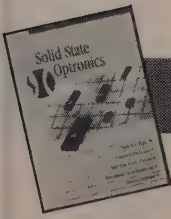
* Note: a limiting resistor in the value indicated is to be connected in series with the input.

OUTPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Operating Voltage Range	V_{dc}			60	
On Resistance	Ω			6	I_f = 1 mA
Minimum Off-State dv/dt	V/µS	600			Berkeley Noise Generator
Maximum Load Current	mA			200	Free Standing Air
Max. Surge Current (one cycle)	A			3	

COUPLED SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Isolation Voltage	V_p	4000			T = 1 minute
Isolation Resistance	Ω	10^{11}			
Coupled Capacitance	pF			2.0	



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Solid State Optronics, Inc.

Form "A", AC Output Solid State Relay

1 A / 400 V (S642)
600 V (S742)

THE MOST EFFICIENT SOLID STATE RELAYS ON THE MARKET

Models S642/S742

Standard Features

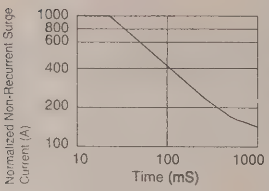
- Inverse parallel SCR output
- High transient immunity
- True zero volt turn-on
- Input-to-output isolation meets or exceeds VDE requirements
- Very low leakage current
- Blocking voltage of 400 V or 600 V peak
- Standard 16-pin DIP package
- U.L. listed
- Internal 300 Ω resistor option (S642-1)
- Surface mount option (S642-5)

Applications

- Interface between microprocessors and logic circuits
- Drive small lamps / solenoids
- Medical electronic equipment
- Communication equipment

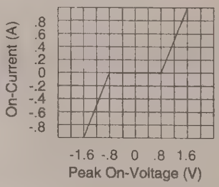
Absolute Maximum Ratings

Storage Temperature: -55°C to 125°C
Operating Temperature
(see derating curve): -40°C to 100°C
Continuous Input Current: 40 mA
Transient Input Current: 400 mA
Reverse Input Control Voltage: 6 V
Output Voltage: 400 V/ 600 V
Output Power Dissipation: 1.2 W

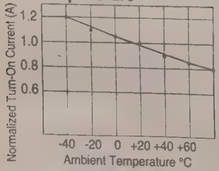


Maximum Allowable Non-recurrent Peak Surge Current Rated at Load Conditions

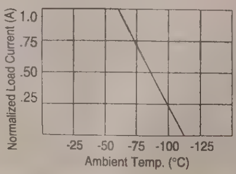
Maximum Peak Voltage Vs. On Current



Turn-On Current vs. Temperature



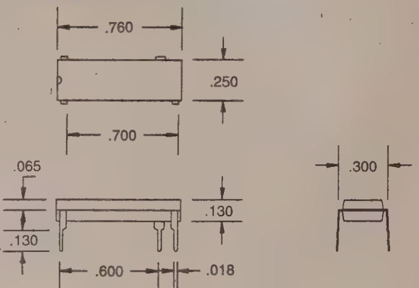
Maximum Load Current vs. Ambient Temperature



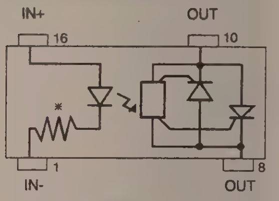
Description

The S642/S742 are multipurpose, bi-directional, single-pole, single-throw, normally open relays. The circuit is composed of one LED on the input side which activates an optically coupled IC circuit on the output side — controlling the firing angle of two pairs of back-to-back SCRs. This circuit assures no false triggering under most adverse conditions, and a tight zero volt window not exceeding 5 V peak.

Outline Dimensions IN INCHES



Schematic Diagram



* Resistor is Optional

Electrical Characteristics (25°C Air)

INPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Forward Voltage V_f	V		1.2	1.5	I_f = 10 mA
Reverse Voltage V_r	V	6.0	12		I_r = 10 μA
Reverse Current I_r	μA			10	
Input Impedance *	Ω		300		
Junction Capacitance Cji	pF		50		V = 0
Must Operate Current	mA		2	5	Full load, resistive
Must Operate Voltage	V			4.5	

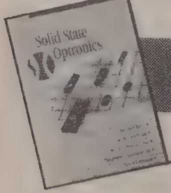
OUTPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Forward & Reverse S642 *	V_p	400			
Blocking Voltage S742 *		600			
Current Rating	A			1	Up to 60°C
Surge Current Rating	A	10			See Fig. 3
dv/dt Rating without a Snubber Network	V/μS	400			Berkeley noise generator, Model3020
Voltage Across Load at Turn-On	V_{peak}			5.0	I_f = 10 mA
On Voltage (V_{tm})	V			1.2	I_{load} = 1 A
Holding Current	mA			1.0	
Forward & Reverse Leakage Current I_{fx}, I_{rx}	μA		100		V_p = 200 V

* S642, S742 are both available with an optional 300 ohm resistor. Add -1 to part number (eg..S642-1).

COUPLED SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Isolation Voltage	V_{rms}	3750			T = 1 minute
Isolation Resistance	Ω	10^{11}			
Isolation Capacitance	pF		3.0		



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Solid State Optronics, Inc.

1 Form "C", AC/DC Solid State Relay

400 V / 8, 20 Ω

THE MOST EFFICIENT SOLID STATE RELAYS ON THE MARKET

Model AD4-C113

Standard Features

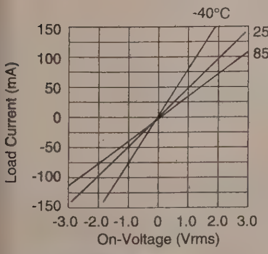
- Single pole, double throw bi-directional solid state switch
- "Break before make" contacts
- High input to output isolation
- High off-contact impedance
- Very low contact offset voltage: < 0.5 μV
- Load current rated at 300 mA
- Inrush current capability rated at up to 5 A
- High transient immunity: >2000 V/μS
- Very low control current
- 8 Ω maximum on-resistance on normally open, 20Ω on normally closed relay
- Auto insertable 8-pin DIP package outline
- Surface mount option (AD4-C113-S)

Applications

- Telecom tip/ring control circuits
- Robotics
- Process control
- Programmable controllers
- Energy management
- Automatic test equipment
- Medical electronics
- Reed relay replacement
- Highly inductive loads

Absolute Maximum Ratings

Storage Temperature: -55°C to 125°C
Operating Temperature: -40°C to 85°C
Continuous Input Current: 40 mA
Transient Input Current: 400 mA
Reverse Input Control Voltage: 6 V
Output Voltage: ±400 V
Output Power Dissipation: 400 m W

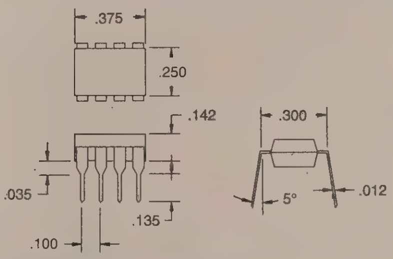


On-State I-V Characteristics

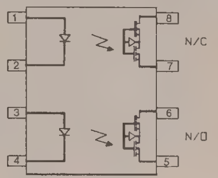
Description

The AD4-C113 is composed of two totally isolated relays: one normally open and one normally closed. Each relay has bi-directional, single-pole, single-throw contacts. Totally independent of its counterpart, each relay consists of an LED driver that activates an integrated circuit that drives a pair of DMOS transistors. These transistors are protected with free wheeling diodes that can handle up to 1.5 A inrush current, making the relay ideal for switching lamps and highly inductive loads.

Outline Dimensions IN INCHES



Schematic Diagram



Electrical Characteristics (25°C Air)

INPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
LED Forward Voltage	V		1.2	1.5	$I_f = 10.0$ mA
LED Reverse Voltage	V	6.0	12.0		$I_r = 10.0$ μA
Turn-On Current	mA		2.5	5.0	
Turn-Off Current	mA		0.5		

OUTPUT SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Blocking Voltage	Vp	400			$I_O = 10.0$ μA
Load Current	mA			100	$I_{in} = 5.0$ mA
On-Resistance Form "A" Form "B"	Ω Ω			8.0 25.0	$I_l = 100$ mA $I_l = 100$ mA
Leakage Current	μA			10.0	V_O = Maximum rated
Output Capacitance	pF			20.0	$V_O = 25$ V, f = 1.0 mHz
Offset Voltage	μV			0.2	$I_{in} = 5.0$ mA

COUPLED SPECIFICATIONS

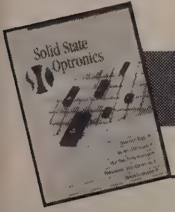
PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Isolation Voltage	Vp	3750			T = 1 minute
Isolation Resistance	Ω	10^{11}			
Coupled Capacitance	pF		3.0		

FREE WHEELING DIODE SPECIFICATIONS

PARAMETER	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Continuous Diode Current	A			0.6	$T_c = 25$°C
Pulsed Diode Current	A			2.4	$T_c = 25$°C

SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	UNIT	MIN.	TYP.	MAX.	TEST CONDITIONS
Turn-On Time	Tòn	mS		7.0 7.0	15.0 15.0	$I_f = 5.0$ mA, $V_O = 25$ V $I_f = 10.0$ mA, $V_O = 25$ V $I_l = 100$ mA
Turn-off Time	Toff	mS		7.0 7.0	15.0 15.0	$I_f = 5.0$ mA, $V_O = 25$ V $I_f = 10.0$ mA, $V_O = 25$ V $I_l = 100$ mA
Contact Transient Rejection	dv/dt	V/μS	 2000	> 7000 		dV = 500 V dV = 50 V



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STANCOR/RBM

AC Relays

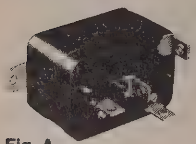


Fig. A
Type 84

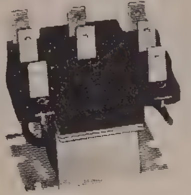


Fig. B. Type 91

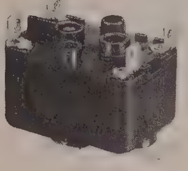


Fig. C. Type 184

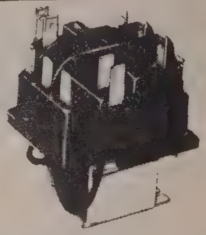


Fig. D. Type 192

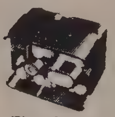


Fig. E
Type 129

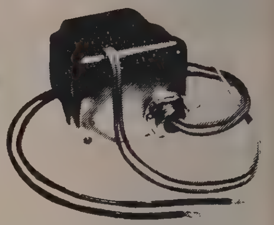


Fig. F. Type 129AR Add-A-Relay

AC GENERAL PURPOSE RELAYS

Operate in any position. Coils are for 60 Hz operation. Ratings listed are continuous unless noted otherwise. **Breakdown Voltage:** 1500 V rms, 60 Hz, opposite polarity or to ground: 1000 V rms, 60 Hz, open contacts same polarity. **Electrical Life:** 100,000 operations at rated load.

Fig. A. Type 84—Totally enclosed type with silver alloy contacts rated at 125-250 VAC. Models 84-922-928 rated 3 amps at 125 VAC or 1.5 amps at 250 VAC pilot duty. All others: SPNO—16 amps, resistive; 8 amps (25 amps inrush) inductive. SPDT—8 amps resistive; 8 amps (18 amps inrush) inductive. Models 84-901-908 have screw terminals; models 84-912-928 have $\frac{1}{4}$" tab terminals. **Size:** 2$\frac{3}{8}$" × 1$\frac{5}{8}$" × 1$\frac{1}{2}$" overall. Mounting hardware included in boxed quantity only.

Part No.	Contacts	Coil V (50 60 Hz)
84-901	SPNO	6
84-902	SPNO	24
84-903	SPNO	120
84-906	SPDT	24
84-907	SPDT	120
84-908	SPDT	208/240
84-912	SPNO	24
84-913	SPNO	120
84-914	SPNO	208/240
84-917	SPDT	120
84-918	SPDT	208/240
84-922	SPNO	24
84-926	SPDT	24
84-927	SPDT	120
84-928	SPDT	208/240

Fig. B. Type 91—Solenoid action type with quick-connect terminals; operates in any position. DPDT contact arrangement. **Power Rating (A):** Enclosed fine silver contacts rated 15 amps, 277 VAC. max., resistive: 12 amps (60 amps inrush), 125 VAC or 6 amps (35 amps inrush), 250 VAC, inductive. **Pilot Rating (B):** Gold alloy crossbar contacts rated 3 amps, 277 VAC. max., resistive; 125 VA, 1/10 hp, 125/250 VAC, inductive.
Size: 2$\frac{1}{8}$" × 1$\frac{7}{8}$" × 2$\frac{3}{8}$". Quick-connect wiring terminals included in boxed quantity only.

Part No.	Coil V‡	Circuit Rating	
		#1*	#2†
91-901	24	A	A
91-902	120	A	A
91-903	240§	A	A
91-905	120	A	B
91-906	240§	A	B

*Three terminals at the mounting hole side. † Three terminals at the coil terminal side. ‡50/60 Hz, §208/240 volts. #A, power rating; B, pilot rating.

Fig. C. Type 184—Totally enclosed type with mounting bracket; operates in any position. Models 184-902–918 rated 18 amps resistive at 277 VAC; 12 amps (60 amps inrush) inductive at 125 VAC; 8 amps (48 amps inrush) inductive at 250 VAC; 7 amps (42 amps inrush) inductive at 277 VAC. Models 184-922–928 rated 3 amps at 277 VAC; 125 VA at 125 VAC; 277 VA at 277 VAC. Models 184-902–907 have screw terminals; others have $\frac{1}{4}$" quick-connect terminals. **Size:** 2$\frac{3}{8}$" × 1$\frac{17}{64}$" × 1$\frac{1}{2}$".

Part No.	Contacts	Coil V (50 60 Hz)
184-902	SPNO	24
184-903	SPNO	120
184-907	SPDT	120
184-912	SPNO	24
184-914	SPNO	208/240
184-916	SPDT	24
184-922	SPNO	24

Fig. D. Type 192—Solenoid action type with quick-connect terminals; operates in any position. 3PDT contact arrangement. Power Rating (A): Fine silver enclosed contacts rated 15 amps, 277 VAC max., resistive; 12 amps (60 amps inrush), 125 VAC or 6 amps (35 amps inrush) 250 VAC, inductive. Size: 2 $\frac{3}{8}$"x 2$\frac{3}{9}$" x 2$\frac{3}{4}$". Quick-connect wiring terminals included in boxed quantity only.

Part No.	Coil V†	Circuit Rating		
		#1	#2	#3
192-902	120	A	A	A
192-903	240*	A	A	A

*208/240 volts. †50/60 Hz. #A power rating.

AC POWER RELAYS

Fig. E. Type 129—Totally enclosed; silver alloy contacts rated 18 amps resistive or 18 amps inductive at 250 VAC max., 1 hp at 125 V or 2 hp at 250 V. **Size:** 2$\frac{3}{8}$" × 1$\frac{7}{8}$" × 1$\frac{7}{8}$" overall.

Part No.	Contacts	V Coil V‡
129-902	SPNO	24
129-903	SPNO	120
129-904	SPNO	208
129-906†	SPDT	24
129-907†	SPDT	120
129-911§	SPNO	24
129-912§	SPNO	120

*208/230 volts. †All contact terminals must be wired to same polarity. ‡50/60 Hz. § Quick-connect. $\frac{1}{4}$" tab terminals.

Fig. F. Type 129AR Add-A-Relay—Same as Type 129 except has aluminum diecast base and bushing; rated 1 hp at 120 V. 1$\frac{1}{2}$ hp at 250 V. High impact phenolic enclosure; 8" color-coded leads. **Size:** 2$\frac{3}{4}$" × 2$\frac{9}{16}$" × 3$\frac{1}{16}$". Mounts in $\frac{1}{2}$" dia. knock-out. Mounting hardware supplied. Meets standard code requirements. UL white card Listed.

Part No.	Contacts	V Coil V‡
129AR-901	SPNO	24
129AR-902	SPNO	120
129AR-905†	SPDT	120

†All contact terminals must be wired to same polarity. ‡50/60 Hz.

TYPE 91 QUICK CONNECT SOCKET AND TERMINAL KIT

Polarized to prevent improper assembly.
Part No. 91-180-1—

DC GENERAL PURPOSE RELAYS

Same as Types 84 and 91 AC General Purpose Relays except for DC operation. See illustrations and specifications under AC General Purpose Relays.

Part No.	Coil VDC	Coil Resis. Ohms†	Contact Rating		Contacts
			VDC	Amps	
84D-902	12	90.0	12	3	SPDT
84D-903	24	208.0	24	1.5	SPDT
91D-912	12	23.0	32	10	2PDT
91D-913	24	102.0	32	10	2PDT

*Inductive. †At 25°C. ‡Resistive rating.

STANCOR®/RBM

AC Relays

Fig. B

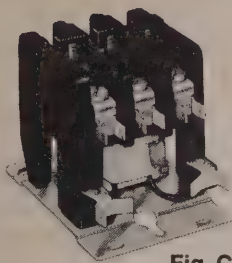


Fig. C

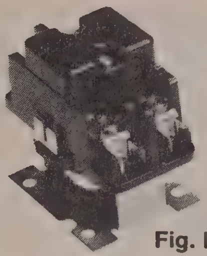


Fig. D

AC POWER CONTRACTORS

Fig. B. Type 75—2PNO: screw power terminals, #8 solid wire max. Quick connect or 13″ lead coil termination. Protective contact cover. Hardware included.
Size: 2½″ × 2⅛″ × 2¼″ overall.

Fig. C. Type 154—3PNO (40 amps type also with(2PNO). 20 and 25 amps, screw connectors line and load side for #14 through #8 wire; ¼″ double quick connect auxiliary and coil terminals. 30 and 40 amps, pressure connectors on line side for #14 through #4 wire: screw connectors on load side (pressure connectors for 40 amps): ¼″ double quick connect auxiliary and coil terminals. Non-positional type 154 power contractors come with interchangeable mounting: low coil wattage and non-corroding structure. Type 154 has low temperature rise: riveted terminal assemblies. Hardware included in boxed quantity only. **Size:** 3¾″ × 3⅛″ (3¼″ for 40 amps) × 2¾″ overall.

Fig. D Type 122—2PNO Straight-Thru Wiring, Low Cost ¼" Auxiliary Quick-Connect Terminals Screw Power Terminals. For #10 Solid Wire Max.Double-Make Contacts Small Size. Wt. 10.5 oz (Approx).

AC Power Contractors

Contact amp ratings listed are continuous unless noted otherwise.

Type	Contact Rating (AC), Inductive
75	1 hp/pole, 115/230 V; 2 pole, 2 hp, 230 V or 18 amps cont. (90 amps inrush): 25 amps, 240 V, pole resistive.

Part No.	Contacts	Coil Volts
75-902 **75-903** **75-905** **75-906**	2PNO 2PNO 2PNO 2PNO	115/120 208/240 115/120 208/240
154	Type 154-902 to 154-903, 20 amps (80 amps inrush), 600V; 120 amps inrush, 277V; 100 amps inrush, 480 V; 30 amps, 600 VAC resistive. Type 154-904 to 154-905, 25 amps (100 amps inrush), 600 V; 150 amps inrush, 277 V; 125 amps inrush, 480 V; 35 amps. 600 VAC resistive. Type 154-907 to 154-908, 30 amps (120 amps inrush), 600V; 180 amps inrush, 277 V; 150 amps inrush 480 V; 40 amps, 600 VAC resistive. Type 154-910 to 154-915, 40 amps (160 amps inrush), 600 V; 240 amps, inrush, 277 V; 200 amps inrush, 480 V; 50 amps, 600 VAC resistive.	

* Quick-connect tab terminals:

TWO POLE NORMALLY OPEN

Call Volage (50/60 Hz	Catalog Number	Contact Rating	
		Inductive	Resistive
24	122-901	30 Amp. Cont. 150 Amp. Inrush @ 277 V.A.C. Per Pole	40 Amp. @ 600 V.A.C.
120	122-902		
208/240	122-903		
24	122-905	40 Amp. Inrush @ 277 V.A.C. Per Pole With Cover	40 Amp. @ 600 V.A.C.
120	122-906		
208-240	122-907		

U.L. File No. E12139 CSA File No. LR13360

STANCOR®/RBM

Relays

Heavy Duty Power Contactors
D.C. Power Contactors
Type 124

Terminal Hardware Supplied

Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 4 Terminal Isolated Coil
12 V	13.2	124-902
24 V	53	124-903
36 V	120	124-904

Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 3 Terminal Grounded Coil
12 V	13.2	124-906
24 V	53	124-907

N.O. Contact Rating

Voltage DC	D.C. Inductive Load Continuous	Inrush
12 V	100 Amps.	400 Amps.
24 V	100 Amps.	400 Amps.
36 V	100 Amps.	400 Amps.

Coil Voltage D.C.	Coil Resistance +8% 25°	SPDT 6 Terminal Isolated Coil
12 V	13.2	124-910
24 V	53	124-911
36 V	120	124-912

- Max. Pick Up 75% rated coil voltage.
- Design Ambient—40°C to 65°C
- Maximum Continuous coil watts. 12 @ rated voltage.
- Recommended Mounting Position: Unit in vertical plane with coil terminals up. Horizontal plane is acceptable.
- Design meets U.L. 583 Industrial Truck Standard. Dust and splash proof cover.
- Application: Controlling D.C. starting motors on gasoline engine driven auxiliaries. Battery charging power circuits, motor reversing circuits as found in winch applications.
- The 124 is also applicable where ruggedness and high current capacity is required for D.C. mobile equipment such as: in-plant lifts, industrial equipment, recreational vehicle—golf carts, camp trailers, motor homes.
- Contact Termination: 5/16" -24 UNF-2A stud.
- Coil Termination: #10-32 UNF-2A tread.

TYPE 586

Sealed Solenoid is Dust and Splash Proof

Continuous Duty Coil Silver Contacts

Pole Form: SPNO, SPDT

Incorporates double-make or double-break contacts

Type 568 coil is rated approximately 12 watts continuous duty.
Contact rating 200 Amps. continuous. 600 Amp in rush N.O. contacts.

SINGLE POLE NORMALLY OPEN 4 TERMINALS
SINGLE POLE DOUBLE THROW 6 TERMINALS

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C SPNO	Cat. No. S.P.N.O.	Cat. No. S.P.D.T.	Resistance in Ohms @ 25°C SPDT
6	3.3	586-901	589-910	5.25
12	13.2	586-902	586-911	21.0
15	21.0	586-903	586-912	37.8
24	53	586-905	586-914	84.0
36	120	586-906	586-915	189.0
48	218	586-907	586-916	336.0

Type 586 Sealed Contactors are designed for controlling DC starting-motors on gasoline engine driven auxilaries, battery-charging power circuits, low-voltage DC motor generator sets, golf carts, reversing circuits in winch applications, industrial lift trucks, to mention a few.

Type 70

CONTACT RATING
D.C. INDUCTIVE LOAD—36 V. MAX.

	Normally Open		Normally Closed	
Voltage	Continuous	Inrush	Continuous	Inrush
6	80 Amp.	300 Amp.	60 Amp.	100 Amp.
12	80 Amp.	150 Amp.	60 Amp.	60 Amp.
24-36	50 Amp.	50 Amp.	30 Amp.	30 Amp.

- Non-turning studs
- Drawn steel dust proof enclosure
- Copper stud power & coil terminals
- Double break rotating disc movable contact
- Solenoid actuated
- Suggested mounting—cap down

SINGLE POLE NORMALLY OPEN 4 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-901	Copper
12	16	70-902	
24	60	70-903	
36	114	70-904	
12	16	70-906	Silver
24	60	70-907	
36	114	70-908	

SINGLE POLE NORMALLY OPEN 3 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-913	Copper Coil Grounded to Case
12	16	70-914	
24	60	70-915	
6	4	70-917	Copper Coil Grounded to Load
12	16	70-918	

SINGLE POLE DOUBLE THROW 6 TERMINAL

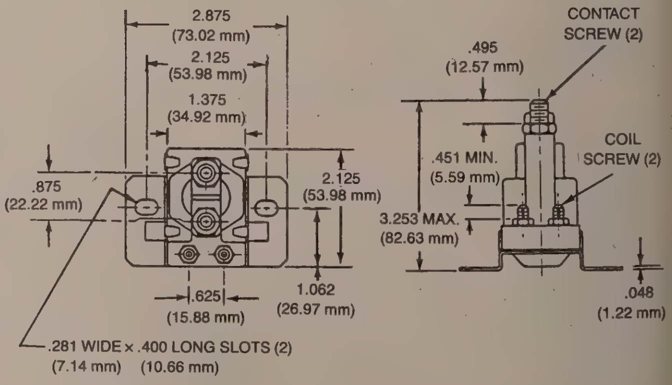
Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
12	16	70-910	N.O. and N.C. Silver
24	60	70-911	
36	114	70-912	
12	16	70-922	N.O. Copper and N.C. Silver
24	60	70-923	

HEAVY DUTY D.C. POWER CONTACTOR TYPE 120 SOLENOID

SINGLE POLE NORMALLY OPEN

Catalog Number Continuous Duty Standard Bracket	L Bracket	Coil Volts DC	Coil Resistance Continuous Duty
120-901	120-907	12	16.0
120-902	120-908	15	20.8
120-903	120-909	18	37.0
120-904	120-910	24	64.0
120-905	120-911	36	100.0
Intermittent Duty **Standard Bracket**	**L Bracket**	**Coil Volts DC**	**Intermittent Duty**
120-906	120-912	12	6.0

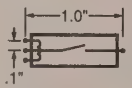
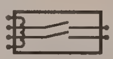
Rating	Full Load	Inrush	Elec. Life	Contact Material
Continuous	100A	400A	25,000	Silver Alloy
Intermittent	80A	400A	10,000	Copper



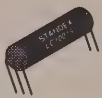
STANDEX REED RELAYS

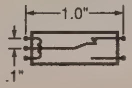
- ❑ Widest range of pin-outs, contact configurations and contact ratings
- ❑ Versions to meet US, CSA, FCC and European Standards – up to 5000 VDC contact to coil breakdown voltages
- ❑ Standex relays use our own reed switches with contact ratings for dry circuit and power switching applications
- ❑ Competitive pricing & delivery from stock
- ❑ Most recognized under Component Program of Underwriters Laboratories

Series LG Form A

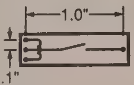
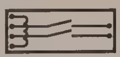
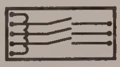
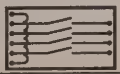
P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form	
LG100-1-5	5	500	3.5	0.5	1A	
LG100-1-6	6	125	4.0	0.5		
LG100-1-12	12	500	8.0	1.0		
LG100-1-24	24	2000	16.0	2.0		
LG100-2-5	5	500	3.5	0.5	2A	
LG100-2-6	6	125	4.0	0.5		
LG100-2-12	12	500	8.0	1.0		
LG100-2-24	24	2000	16.0	2.0		

Series LC Form C

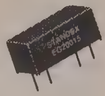


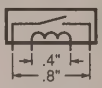
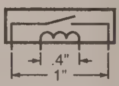
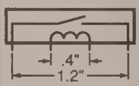
P/N	Coil VDC	Coil Res (ohms)	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form	
LC100-1-5	5	500	3.5	0.5	1C	
LC100-1-6	6	125	4.0	0.5		
LC100-1-12	12	500	9.0	1.0		
LC100-1-24	24	2000	18.0	2.0		

Series JG Form A

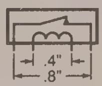
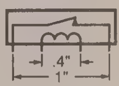
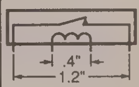
P/N	Coil VDC	Coil Res (ohms)	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form	
JG100-1-5	5	500	3.5	0.5	1A	
JG100-1-6	6	125	4.0	0.5		
JG100-1-12	12	500	9.0	1.0		
JG100-1-24	24	2000	18.0	2.0		
JG100-2-5	5	250	3.5	0.5	2A	
JG100-2-6	6	110	4.0	0.5		
JG100-2-12	12	440	9.0	1.0		
JG100-2-24	24	1760	18.0	2.0		
JG100-3-6	6	85	4.0	0.5	3A	
JG100-3-12	12	340	9.0	1.0		
JG100-3-24	24	1360	18.0	2.0		
JG100-4-6	6	62	4.0	0.5	4A	
JG100-4-12	12	250	9.0	1.0		
JG100-4-24	24	1000	18.0	2.0		

Series EG Form A

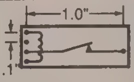
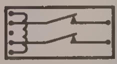


P/N	Coil VDC	Coil Res (ohms)	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form	
EG200-1-5	5	500	3.5	0.5	1A	
EG200-1-6	6	125	4.0	0.5		
EG200-1-12	12	500	9.0	1.0		
EG200-1-24	24	2000	18.0	2.0		
EG300-1-5	5	500	3.5	0.5	1A	
EG300-1-6	6	125	4.0	0.5		
EG300-1-12	12	500	9.0	1.0		
EG300-1-24	24	2000	18.0	2.0		
EG400-1-5	5	500	3.5	0.5	1A	
EG400-1-6	6	125	4.0	0.5		
EG400-1-12	12	500	9.0	1.0		
EG400-1	24	2000	18.0	2.0		

Series EB Form B

P/N	Coil VDC	Coil Res (ohms)	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form	
EB200-1-5	5	500	3.8	0.5	1B	
EB200-1-6	6	125	4.0	0.5		
EB200-1-12	12	500	9.0	1.0		
EB200-1-24	24	2000	18.0	2.0		
EB300-1-5	5	500	3.8	0.5	1B	
EB300-1-6	6	125	4.0	0.5		
EB300-1-12	12	500	9.0	1.0		
EB300-1-24	24	2000	18.0	2.0		
EB400-1-5	5	500	3.8	0.5	1B	
EB400-1-6	6	125	4.0	0.5		
EB400-1-12	12	500	9.0	1.0		
EB400-1	24	2000	18.0	2.0		

Series JB Form B

P/N	Coil VDC	Coil Res (ohms)	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form	
JB100-1-5	5	500	3.8	0.5	1B	
JB100-1-6	6	125	4.0	0.5		
JB100-1-12	12	500	9.0	1.0		
JB100-1-24	24	2000	18.0	2.0		
JB100-2-6	6	110	4.0	0.5	2B	
JB100-2-12	12	440	9.0	1.0		
JB100-2-24	24	1760	18.0	2.0		

Standex Electronics

4538 Camberwell Road
Cincinnati, Ohio 45209
Phone (513) 871-3777
FAX (513) 871-3779

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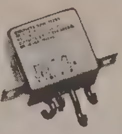
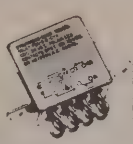
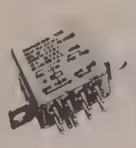
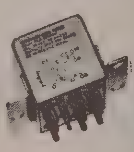
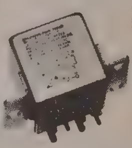
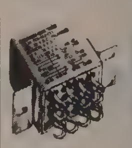
Standex manufactures over 500 standard reed relays for a broad range of applications including security, instrumentation, ATE, appliance, automotive and telecommunications. Standex reed relays use Standex reed switches (see our ad in the switch section). – A broad range of reed switches for demanding applications.

Call or write for complete information and application assistance.

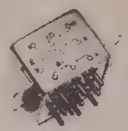
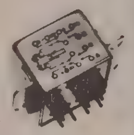
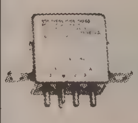
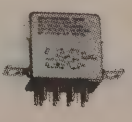
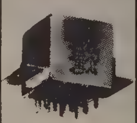
10 Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

MAGNETICALLY POLARIZED, SINGLE SIDE STABLE 10A-25A, S.P.D.T. to 6P.D.T.

	SERIES	FCA-125	FCA-210	FCA-212	FCA-325	FCAC-325	FCA-410	FCA-412	FCA-610
									
	Applicable Mil-Spec	MIL-R-6106 MIL-R-6106/19	MIL-R-6106 MS 27401	—	MIL-R-6106 MS 27743	MIL-R-6106 MIL-R-6106/13	MIL-R-6106 MS 27400	—	MIL-R-6106 MIL-R-6106/8
FEATURES		• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available
ELEC	Contact Rating	25 amps. @ 28 Vdc 115V/400 Hz 1ϕ	10 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	12 amps @ 28 Vdc 115/400 Hz 1ϕ	25 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	Main: 25 amps. Aux: 2 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	12 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ
	Contact Form	S.P.D.T.	D.P.D.T.	D.P.D.T.	3P.D.T.	3P.S.T.-N.O./1P.D.T.	4P.D.T.	4P.D.T.	6P.D.T.
	Rated Coil Voltages	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac
MECH	Dimensions (LxWxH)	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.053″ x 1.483″ x 1.010″ max.
	Weight	1.6 oz. (45.4g) max.	1.6 oz. (45.4g) max.	1.6 oz. (45.4g) max.	2.89 oz. (82g) max.	2.89 oz. (82g) max.	2.72 oz. (77g) max.	2.72 oz. (77g)	4.16 oz. (117.94g) max.
	Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks
ENVIR	Temperature	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C
	Shock	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	50G, 6 ms.
	Vibration	30G, 10 to 3,000 Hz	30G, 33 to 3,000 Hz	30G, 33 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 33 to 3,000 Hz	30G, 33 to 3,000 Hz	20G, 10 to 2,000 Hz

MINIATURE MAGNETICALLY POLARIZED, SINGLE SIDE STABLE 5A-10A, D.P.D.T. TO 4P.D.T.

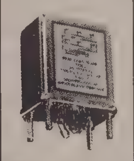
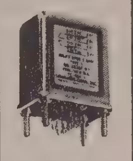
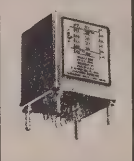
MAGNETICALLY POLARIZED, BI-STABLE LATCHING 10A-25A S.P.D.T. TO 4P.D.T.

	SERIES	FCB-210	FCB-310	FCB-410	FCAL-125	FCAL-210	FCAL-325	FCACL-325	FCAL-410
									
	Applicable Mil-Spec	MIL-R-6106 MIL-R-6106/21 MIL-R-6106/27	MIL-R-6106 MIL-R-6106/24 MIL-R-6106/29	MIL-R-6106 MIL-R-6106/22 MIL-R-6106/28	—	MIL-R-6106 MS 27744 superseded by MIL-R-6106/50	—	—	MIL-R-6106 MS 27745 superseded by MIL-R-6106/51
FEATURES		• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet drive • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available	• Hermetically sealed • All welded construction • Balanced force • Permanent magnet latching • Suppression available
ELEC	Contact Rating	5 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps. @ 28 Vdc 115V 400 Hz 3ϕ	5 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	25 amps. @ 28 Vdc 115/400 Hz 1ϕ	10 amps. @ 28 Vdc 115V/200V 400 Hz 3ϕ	25 amps. @ 28 Vdc 115/200V 400 Hz 3ϕ	Main: 25 amps. Aux: 2 amps. @ 28 Vdc 115/200V 400Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ
	Contact Form	D.P.D.T.	3P.D.T.	4P.D.T.	S.P.D.T.	D.P.D.T.	3P.D.T.	3P.S.T.-N.O./1P.D.T.	4P.D.T.
	Rated Coil Voltages	28 Vdc	28 Vdc	28 Vdc	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac
MECH	Dimensions (HxWxL)	0.810″ x 0.410″ x 0.610″ max.	0.810″ x 0.810″ x 0.640″ max.	0.810″ x 0.810″ x 0.640″ max.	1.025″ x 0.525″ x 1.010″ DC (1.125″ AC)	1.025″ x 0.525″ x 1.010″ (1.125″ AC)	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.
	Weight	.544 oz. (15.4g) max	.99 (28.15g) max.	.93 oz. (26.4g) max.	1.6 oz. (45.4g) max.	1.6 oz. (45.4g) max.	2.87 oz. (82g) max.	2.87 oz. (82g) max.	2.72 oz. (77.2g) max.
	Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket pins Circuit Board Pins Solder Hooks
ENVIR	Temperature	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C
	Shock	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.
	Vibration	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz

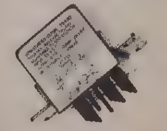
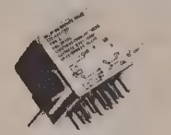
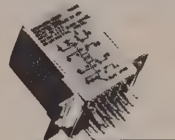
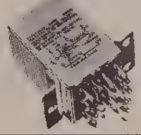
393 **Struthers-Dunn/HI-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500; EASY LINK 62287939; FAX: 609-589-2619**

11 S-D Hi-G Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

GENERAL PURPOSE
2A-25A D.P.D.T. TO 6P.D.T.

	SERIES	FC-4	FC-6	FC-200	FC-400	FC-402	FC-404	FC-406	FC-325
									
	Applicable Mil-Spec	MIL-R-5757/7	MIL-R-5757/1	MIL-R-6106 MS 24149	MIL-R-6106 MIL-R-5757/18	MIL-R-6106	MIL-R-6106 MIL-R-5757/15	MIL-R-6106 MIL-R-5757/16	MIL-R-6106 MS 27418
FEATURES		• Hermetically sealed • Balanced rotary armature • Suppression available	• Hermetically sealed • Balanced rotary armature • Suppression available	• Hermetically sealed • Balanced armature • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Bifurcated contacts • Suppression available	• Hermetically sealed • Balanced armature • Suppression available
ELEC.	**Contact Rating**	Low level to 2 amps @ 28 Vdc	Low level to 2 amps @ 28 Vdc	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115V/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/400 Hz 1ϕ	5 amps @ 28 Vdc 115/400 Hz 1ϕ	5 amps @ 28 Vdc 115/400 Hz 1ϕ	25 amps @ 28 Vdc 115/200V 50 to 60 & 400 Hz 3ϕ
	Contact Form	4P.D.T.	6P.D.T.	D.P.D.T.	4P.D.T	D.P.D.T.	4P.D.T.	6P.D.T.	3P.S.T./N.O.
	Rated Coil Voltages	26.5 Vdc 115 Vac	26.5 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac	28 Vdc 115 Vac
MECH.	**Dimensions (LxWxH)**	1.84″ x 1.060″ dia. max.	1.94″ x 1.20″ dia. max.	2.600″ x 2.500″ x 1.625″ max.	1.531″ x 1.531″ x 1.812″ max.	1.531″ x 1.100″ x 1.781″ max.	1.531″ x 1.130″ x 1.781″ max.	1.531″ x 1.531″ x 1.812″ max.	1.531″ x 1.531″ x 1.680″ max.
	Weight	3.2 oz. (90.8g) max.	4.32 oz. (122.6g) max.	7.0 oz. (200g) max.	7.2 oz. (204g) max.	5.10 oz. (144g) max.	4.8 oz. (136g) max.	6.0 oz. (170g) max.	8.18 oz. (232g max.
	Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Screw Terminals	Socket Pins Solder Hooks	Socket Pins Solder Hooks	Socket Pins Solder Hooks	Socket Pins Solder Hooks	Solder Hooks Screw Terminals
ENVIRON.	**Temperature**	−65°C to +125°C	−65°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C	−70°C to +125°C
	Shock	100G, 11 ms.	100G, 11 ms.	25G, 11 ms.	50G, 11 ms.	50G, 11 ms.	50G, 11 ms.	50G, 11 ms.	50G, 11 ms.
	Vibration Sine	15G, 10 to 2,000 Hz	15G, 10 to 2,000 Hz	10G, 10 to 1,500 Hz	10G, 10 to 1,500 Hz	10G, 55 to 1,500 Hz	10G, 55 to 1,500 Hz	10G, 55 to 1,500 Hz	10G, 5 to 1,000 Hz

TIME CONTROL, RELAY OUTPUT—
10A-25A, D.P.D.T. to 6P.D.T.

	SERIES	TDC	TDD	TDE	TDF	TDG
						
	Applicable Mil-Spec	MIL-R-83726/30 MIL-R-83726/31	MIL-R-83726/28 MIL-R-83726/29	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726
FEATURES		• Adjustable delay on operate or release • Hermetically sealed • Polarity protected	• Fixed delay on operate or release • Hermetically sealed • Polarity protected	• Fixed or adjustable delay on operate or release • Hermetically sealed • Polarity protected	• Fixed or adjustable delay on operate or release • Hermetically sealed • Polarity protected	• Fixed or adjustable delay on operate or release • Hermetically sealed • Polarity protected
ELEC.	**Contact Rating**	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	25 amps @ 28 Vdc 115/200V 400 Hz 3ϕ	10 amps @ 28 Vdc 115/200V 400 Hz 3ϕ
	Contact Form	D.P.D.T.	D.P.D.T	4P.D.T., 3P.D.T. (Adj.) 4P.S.T./N.O. (Adj.)	3P.D.T, 2P.D.T. (Adj), 3P.S.T./N.O. (Adj.)	6P.D.T., 5P.D.T. & 1P.S.T./N.O. (Adj.)
	Input Voltage	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal
	Control Voltage	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal	28 Vdc nominal
	Operating Current	110 ma. max.	110 ma. max.	110 ma. max.	110 ma. max.	190 ma. max.
TIMING	**Timing Mode**					
	Delay on Operate	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.
	Delay on Release	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.	.05 to 600 sec.
MECH.	**Dimensions(LxWxH)**	1.025″x1.025″x 1.010″ max.	1.025″ x 1.025″ x 1.010″ max.	1.025″ x 1.025″ x 1.500″ max.	1.025″ x 1.025″ x 1.500″ max.	1.053″ x 1.483″ x 1.500″ max.
	Weight	2.5 oz. (71g) max.	2.5 oz. (71g) max.	3.0 oz. (85g) max.	3.0 oz. (85g) max.	3.88 oz. (110g) max.
	Terminals	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks	Socket Pins Circuit Board Pins Solder Hooks
ENVIRON.	**Temperature**	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C
	Shock	200G, 6 ms.	200G, 6 ms.	200G, 6 ms.	100G, 6 ms.	50G, 6 ms.
	Vibration Sine	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	30G, 10 to 3,000 Hz	20G, 10 to 2,000 Hz	20G, 10 to 2,000 Hz

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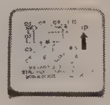
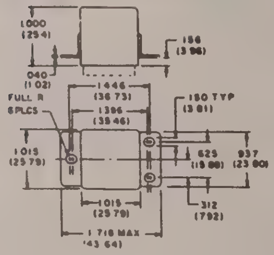
MILITARY/AEROSPACE RELAYS

MERCURY WETTED RELAYS 7.5VA-FORM A; 3VA-FORM C

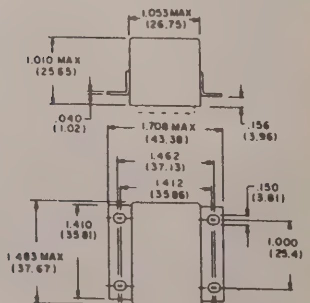
	MRRW	MRRW
		
	MIL-R-83407 MIL-R-83407/3	MIL-R-83407 MIL-R-83407/3
FEATURES	• Mercury wetted contacts • Hermetically sealed • Welded construction • Coils have back EMF suppression • Electrostatic shielded • Suppression Available	• Mercury wetted contacts • Hermetically sealed • Welded construction • Coils have back EMF suppression • Electrostatic shielded • Suppression Available
ELEC.	1A, 1C Form A Form C 500 150 1.0 1.0 7.5 2.0 4.5 & 12.0 —	2A, 3A, 2C Form A Form C 500 150 1.0 1.0 7.5 2.0 4.5 & 12.0 —
MECH	1.100″ x 0.515″ x 0.410″ max. .42 oz. (12g) max.	1.100″ x 1.062″ x 0.410″ max. .70 oz. (20g) max.
TIMING	−38°C to +105°C 3.0 ms. max. 3.0 ms. max.	−38°C to +105°C 3.0 ms. max 3.0 ms. max.

MIL SENSORS

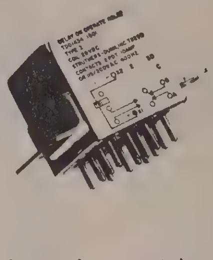
No.1



No.2



MIL SENSORS FOR VOLTAGE, CURRENT OR FREQUENCY



Struthers-Dunn custom designs and manufactures various sensors, to monitor AC and DC circuits and detect and signal when the parameters of voltage, current, or frequency deviate from the required nominal range. All are designed to meet the environmental specifications for military and aerospace applications.

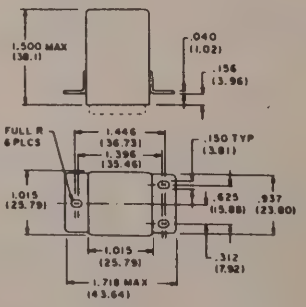
These sensors typically employ some appropriate version of our extensive line of MIL-approved relays, combined with the sensing and relay control circuitry. A time-delay option can be added to hold off relay operation when an abnormal condition is transient or can be tolerated for some longer preset time.

Sensor relay contacts are available in many configurations, from S.P.D.T. reed contacts, suitable for control of signal lights, to 4-pole 10 amp or 3-pole 25 amp power contacts, to control 3-phase circuits. Magnetic latching relays can be provided for all contact arrangements.

Enclosures are hermetically sealed with terminals for socket plug-in, circuit-board mounting, or solder hooks. Three enclosure types suitable for sensor assemblies are dimensioned below: No. 1 can provide up to D.P.D.T., 10 amps; Nos. 2 and 3 up to 4PDT, 10 amps; and No. 3 3 PST-NO, 25 amps plus auxiliary S.P.D.T. 2 ampere contacts, or 3PDT, 25 amps

Dimensions in inches ± .010 and (MM ± .25) except as noted.

No.3



COMBINATION ELECTROMECHANICAL/ SOLID-STATE RELAY 30 AMP 1PST

- **180 kW Max. Switching Capability**
- **500 Vpk 30 AMP Contacts (AC or DC)**
- **5 Million Operations**
- **Bounce & Chatter Free Operation**
- **Arcless Design**
- **-55°C to +125°C Operating Temperature**
- **Hermetically Sealed**
- **Weight 4.0 Oz. Max.**

HV-1A30

The HV-1A30 Series relay is a high voltage device that combines electromechanical contacts with solid state electronics for increased performance over traditional relays. The result is a high power contactor in a small relay package which has a 100 times longer life than conventional relays and features bounce-, chatter- and arc-free operation to reduce EMI.

This relay can make and break up to 1000% of its rated current, and is capable of carrying extremely high overloads for short periods. Its current carrying ability does not derate at extreme temperatures or for different types of loads.

Struthers-Dunn can custom design and manufacture product variations, such as adding time delays or various sensors to monitor AC and DC circuits and to detect and signal when the parameters of voltage, current or frequency deviate from the required nominal range.

All HV-1A30 Series relays are designed to meet the environmental specifications for military and aerospace applications.

Type of Load	Life (Min) Cycles X10^6	at 500 VDC* (AMPS)	At 350 VAC rms (AMPS)
Resistive	5	30	30
Inductive	5	30	30
Motor	5	30	30
Lamp	5	30	30

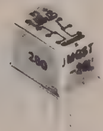
*Inductive spike clamped at 500 V across contacts

Overload Current: 300 AMPS DC or AC
Max. Contact Drop at 30 AMPS: 0.180 Volts
Rupture Current: 300 AMPS DC or AC
Absolute Max. Contact Voltage: 600 Vpk
Contact Bounce: None
Absolute Max. Switching Capability: 180 kW
Nominal Switching Capability: 15 kW

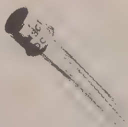
13 Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

MILITARY MINIGRID LOW LEVEL TO 1 AMP D.P.D.T.

MILITARY TO-5 LOW LEVEL TO 1 AMP D.P.D.T.

	SERIES	(J) MGA	(J) MGS	(J) MGAT	(J) MGST	(J) MA	(J) MS
							
	Applicable Mil-Spec	MIL-R-39016/17 MIL-R-39016/18 MIL-R-39016/19	MIL-R-39016/41 MIL-R-39016/42 MIL-R-39016/43	MIL-R-28776/6	MIL-R-28776/7	MIL-R-39016/9 MIL-R-39016/15 MIL-R-39016/20	MIL-R-39016/11 MIL-R-39016/16 MIL-R-39016/21
FEATURES		• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction • MOSFET driver	• Hermetically sealed • All welded construction • MOSFET driver	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction
ELEC.	Contact Rating Contact Form Rated Coil Voltages	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 30 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc
MECH	Dimensions (LxWxH) Weight Terminals	0.370″ sq. max. x 0.280″ max. ht. 0.09 oz. (2.55g) max. Straight Pins 0.187 and 0.500	0.370″ sq. max. x 0.375″ max. ht. 0.12 oz. (3.40g) max. Straight Pins 0.187 and 0.500	0.470″ x 0.370″ x 0.280″ max. 0.11 oz. (3.12g) max. Straight Pins 0.500	0.470″ x 0.370″ x 0.375″ max. 0.18 oz. (5.11g) max. Straight Pins 0.500	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.55g) 0.10 oz. (2.80g) with mounting pad Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.15 oz. (4.25g) 0.16 oz. (4.50g) with mounting pad Straight Pins 0.187, 0.500 and 1.5
OPTIONS	Suppression Mounting Styles	Available for DC units. Mounting pad available.	Available for DC units. Mounting pad available.	All DC units. Mounting pad available.	All DC units. Mounting pad available.	Available for DC units. Mounting pads available.	Available for DC units. Mounting pads available.
ENVIRON.	Temperature Shock Vibration Sine	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz

MILITARY TO-5 LOW LEVEL TO 1 AMP S.P.D.T. AND D.P.D.T.

	SERIES	(J) MAT	(J) MST	(J) 1MA	(J) 1MS	(J) 1MAT	(J) 1MST
							
	Applicable Mil-Spec	MIL-R-28776/1	MIL-R-28776/3	MIL-R-39016/7 MIL-R-39016/23 MIL-R-39016/24	MIL-R-39016/10 MIL-R-39016/25 MIL-R-39016/26	MIL-R-28776/5	MIL-R-28776/4
FEATURES		• Hermetically sealed • All welded construction • Transistor driver	• Hermetically sealed • All welded construction • Transistor driver	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction • Transistor driver	• Hermetically sealed • All welded construction • Transistor driver
ELEC.	Contact Rating Contact Form Rated Coil Voltages	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 40 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc S.P.D.T. 5 to 40 Vdc
MECH	Dimensions (LxWxH) Weight Terminals	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.55g) max. Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.15 oz. (4.26g) max. Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.280″ max. ht. 0.08 oz. (2.27g) max. 0.09 oz. (2.5g) with mounting pad Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.10 oz. (2.84g) max. 0.11 oz. (3.09g) with mounting pad Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.55g) max. Straight Pins 0.187, 0.500 and 1.5	0.370″ dia. x 0.375″ max. ht. 0.14 oz. (3.98g) max. Straight Pins 0.187, 0.500 and 1.5
OPT	Suppression Mounting Styles	All DC units Mounting pad available.	All DC units. Mounting pad available.	Available for DC units. Mounting pad available.	Available for DC units. Mounting pad available.	All DC units. Mounting pad available.	All DC units. Mounting pad available.
ENVIRON	Temperature Shock Vibration Sine	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 75G, 6 ms. 30G, 10 to 3,000 Hz

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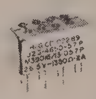
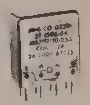
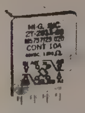
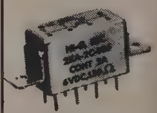
14 Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

MILITARY CRYSTAL CAN TYPE
2A-10A, D.P.D.T.

	SERIES	(J) 2G-4650	(J) 2K-4730 & 4940	2B-1506	2BC-1510	2T-2911
						
	Applicable Mil-Spec	MIL-R-39016 MIL-R-39016/13	MIL-R-39016/6 MIL-R-39016/22	MIL-R-5757/10	MIL-R-5757/13	MIL-R-5757/23
FEATURES		• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction
ELEC.	Contact Rating No. of Cycles Contact Form Rated Coil Voltages	2 amps. @ 28 Vdc 100K min. D.P.D.T. 5 to 36 Vdc	2 amps. @ 28 Vdc 100K min. D.P.D.T. 5 to 26 Vdc for /6 6 to 26 Vdc for /22	2 amps. @ 28 Vdc 100K min. D.P.D.T. 6 to 26 Vdc	2 amps. @ 28 Vdc 100K min. D.P.D.T. 6 to 40 Vdc	10 amps. @ 28 Vdc 50K min. D.P.D.T. 6 to 120 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.310″ x 0.610″ x 0.320″ max. 0.17 oz. (4.82g) max. Circuit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.410″ max. 0.46 oz. (13g) max./6 0.35 oz. (9.92g) max./22 Straight Pins 0.187 Solder Hooks 0.190 Wire Leads 3.000 Plug-In 0.187	0.400″ x 0.800″ x 0.875″ max. 0.8 oz. (22.68g) max. Pin .187 Solder Lug	0.400″ x 0.800″ x 1.271″ max. 1.1 oz. (31.2g) max. Pin .187 Solder Lug	0.625″ x 1.075″ x 1.300″ max. 2.0 oz. (56.7g) max. Circut Board Pins Solder Hooks
OPTIONS	Suppression Mounting Styles	— Bracket mounting available.	M39016/22 only Bracket & stud mounting available.	— Bracket, stud and laydown mounting available.	— Bracket, stud and laydown mounting available.	— Bracket mounting available.
ENVIRON.	Temperature Shock Vibration	−65°C to +125°C 100G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6ms. 20G, 10 to 2,000 Hz

GENERIC TO-5
LOW LEVEL TO 1 AMP D.P.D.T.

GENERIC CRYSTAL CAN TYPE
LOW LEVEL TO 10 AMP., S.P.D.T TO 4P.D.T.

	SERIES	CA	CS	G	K	B (BR)	4B	KA
								
FEATURES		• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction
ELEC.	Contact Rating Contact Form Rated Coil Voltages	1 amp. @ 28 Vdc D.P.D.T. 5 to 26 Vdc	1 amp. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	2 amps. @ 28 Vdc D.P.D.T. 5 to 36 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 26 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 76 Vdc 26 to 115 Vac (BR)	2 amps @ 28 Vdc 4P.D.T. 6 to 115 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 48 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.370″ dia. x 0.280″ max. ht. 0.09 oz. (2.54g) max. Straight Pins 0.5 min.	0.370″ dia. x 0.375″ max. ht. 0.12 oz. (3.39g) max. Straight Pins 0.5 min.	0.310″ x 0.610″ x 0.320″ max. 0.17 oz. (4.82g) max. Circuit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.410″ max. 0.35 oz. (9.9g) max. Straight Pins 0.187 Solder Hook 0.195 Wire Leads 1.500 Plug-in 0.187	0.410″ x 0.810″ x 0.900″ max. 1.0 oz. (28.3g) max. Pin 0.187 Solder Lug	0.810″ sq. max. x 0.875″ max. ht. 1.0 oz. (28.3g) max. Circit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.500″ max. 0.4 oz. (11.3g) max. Straight Pins 0.187 Solder Hook 0.195 Wire Leads 1.500 Plug-in 0.187
OPTIONS	Suppression Mounting Styles	Available for DC units Mounting pad available.	Available for DC units. Mounting pad available.	Available for DC units. Bracket mounting available.	Available for DC units. Bracket & stud mounting available.	Available for DC units. Bracket, stud and laydown mounting available	Available for DC units. Bracket & stud mounting available	Available for DC units. Bracket & stud mounting available
ENVIRON.	Temperature Shock Vibration	−55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz	−55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz	−65°C to +125°C 100G, 6 ms. 30G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 3,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms 20G, 10 to 3,000 Hz

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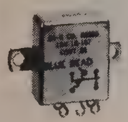
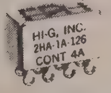
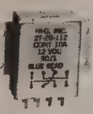
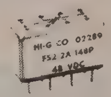
15 S-D Hi-G Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

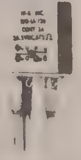
GENERIC CRYSTAL CAN TYPE LOW LEVEL TO 10 AMP, S.P.D.T. TO 4P.D.T.

	SERIES	BK	BC	BA	HA	BN	BCN
							
FEATURES		• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature	• Hermetically sealed • All welded construction • Balanced armature
ELEC.	Contact Rating Contact Form Rated Coil Voltages	2 amps. @ 28 Vdc S.P.D.T. and D.P.D.T. 1.8 to 32.0 Vdc	2 amps. @ 28 Vdc S.P.D.T. and D.P.D.T. 1.8 to 40 Vdc	2 amps. @ 28 Vdc D.P.D.T. 6 to 26 Vdc	4 amps. @ 28 Vdc D.P.D.T. 6 to 26 Vdc	5 amps. @ 28 Vdc D.P.D.T. 6 to 76 Vdc	5 amps. @ 28 Vdc D.P.D.T. 6 to 40 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.410″ x 0.810″ x 0.900″ max. 0.95 oz. (26.8g) max. Pin 0.187 Solder Lug Circuit Lead 1.500	0.400″ x 0.800″ x 1.281″ max. 1.1 oz. (31.1g) max. Pin 0.187 Solder Lug	0.410″ x 0.810″ x 0.900″ max. 0.95 oz. (26.8g) max. Pin 0.187 Solder Lug Circuit Lead 1.500	0.410″ x 0.810″ x 0.450″ max. 0.35 oz. (9.9g) max. Straight Pins 0.187 Solder Hook 0.195	0.410″ x 0.810″ x 0.910″ max. 0.95 oz. (26.8g) max. Pin 0.187 Solder Lug	0.410″ x 0.810″ x 1.281″ max. 1.1 oz. (31.2g) max. Pin 0.187 Solder Lug
OPTIONS	Suppression Mounting Styles	Available for DC units. Bracket, stud and laydown mounting available.	Available for DC units. Bracket, stud and laydown mounting available.	Available for DC units. Bracket, stud and laydown mounting available.	Available for DC units. Bracket & stud mounting available	Available for DC units. Bracket, stud and laydown mounting available	Available for DC units. Bracket, stud and laydown mounting available
ENVIR.	Temperature Shock Vibration	−65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +125°C 100G, 6 ms. 15G, 10 to 2,000 Hz

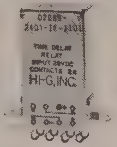
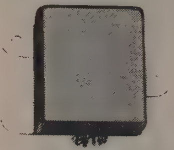
GENERIC CRYSTAL CAN TYPE LOW LEVEL TO 10 AMP, S.P.D.T. TO 4P.D.T.

	SERIES	T (TR)	FS2	FS3	FS5
					
FEATURES		• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction	• Hermetically sealed • All welded construction
ELEC	Contact Rating Contact Form Rated Coil Voltages	10 amps. @ 28 Vdc D.P.D.T. 6 to 115 Vdc 115 Vac (TR)	2 amps. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	2 amps. @ 28 Vdc D.P.D.T. 5 to 48 Vdc	5 amps. @ 28 Vdc D.P.D.T. 5 to 48 Vdc
MECH.	Dimensions (LxWxH) Weight Terminals	0.625″ x 1.075″ x 1.300″ max. 2.0 oz. (56.7g) max. Circuit Board Pins Solder Hooks	0.410″ x 0.810″ x 0.410″ max. 0.35 oz. (10g) max. Straight Pins 0.187 Solder Hook 0.190	0.410″ x 0.810″ x 0.500″ max. 0.4 oz. (11.3g) max. Straight Pins 0.187 Solder Hook 0.190	0.410″ x 0.810″ x 0.460″ max. 0.38 oz. (10.8g) max. Straight Pins 0.187 Soldre Hook 0.190
OPTIONS	Suppression Mounting Styles	Available for DC units. Bracket mounting available.	Available for DC units. Bracket & stud mounting available.	Available for DC units. Bracket & stud mounting available.	Available for DC units. Bracket & stud mounting available.
ENVIR.	Temperature Shock Vibration	−65°C to +125°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz	−55°C to +125°C 30G, 6 ms. 20G, 10 to 500 Hz	−55°C to +125°C 30G, 6 ms. 10G, 10 to 500 Hz

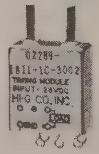
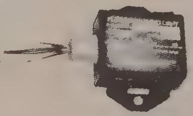
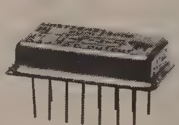
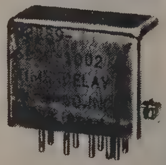
RF, CRYSTAL CAN, 75W 500 MHz, S.P.D.T. & D.P.D.T.

	SERIES	RFC	RFK	RFB/C
				
FEATURES		• Hermetically sealed • All welded relay construction • 150 mW	• Hermetically sealed • All welded relay construction • 250 mW	• Hermetically sealed • All welded relay construction • 250 mW (RFB) 40 mW (RFBC)
ELEC.	Aux. Contact Rating Power Capacity Power Switching Contact Form Rated Coil Voltages	2 amps. @ 28 Vdc 150 W 75 W S.P.D.T. 6 to 26.5 Vdc	2 amps. @ 28 Vdc 150 W 75 W D.P.D.T. 6 to 26.5 Vdc	2 amps. @ 28 Vdc 150 W 75 W D.P.D.T. 6 to 76 Vdc
RF CHARACTERISTICS	Frequency Range Voltage Standing Wave Ratio (VSWR) Characteristic Impedance Isolation	0 to 500 MHz < 1.1:1 typical @100 MHz < 1.2:1 typical @ 500 MHz 50 ohms standard 50 dB typical @ 100 MHz 40 dB typical @ 500 MHz	0 to 500 MHz < 1.1:1 typical @ 100 MHz < 1.2:1 typical @ 500 MHz 50 ohms standard 50 dB typical @ 100 MHz 40 dB typical @ 500 MHz	0 to 500 MHz < 1.1:1 typical @ 100 MHz < 1.2:1 typical @ 500 MHz 50 ohms standard 50 dB typical @ 100 MHz 40 dB typical @ 500 MHz
MECH.	Dimensions (LxWxH) Termination	0.500″ x 0.500″ x 0.510″ max. 6″ RG 196A/U standard	0.410″ x 0.810″ x 0.410″ max. 6″ RG 196A/U standard	0.410″ x 0.810″ x 0.900″ max. 6″ RG 196A/U standard (RFB) 0.410″ x 0.810″ x 1.281″ max. (RFBC)
ENVIR.	Temperature Shock Vibration	−65°C to +85°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +85°C 100G, 6 ms. 20G, 10 to 2,000 Hz	−65°C to +85°C 100G, 6 ms. 20G, 10 to 2,000 Hz

TIME CONTROL, RELAY OUTPUT

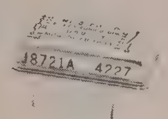
	SERIES	1600 & 1700	2400	4600 & 4700	5600 & 5700	6600 & 6700
						
	Applicable Mil-Spec	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726	MIL-R-83726/7 MIL-R-83726/8
FEATURES		• Delay on Operate • Fixed, 1600 series • Adjustable, 1700 series • Multiple mounting styles • AC or DC units	• Delay on Operate—Fixed • Multiple mounting styles • Consult factory for custom units.	• Interval Timer • Fixed, 4600 series • Adjustable, 4700 series • AC or DC units	• Delay on Release • Fixed, 5600 series • Adjustable, 5700 series • Multiple mounting styles	• Delay on Operate, 6600 series • Delay on Release, 6700 series
ELEC.	Contact Rating Input Voltage Control Voltage Operating Current Control Current Operating Voltage min.-max. Contact Form	4A or 10A res @ 28 Vdc 28 Vdc nominal — 200 ma. max. — 18 to 31 Vdc 1,2,3 or 4P.D.T.	2A res @ 28 Vdc 28 Vdc nominal — 85 ma. max. — 18 to 31 Vdc 2P.D.T.	4A or 10A res @ 28 Vdc 28 Vdc nominal — 200 ma. max. — 18 to 31 Vdc 1,2,3 or 4P.D.T.	2A, 5A, or 10A res @ 28 Vdc 28 Vdc nominal 10 to 31 Vdc 250 ma. max. 25 ma. max. 18 to 31 Vdc 2P.D.T.	2A res @ 28 Vdc 28 Vdc nominal 18 to 31 Vdc (6700 only) 80 ma. max. 2 ma. max. (6700 only) 18 to 31 Vdc 2P.D.T.
TIMING	Timing Mode Delay on Operate Delay on Release % Accuracy Recycle Time	0.05 to 600 sec. — ±10% of nominal value 10 ms. (DC), 50 ms. (AC)	0.05 to 600 sec. — ±10% of nominal value 20 ms. max.	0.10 to 600 sec. — ±10% of nominal value 10 ms. (DC), 50 ms. (AC)	— 0.05 to 600 sec. ±10% of nominal value 10 ms. (DC), 50 ms. (AC)	0.06 to 300 sec. 0.10 to 300 sec. ±10% of nominal value 10 ms. max.
MECH.	Dimensions (LxWxH) Weight Terminals	1.790″ x 1.284″ x 2.419″ max. 8.5 oz. (240g) max. "J" type solder hooks	0.809″ x 0.406″ x 1.500″ max. 1.2 oz. (30g) max. "J" type solder hooks or P.C. board mount	1.790″ x 1.284″ x 2.419″ max. 8.5 oz.(240g) max. "J" type solder hooks	1.542″ x 1.542″ x 1.812″ 8.5 oz. (240g) max. "J" type solder hooks	1.59″ x 1.0″ x 1.750″ max. 4 oz. (113g) max. "J" type solder hooks
ENVIR	Temperature Shock Vibration	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 80 to 3,000 Hz

TIME CONTROL, SOLID STATE OUTPUT

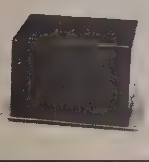
	SERIES	1800 & 1900	2600	4800	6001 & 6155		6800 & 6900
							
	Applicable Mil-Spec	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726	MIL-R-83726/13 (6001 only) 6155 manufactured with reference to MIL-R-83726		MIL-R-83726/24 MIL-R-83726/25
FEATURES		• Delay on Operate • Fixed, 1800 series • Adjustable, 1900 series • Several packaging styles	• Repeat Cycle—Fixed • Frequency selectable • Duty cycle selectable	• Interval—Fixed • Several packaging styles	• Delay on Operate—Fixed • Solid State Output • 14 pin D.I.P.		• Delay on Operate—Fixed MIL-R-83726/24 • Delay on Release—Fixed MIL-R-83726/25 • Plug-in crystal can module
ELEC.	Contact Rating Input Voltage Control Voltage Operating Current Control Current Operating Voltage min.-max. Contact Form	300 ma. @ 25°C 28 Vdc nominal — 10 ma. max. — 18 to 31 Vdc S.P.S.T./N.O.	300 ma. @ 25°C, 28 Vdc nominal — 30 ma. — 18 to 31 Vdc S.P.S.T./N.O.—Closure to Ground	300 ma. @ 25°C 28 Vdc nominal — 40 ma. max. — 18 to 31 Vdc S.P.S.T.N.O.	300 ma. @ 25°C 28 Vdc nominal — 10 ma. max. — 18 to 31 Vdc S.P.S.T.N.O. Closure to Ground	20 ma @ 25°C 5 Vdc nominal — 25 ma. max. — 4.5 to 5.5 Vdc S.P.S.T/N.O. Closure to Ground	150 ma. max. 28 Vdc nominal 28 Vdc nominal (/25 only) 10 ma. max. 2 ma. max. (/25 only) 20 to 32 Vdc S.P.S.T.—To Input Voltage
TIMING	Timing Mode Delay on Operate Delay on Release % Accuracy Recycle Time	0.05 to 600 sec. — ±10% of nominal value 10 ms. min.	0.05 to 600 sec., ON-time 0.05 to 600 sec, OFF-time ±10% of nominal value —	0.05 to 100 sec. (time interval) — ±10% of nominal value 10 ms. min.	0.05 to 600 sec. ±10% of nominal value 10 ms. min.	100 ms. min.	0.05 to 500 sec. (/24 only) 0.05 to 500 sec. (/25 only) ±10% of nominal value 10 ms. min.
MECH.	Dimensions (LxWxH) Weight Terminals	0.809″ x 0.406″ x 0.892″ 1 oz. (28g) max. "J" hook or P.C. board mount	1.790″ x 1.284″ x 2.419″ 8 oz. (200g) max. "J" type hook	0.809″ x 0.400″ x 1.500″ 2 oz.(50g) max. "J" hook or P.C. board mount	0.920″ x 0.580″ x 0.420″ 0.42 oz. (12g) max. 14 pins, D.I.P., 0.28″ long		0.810″ x 0.410″ x 0.640″ 0.56 oz. (16g) max. 8 pin, plug-in
ENVIR	Temperature Shock Vibration	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 50G, 1 ms. 20G, 10 to 2,000 Hz	−55°C to +125°C 150G, 1 ms. 20G, 80 to 3,000 Hz		−55°C to +125°C 1,100G, 0.5 ms. 20G, 500 to 3,000 Hz

17 Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

SOLID STATE RELAYS

	SERIES	JTS-5	JTS-6	JTS-7	JDS-9	JPS-10
						
	Applicable Mil-Spec	MIL-R-28750/5	MIL-R-28750/6	MIL-R-28750/7	MIL-R-28750/9	MIL-R-28750/10
FEATURES		• Transformer isolated, AC or DC • TO-5 package • "W" or "Y" level screening available.	• Transformer isolated • TO-5 package • "W" or "Y" level screening available.	• Transformer isolated • TO-5 package • "W" or "Y" level screening available.	• 1,500 Vrms optical isolation • D.I.P. package • "W" or "Y" level screening available.	• 1,500 Vrms optical isolation • Heavy duty die cast construction • "W" or "Y" level screening available.
ELEC.	**Input Data**					
	Input Voltage Range	4.0 to 7.0 Vdc	4.0 to 7.0 Vdc	4.0 to 7.0 Vdc	3.8 to 32 Vdc	4.0 to 32.0 Vdc
	Input Current	22 ma. DC max. @ rated voltage	22 ma. DC max. @ rated voltage	22 ma. DC max. @ rated voltage	18 ma. DC max. @ rated voltage	16 ma. DC max. @ rated voltage
	Rated Output Voltage	±40V, AC or DC	40 Vdc	250 Vdc	250 Vrms AC	25 to 220 Vrms AC
	Contact Form	S.P.S.T. N.O.	S.P.S.T. N.O.	S.P.S.T. N.O.	S.P.S.T. N.O.	S.P.S.T. N.O.
MECH.	Dimensions (LxWxH)	0.370" dia. max. x 0.275" max.	0.370" dia. max. x 0.275" max.	0.370" dia. max. x 0.275" max.	0.883" x 0.530" x 0.190" max.	2.410" x 1.570" x 1.845" max.
	Weight	0.18 oz. (5g) typical	0.18 oz. (5g) typical	0.18 oz. (5g) typical	0.18 oz. (5g) typical	6 oz. (170g) typical
	Terminals	P.C. Board mounting, 0.50" min. leads	P.C. Board mounting, 0.50" min. leads	P.C. Board mounting, 0.50" min. leads	0.25" min. leads	"J" type solder hooks
ENVIR	Temperature	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +110°C	−55°C to +110°C
	Shock	1500G, .5 ms.	1500G, .5 ms.	1500G, .5 ms.	100G, 6 ms.	1500G, .5 ms
	Vibration	100G, 10 to 2,000 Hz	100G, 10 to 2,000 Hz	100G, 10 to 2,000 Hz	20G, 10 to 2,000 Hz	30G, 10 to 3,000 Hz

POWER MONITORS

	SERIES	9000
		
	Applicable Mil-Spec	Manufactured with reference to MIL-R-83726
FEATURES		• Independent voltage, (9001), frequency (9002) & phase sensors (9003) modules are also available • Transformerless design • B.I.T. mode
ELEC.	**Input Data**	
	Voltage Range	80 to 140 Vac
	Frequency Range	40 to 480 Hz
	Phase Detection	Phase loss, reversal or missing neutral
	Input	3φ WYE with neutral
	Input current	30 ma./phase max.
	Auxiliary Voltage	28 Vdc (B.I.T.)
	Trip Value Accuracies	
	Over Voltage	± 1% of set point
	Under Voltage	± 1% of set point
	Over Frequency	± 1% of set point
	Under Frequency	± 1% of set point
	Hysterisis	0.25% of setpoint
	Output Data	
	Contact Rating	1.0A res. @ 28 Vdc
	Contact Form	D.P.D.T. relays, one per function
MECH.	Dimensions (LxWxH)	5.500" x 4.000" x 3.250" max.
	Weight	3.0 lbs. (1400g) max.
	Terminals	Plug-in connector Winchester MRE-26P-G
ENVIR	Temperature	−10°C to +85°C
	Shock	—
	Vibration	—

AC & DC VOLTAGE SENSORS

SERIES	1310 & 1350	9001
	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726
	• AC 1350 Series • DC 1310 Series	• Voltage band sensing • Open frame modular construction • 3φ sensing • B.I.T. mode
Pull-In Voltage	50 to 150 Vac, 10 to 150 Vdc	80 to 140 Vdc, 3φ, WYE
Input Frequency		40 to 480 Hz
Drop Out Voltage	1.5 Vac, 0.25 Vdc below pull-in	0.25 Vac (Typical)
Sensing Function	Relay energized above pull-in voltage	Relay energizes in pass band
Current Drain	100 ma. AC, 15 ma. DC max. @ 25°C	10 ma./phase max.
% Accuracy	±2.5%	±1%
Max. Voltage	150% of pull-in voltage	200 Vac/ms (10 sec. max.)
Auxiliary Voltage	—	28 Vdc (B.I.T.)
Operate Time	50 ms. max.	2.0 sec. max @ 115 Vac
Release Time	50 ms. max.	See graph
Contact Rating	2A res. @ 30 Vdc	1.0A res. @ 28 Vdc
No. of Cycles	100K	100K
Contact Form	D.P.D.T.	D.P.D.T.
Dielectric Strength	1,000 Vrms, 60 Hz, all terminals to case	—
Dimensions (LxWxH)	1.250" x 1.000" x 2.000" max.	4.000" x 2.250" x 1.375" max.
Weight	3.5 oz. (99g) max.	8.0 oz. (228g) max.
Terminals	J-type solder hooks	30 pin airborne plug-in connector
Temperature	−55°C to +125°C	−10°C to +85°C
Shock	50G, 1 ms.	—
Vibration	20G, 10 to 2,000 Hz	—

FREQUENCY SENSORS

SERIES	7000	9002
	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726
	—	• Frequency band sensing • 3φ sensing • B.I.T. mode
Input Voltage	95 to 135 Vac	80 to 140 Vac, 3φ WYE
Input Frequency Range	40 to 480 Hz	40 to 480 Hz
% Accuracy	±2%	±1%
Contact Form	D.P.D.T.	D.P.D.T.
No. of Cycles	100K min.	100K min.
Contact Rating	4A res. @ 30 Vdc	1A res. @ 28 Vdc
Dielectric Strength	1,000 Vrms, 60 Hz, all terminals to case	—
Insulation Res.	1,000 MΩ min. @ 500 Vdc	—
Current Drain	150 ma. max.	10 ma./phase
Hysteresis	0.5% from Trip Point	.25 Hz
Sensing Function	Relay energizes above frequency set point	Relay energizes in pass band
Dimensions (LxWxH)	1.790" x 1.284" x 2.419" max.	4.000" x 2.250" x 1.375" max.
Weight	8.5 oz. (241g)	8.0 oz. (229g) max.
Terminals	J-type solder hooks	30 pin airbone plug-in connector
Temperature	−55°C to +85°C	−10°C to +85°C
Shock	50G, 1 ms.	—
Vibration	20G, 10 to 2,000 Hz	—

393 **Struthers-Dunn/HI-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500; EASY LINK 62287939; FAX: 609-589-2619**

18 Struthers-Dunn/Hi-G MILITARY/AEROSPACE RELAYS

PHASE SENSORS

	SERIES	1400	9003
	Applicable Mil-Spec	Manufactured with reference to MIL-R-83726	Manufactured with reference to MIL-R-83726
FEATURES		—	• Open frame modular construction • Phase sequence A, B, C • B.I.T. mode
ELEC.	Input Voltage	115 or 208 Vac	60 to 140 Vdc, 3ϕ WYE
	Input Frequency	50, 60 or 400 Hz	40 to 480 Hz
	Operate Time	75 ms. max.	500 ms. max
	Release Time	100 ms. max.	400 ms. ±20%
	Contact Form	S.P.D.T.	D.P.D.T.
	No. of Cycles	100K	100K
	Contact Rating	2A res. @ 30 Vdc	1A res. @ 28 Vdc
	Dielectric Strength	1,000 Vrms, 60 Hz, all terminals to case.	—
	Insulation Res.	1,000 MΩ min. @ 500 Vac	—
	Sensing Function	Relay energized for phase sequence A, B & C	Relay energized for phase sequence A, B & C
MECH.	Dimensions (LxWxH)	2.640″ x 1.740″ x 4.000″ max.	4.000″ x 2.250″ x 1.375″ max.
	Weight	12 oz. (350g) max.	8.0 oz. (228g) max.
	Terminals	"J" type solder hooks	30 pin airborne plug-in connector
ENVIR.	Temperature	*−55°C to +85°C	*−10°C to +85°C
	Shock	50G, 1 ms	—
	Vibration	20G, 10 to 2,000 Hz	—

INDUSTRIAL PRODUCTS

	SERIES	TIME DELAY RELAYS TDO/TDR	INTERVAL TIMER TDN	TIME DELAY PROGRAMMABLE TDP
	Applicable Mil-Spec	—	—	—
FEATURES		• Digital CMOS circuitry • Delay periods up to 2 hours • No "false" operation • Fixed and adjustable models	• Digital CMOS circuitry • Delay periods up to 2 hours • Transient protection • Fixed and adjustable models	• Field programmable input voltage • Delay periods up to 2 hours • Operate or release • Digital CMOS circuitry • No "false" operation
ELEC.	Frequency:	45 to 440 Hz (all DC units)	45 to 440 Hz on AC inputs	45 to 440 Hz (all AC units)
	Input voltages:	24 to 120 Vac, 12 to 125 Vdc	24 to 120 Vac, 12 to 125 Vdc	24 to 240 Vac, 12 and 24 Vdc
	Contacts:	D.P.D.T., 10 amp @ 120 Vac resistive 5 amp @ 240 Vac resistive	D.P.D.T., 10 amp @ 120 Vac resistive 5 amp @ 240 Vac resistive	D.P.D.T., 10 amp @ 120 Vac resistive 5 amp @ 240 Vac resistive
	Accuracy:	±10% over voltage and temperature range	±10% over voltage and temperature range	±10% over voltage and temperature range
	Repeatability:	0.1% typical ±.5% max.	0.1% typical ±.5% max.	0.1% typical ±.5% max.
	Recycle Time:	100 milliseconds max.	500 milliseconds max.	100 milliseconds
	Reset Time:	Less than 100 milliseconds	Less than 100 milliseconds	Less than 100 milliseconds
	Current Drain:	80 ma typical; 150 ma max.	80 ma typical; 150 ma max.	80 ma typical; 150 ma max.
	Temperature Range:	Operational −10°C to +55°C Storage −55°C to +85°C	Operational −10°C to +55°C Storage −40°C to +85°C	Operational −10°C to +55°C Storage −40°C to +85°C
	Transient Protection:	Twice input voltage for 1 mil/sec standard. Optional protection up to 2500 Vac available. Consult factory.	Twice input voltage for 1 millisec standard. Optional protection up to 2500 Vac available. Consult factory.	Twice input voltage for 1 millisec standard. Optional protection up to 2500 Vac available. Consult factory.
TIMING	Timing mode	0.3 to 300 seconds, 1 to 120 minutes.	0.3 to 300 seconds, 1 to 120 minutes.	0.3 to 300 seconds, 1 to 120 minutes.
MECH.	Dimensions (LxWxH)	Fixed: 2.40″ x 1.90″ x 2.90″ max. Adjustable: 2.40″ x 1.90″ x 3.50″	Fixed: 2.40″ x 1.90″ 2.90″ max. Adjustable: 2.40″ x 1.90″ x 3.50″	Fixed: 2.40″ x 1.90″ 2.90″ max. Adjustable: 2.40″ x 1.90″ x 3.50″
OPTIONS		Accuracy ±5% Input voltage as required Current drain with relay de-energized less than 1 ma Delay times beyond 2 hours Specialized functions	Accuracy ±5% Input voltage as required Current drain with relay de-energized less than 1 ma Specialized functions (pulse interval operation)	Accuracy ±5% Input voltage as required Current drain with relay de-energized less than 1 ma Specialized functions (pulse interval operation)

393 **SD/Hi-G Sales Headquarters, Lambs Rd., Pitman, NJ 08071-0901; Tel. 609-589-7500; EASY LINK 62287939; FAX 609-589-2619**

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide D•2221
Batteries, Product Selection Guide D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide C•1003
Capacitors, Product Selection Guide A•1003
Coils, Chokes, Inductors, Product Selection Guide A•1179
Connectors, Terminals & Sockets, Product Selection Guide C•1139
Cores, Magnets & Ferrites A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide A•1326
DC-DC Converters D•2049
DC Power Supplies, Product Selection Guide D•1488
Delay Lines, Product Selection Guide A•1513
Discrete Semiconductors, Product Selection Guide A•2130
Displays, Readouts, & CRTs, Product Selection Guide B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide C•1557
Fiber Optics, Product Selection Guide B•1200
Filters, Power, Product Selection Guide A•1584
Filters, Signal, Product Selection Guide A•1617
Instruments, Test & Measuring, Product Selection Guide D•1215
Interconnection Systems, Product Selection Guide C•1670
Keyboards & Keypads, Product Selection Guide B•1818
Lamps, Lights, & Indicators, Product Selection Guide B•1131
Microwave Components, Product Selection Guide A•1719
Military Qualified Products List B•1002
Motors, Drives, & Rotating Components, Product Selection Guide B•1231
Oscilloscopes, Product Selection Guide D•1402
Panel Hardware, Product Selection Guide C•1522
Panel Meters, Analog & Digital, Product Selection Guide D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide A•2053
Power Supplies, AC, Product Selection Guide D•2221
Power Supplies, DC, Product Selection Guide D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide B•1341
Relays, Product Selection Guide B•1401
Resistors, Product Selection Guide A•1859
Solenoids, Product Selection Guide B•1626
Switches, Product Selection Guide B•1658
Thermal Components, Product Selection Guide B•1857
Transducers & Encoders, Product Selection Guide B•1911
Transformers, Product Selection Guide A•2229
Wire & Cable, Product Selection Guide C•1701

TELEDYNE RELAYS

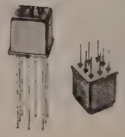
TR® Established Reliability TO-5 Relays

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATE (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
411*		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300
411D*		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300
411DD*		1 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 2000	300
411T*		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300
412*		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
412D*		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
412DD*		2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450
412T*		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
431*	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150
431D*		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150
431DD*		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	100, 200, 630, 1025, 2300, 4000, 6500, 11000	150
431T*		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150
432*		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200
432D*		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200
432DD*		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 850, 1600, 3300, 6500, 11000	200
432T*		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200
421*	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
421D*		1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
421DD*		1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290
420/422*		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
420D/422D*		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
420DD*/422DD*		2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290

Centigrid®

TR® Established Reliability Relays

· General purpose 114 Series
· Sensitive 134 Series



The Centigrid® 114 Series relays are subminiature, hermetically sealed armature relays featuring low profile, .275" (6.99mm) high by .370" (9.4mm) square, with .100" grid spaced terminals. The sensitive 134 Series is .375" (9.55mm) high and features ultra-low coil power dissipation. Both Centigrids® feature all-welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATE (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
114*	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
114D*	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
114DD*	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450
134*	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
134D*	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
134DD*	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200

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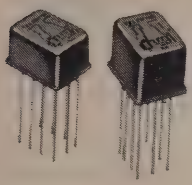
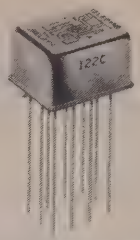




CMOS Compatible Centigrid®
TR® Established Reliability Relays

- **CMOS compatible general purpose 116C Series**
- **CMOS compatible sensitive 136C Series**
- **CMOS compatible magnetic latching 122C Series**

CMOS compatible Centigrid® relays are subminiature, hermetically sealed, armature relays capable of being directly driven by most IC logic families. Their low profile height and .100" grid spaced terminals, which precludes the need for spreader pads, make them ideal for applications where extreme packaging density and/or close PC board spacing are required. The 116C and 136C Series incorporate internal silicon planar epitaxial type diodes for coil suppression, zener diodes to protect the MOSFET gate inputs, and N-channel enhancement-mode MOSFET chips. The 122C, which incorporates the same interface circuitry as the 116C and 136C, is a magnetic latching relay which is actuated by a short duration voltage pulse. The magnetic "memory" of this device precludes the need for constant bias and or battery backup in the event of system power failure.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATE (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
116C*	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450
136C*	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200	200
122C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 120, 280, 500, 1130, 2000	335

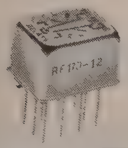
Teledyne Part Numbering System

XXXXX — XX X*

SERIES COIL VOLTAGE RELIABILITY LEVELS A or B (See below)

Reliability Levels applicable to TR® Relays only (indicated by asterisk).

RELIABILITY LEVEL	FAILURE RATE % / 10,000 CYCLES
A	1.5
B	0.75



RF Relays

- **RF120 Series Aerospace Centigrid® Relays**
- **RF170 Series Commercial Centigrid® Relays**

The RF120 and RF170 Series relays are subminiature, hermetically sealed Centigrid® relays featuring extremely low intercontact capacitance that have been optimized to provide exceptional RF performance over the full UHF spectrum. These Series combine microwave switching capability with Teledyne Relays' superior all-welded construction, proven magnetic-latching design, and high force/mass ratios for ruggedness and performance stability in severe environments. Gold plated precious metal contacts ensure reliable DC switching from low-level to 1/2 amp, as well as low, stable insertion loss.

SERIES	CONTACT DATA			TYPICAL RF DATA AT 1 GHz			COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	INTERCONTACT CAPACITANCE (pf. TYP.)	ISOL (dB)	INS. LOSS (dB)	VSWR	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL POWER (mW)
RF120 RF170	2 FORM C	0.5	0.02	45	.15	1.10:1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

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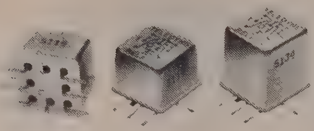
2

TELEDYNE RELAYS

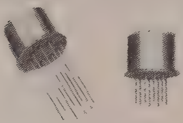


Surface Mount Centigrid® Aerospace Relays

- General purpose S114 Series
- Sensitive S134 Series

Teledyne Relays S114 and S134 Series are subminiature, hermetically sealed, surface mountable relays, which combine the proven reliability of the Centigrid® Series relays with pre-tinned leads specifically formed in compliance with MIL-STD-454 to make them ideal for all types of surface mount reflow processes. The basic design and internal construction are identical to the 114 & 134 Series Centigrid® relays as described on Page 1.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATE (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
S114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450
S134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200



High Environmental Aerospace TO-5 Relays

Designed to withstand severe environmental conditions of shock, vibration, or elevated temperature in excess of normal military specification levels. The following versions are available, all of which are capable of meeting the other requirements of MIL-R-39016:

412H Series--High Temperature (200°C)
412K Series--High Shock (4000 g's/0.5ms)
412V Series--High Vibration (380 g's @ 200 Hz)
432H Series--High Temperature (200°C)
432V Series--High Vibration (380 g's @ 200 Hz)
422H Series--High Temperature (200°C)
422K Series--High Shock (2000 g's/0.5ms)

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATE (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
412H		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
412K		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 80, 160, 300, 600, 1350	500
412V		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130	525
432H	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
432V		2 FORM C	1	5, 6, 9, 12, 18, 26.5	80, 120, 240, 480, 950, 1900	370
422H	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
422K		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

High Current (2 Amperes) Aerospace TO-5 Relays

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATE (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
212	2 FORM C	2	5, 12, 26.5	28, 200, 800	820

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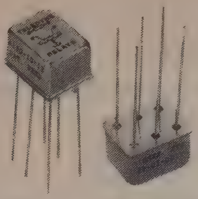
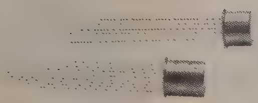


TELEDYNE RELAYS

Ultraminiature Attenuator Relays

The A150 is an ultraminiature attenuator relay designed for operation in 50 ohm systems over a usable frequency range of DC to 3 GHz. The attenuation values vary from 1 - 20 dB and can be used singly or in combination to achieve any value desired. In the de-energized position the A150 provides a "0 loss" path. The energized position is a predetermined attenuation value which eliminates the need for external resistors.

SERIES	COIL VOLTAGE	ATTENUATION VALUES (dB)	IMPEDANCE (Ohms)	FREQUENCY RANGE	INSERTION LOSS (dB)	VSWR	
						THROUGH PATH	ATTENUATED PATH
A150	5, 12, 15, 26.5	1, 2, 4, 8, 10, 16, 20	50	DC-3 GHz	0.55 MAX.	1.30 MAX.	1.45 MAX.



Commercial/Industrial TO-5 Relays

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATE (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
712		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712TN		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
732	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732TN		2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
720/722	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
720D/722D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

Low Cost 172 Series Centigrid® Commercial/Industrial Relays Standard and Surface Mount

Low cost commercial versions of the DPDT Established Reliability Centigrid® relays. Hermetic sealing, all welded construction, and gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMP @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	TYPICAL OPERATING POWER (mW) AT RATED VDC
172	2 FORM C	1	5, 12, 26.5	64, 400, 1600	395
172D	2 FORM C	1	5, 12, 26.5	64, 400, 1600	395
S172	2 FORM C	1	5, 12, 26.5	64, 400, 1600	395
S172D	2 FORM C	1	5, 12, 26.5	64, 400, 1600	395

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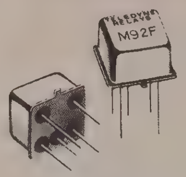
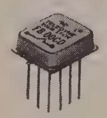
TELEDYNE SOLID STATE

Part Selection Guide For Military Solid State Relays

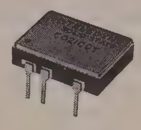
PACKAGE STYLES



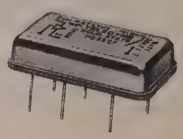
M92F/M93F



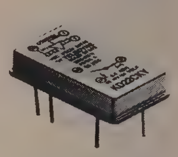
FB



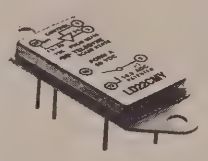
CA/CD



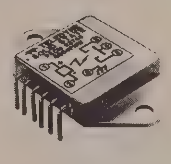
HD/682/683



KA/KD/M33



LA/LD



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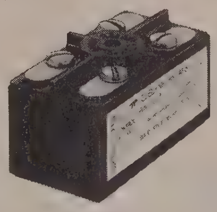

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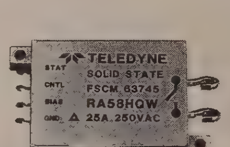

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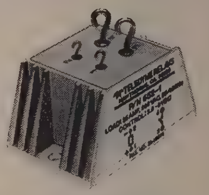

652

	SERIES/MODEL #	MAX. OUTPUT RATING
DC OUTPUT	M93F	135 mA/400 V to 350 mA/100 V②
	683-1	.6 A/50 V③
	CD	2 A/60 V①②
	HD	2 A/60 V①
	KD	5 A/60 V①
	M33-2N	6.5 A/60 V
	LD	10 A/60 V①
BI-DIRECTIONAL OUTPUT	M92F	90 mA/400 V to 240 mA/100 V②
	FB	.25 A/350 V to 1 A/80 V②
	QB00FM	10 A/150 V
AC OUTPUT	682-1	2 A/250 Vrms③
	CA	1 A/250 Vrms
	KA	2 A/250 Vrms①
	LA	7.5 A/250 Vrms①
	602-1	10 A/250 Vrms②
	652	25 A/250 Vrms③
	RA	25 A/250 Vrms①

Notes:

① Available with "smart" options: status, short circuit protection, or thermal protection.
② Covered by DESC drawing. See catalog sheet for drawing number.
③ Qualified to MIL-R-28750. See catalog sheet for slash sheet number.

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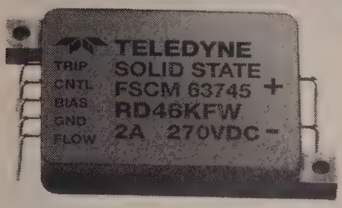
Military Solid State Relays

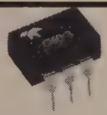


- Temperature-Independent Current Rating and Overload Protection
- Integrated Short Circuit Protection
- Surge Tolerant Overcurrent Protection Prevents Nuisance Tripping
- Optically Isolated Output and Status Lines
- Output Capable of Sourcing and Sinking Load Current
- Extremely Low ON Resistance
- Flow and Trip Status
- TTL-CMOS Compatible Control
- Meets Surge and Spike Requirements of MIL-STD-704

RD/VD Series
28 and 270 Vdc Solid State Power Controllers

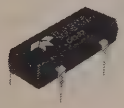
PART NUMBER	DESCRIPTION
RD46CF	28 Vdc, 2A Power Controller
RD46CK	28 Vdc, 5A Power Controller
RD46CL	28 Vdc, 7.5A Power Controller
VD46CM	28 Vdc, 10A Power Controller
VD46CN	28 Vdc, 15A Power Controller
VD46CQ	28 Vdc, 25A Power Controller
RD46KD	270 Vdc, 1A Power Controller
RD46KF	270 Vdc, 2A Power Controller
VD46KK	270 Vdc, 5A Power Controller
VD46KL	270 Vdc, 7.5A Power Controller
VD46KM	270 Vdc, 10A Power Controller

Commercial/Industrial Solid State Relays



Subminiature Optically Coupled Solid State Relays in 6 PIN DIP Packages Available in Surface and Through Hole Mount

TELEDYNE PART NUMBER	CONTROL RATINGS		MAXIMUM LOAD RATINGS			
	TYPICAL CURRENT (mA)	MAXIMUM CURRENT (mAdc)	TYPE (AC/DC)	CURRENT	VOLTAGE	
				@ MAXIMUM INPUT VOLTAGE	CONTINUOUS	TRANSIENT (PEAK)
C60-1	10 @ 1.5 Vdc	50	DC	1.0 Adc	± 50 Vdc	± 50 Vdc
C60-2	10 @ 1.5 Vdc	50	DC	0.75 Adc	± 90 Vdc	± 90 Vdc
C60-3	10 @ 1.5 Vdc	50	DC	0.40 Adc	±180 Vdc	±180 Vdc
C60-4	10 @ 1.5 Vdc	50	DC	0.25 Adc	±360 Vdc	±360 Vdc



Subminiature Optically Coupled Solid State Relays in Standard DIP Packages

TELEDYNE PART NUMBER	CONTROL RATINGS		MAXIMUM LOAD RATINGS			
	VOLTAGE (Vdc)	MAXIMUM CURRENT (mAdc)	TYPE (AC/DC)	CURRENT	VOLTAGE	
				@ MAXIMUM INPUT CURRENT	CONTINUOUS	TRANSIENT (PEAK)
C45-31	5 mA @ 1.5	50	AC	1.0 Arms	250 Vrms	600 Vpeak
C45-32	10 mA @ 3.0	50	AC	1.0 Arms	250 Vrms	600 Vpeak
C45-33	3.5 @ 10 mA	50	AC	1.0 Arms	250 Vrms	600 Vpeak

FET Output Featuring Low On-Resistance

C46F-10	3.8 – 32	12	Bi-Directional	1.0 A	± 50 Vdc	± 50 Vdc
C46F-20	3.8 – 32	12	Bi-Directional	0.75 A	± 90 Vdc	± 90 Vdc
C46F-30	3.8 – 32	12	Bi-Directional	0.4 A	±180 Vdc	±180 Vdc
C46F-40	3.8 – 32	12	Bi-Directional	0.25 A	±360 Vdc	±360 Vdc
C47F-10	3.8 – 32	12	DC	1.75 A	50 Vdc	50 Vdc
C47F-20	3.8 – 32	12	DC	1.0 A	90 Vdc	90 Vdc
C47F-30	3.8 – 32	12	DC	0.6 A	180 Vdc	180 Vdc
C47F-40	3.8 – 32	12	DC	0.4 A	360 Vdc	360 Vdc

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TELEDYNE SOLID STATE

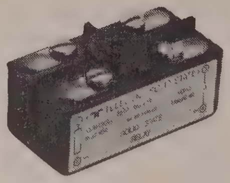
Commercial/Industrial Solid State Power Relays

601 Series – Optically Isolated, Zero Voltage Turn-On 5 and 10 Amps

UL Recognized — File #E59547
CSA Certified — File #31043

CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE		MAXIMUM LOAD CURRENT RATING & PART NUMBERS	
	CONTINUOUS Vrms	TRANSIENT Vpk	5 A	10 A
3-32 Vdc	250	500	601-1	601-2
	250	600	601-1H	601-2H

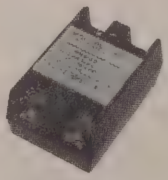
603 Series – Optically/Transformer Isolated



MAXIMUM LOAD CURRENT RATING AND PART NUMBERS		CONTROL VOLTAGE RANGE	ISOLATION	MAXIMUM LOAD VOLTAGE
2 Adc	5 Adc			
603-1	603-2	3-32 Vdc	Optical	50 Vdc
603-21*	603-22*	3-32 Vdc	Optical	50 Vdc
—	603-3	4-10 Vdc	Transformer	250 Vdc
—	603-4	10-32 Vdc	Transformer	250 Vdc
603-11	603-12	90-250 Vac	Optical	50 Vdc

* Note: 603-21, -22 have controlled rise and fall time.

613 Series – High Current, Transformer Isolated



TELEDYNE PART NUMBER	CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT
613-1	4-10 Vdc	50 Vdc	20 Adc
613-2	10-32 Vdc		

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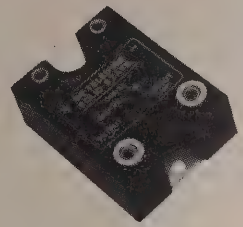
TELEDYNE SOLID STATE

Commercial/Industrial Solid State Power Relays

C15 Series – Optically Isolated, Zero Voltage Turn-On, Zero Current Turn-Off 10, 25, and 40 Amps

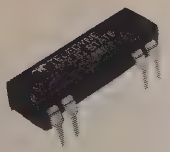


CONTROL VOLTAGE RANGE	OUTPUT (LOAD) CURRENT RATING & PART NUMBER			MAXIMUM LOAD VOLTAGE	
	10 A	20 A	40 A	CONTINUOUS (RMS)	TRANSIENT (PEAK)
3 - 32	C15-31	C15-32	C15-33	250	600

- **TTL Logic Compatible Input**
- **High Dielectric Isolation**

Solid State Computer Input/Output Interface Modules

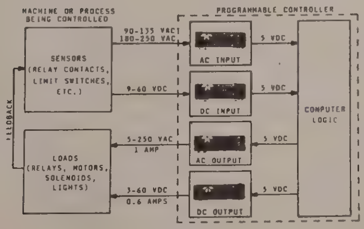
C76 DIP I/O™ System
Optically Isolated — TTL/CMOS Logic Compatible Control



- **Enable Function on Inputs**
- **High Noise Immunity**
- **Meets VDE Voltage and Spacing Requirements**
- **TO-116 DIP Package (16 pin)**

PART NUMBER	TYPE	CHARACTERISTICS
C76A0-1	AC Output	3.8-16 Vdc Input 5-250 Vrms, 1 A Output
C76AI-1	AC Input	90-135 Vrms and 180-250 Vrms Inputs
C76D0-1	DC Output	3.8-16 Vdc Input 3-60 Vdc, 0.6 A Output
C76DI-1	DC Input	9-60 Vdc Input

C76 HYBRID I/O INTERFACE SYSTEM


MACHINE OR PROCESS BEING CONTROLLED
PROGRAMMABLE CONTROLLER
SENSORS (RELAY CONTACTS, LIMIT SWITCHES, ETC.)
LOADS (RELAYS, MOTORS, SOLENOIDS, LIGHTS)
FEEDBACK
90-135 VAC 180-250 VAC
9-60 VDC
5-250 VAC 1 AMP
3-60 VDC 0.6 AMPS
AC INPUT
DC INPUT
AC OUTPUT
DC OUTPUT
5 VDC
5 VDC
5 VDC
5 VDC
COMPUTER LOGIC

Teledyne Solid State C76 DIP I/O™ Modules are designed for use in computerized control systems for noise-free isolated interfacing of computer logic elements to harsh industrial environments. Modules employ custom microcircuits in a TO-116 DIP. Eliminates mounting tracks for low "per-point" cost. Meets VDE requirements. Features CMOS and TTL compatibility, optical isolation, high noise immunity and an ENABLE function on input modules. For use in robotics, computerized process control, machine tool control, programmable controllers and ATE.

TELEDYNE SOLID STATE

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Detailed Specifications on any of our products or a complete catalog are available on request.

OPTICALLY ISOLATED SOLID STATE RELAYS

Customized for medium and high-power needs and

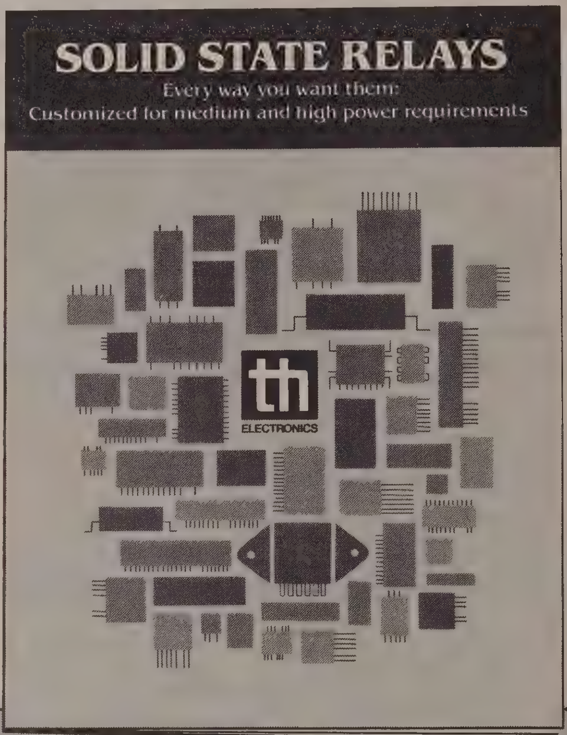
Off-the-shelf • Competitively cost-effective • On-time delivery • Performance-proven reliability • Dialogic engineering

WHAT YOU WANT IS WHAT YOU GET... Maximum customizing-power -- including the "smart" options! Now we enable you to practically "design your own" SSR.

The basic building blocks of an OISSR are:

- LED input network
- PDA generator (including Turn-Off circuit)
- MOSFET/IGBT/SCR output section

Using these, plus any other elements required, we at TH can manufacture for you a relay that precisely fulfills your custom needs.


SOLID STATE RELAYS
Every way you want them:
Customized for medium and high power requirements
th
ELECTRONICS

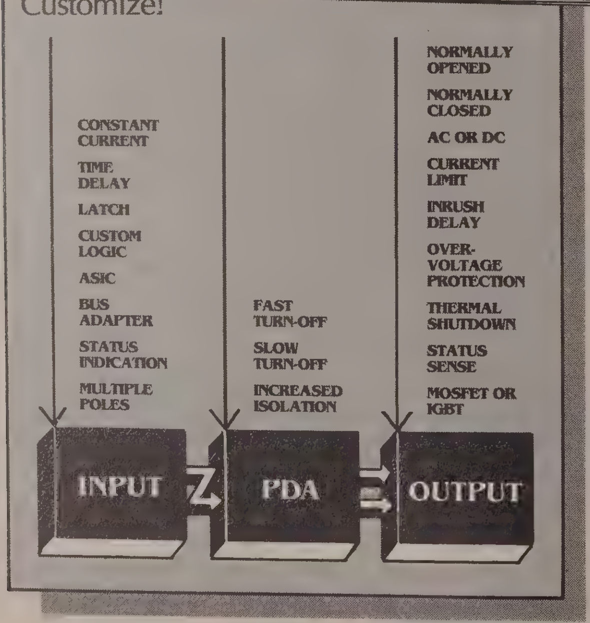
The variables you can "play with" are:

- **Output elements** (MOSFETs, IGBTs or SCRs) to match your load needs
- **Packages** (SIP, DIP, power pack, or your-choice design) to create the power dissipation and form factor you need
- **Input stages** (3V logic, 5V logic, or constant current) to fit your system signal levels.

From your concept - or your-and-our dialogized idea – to a sample in your hands ... 6 to 8 weeks! ... The time it takes some companies to give you a quote!

Talk to us - we love to serve!

Customize!


CONSTANT CURRENT
TIME DELAY
LATCH
CUSTOM LOGIC
ASIC
BUS ADAPTER
STATUS INDICATION
MULTIPLE POLES
FAST TURN-OFF
SLOW TURN-OFF
INCREASED ISOLATION
NORMALLY OPENED
NORMALLY CLOSED
AC OR DC
CURRENT LIMIT
INRUSH DELAY
OVER-VOLTAGE PROTECTION
THERMAL SHUTDOWN
STATUS SENSE
MOSFET OR IGBT
INPUT
PDA
OUTPUT

Compare!

	MOSFETS	BIPOLARS
Temperature coefficient	Positive: thermal stability	Negative: thermal runaway
Safe operating area	No secondary breakdown	Pronounced secondary breakdown
Gain variance	±20% from −55 to +125°C	Changes by 2 to 3 times from −55 to +125°C
Leakage current	Low at high temperature — high upper temperature operating limit (175 to 200°C)	Gain multiplication at high temperature — medium upper temperature limit (125 to 150°C)
Switching time	Independent of temperature	Changes by 2 to 3 times from 25 to 125°C
Turn-on signal	High voltage, low current — easier circuitry	Low voltage, high current
Latch	Do not latch, easy to turn on and off	SCRs and Triacs latch Main power must be turned off before reuse
False turn-on	Do not misfire by rise in temperature	SCRs and Triacs can misfire by rise in temperature
Paralleling	Direct paralleling	Need current sharing resistors

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SOLID STATE RELAY DIVISION, 97 Gannet Drive, Commack, NY 11725 • Tel: 516-543-7161 • Fax: 516-543-7162
TONG HSING ELECTRONIC INDUSTRIES, LTD., 85 Yenping Road So., Taipei, Taiwan • Tel: (02) 371-1101 • Fax: (02) 361-6670

TRIRIDGE CORP. REED RELAYS

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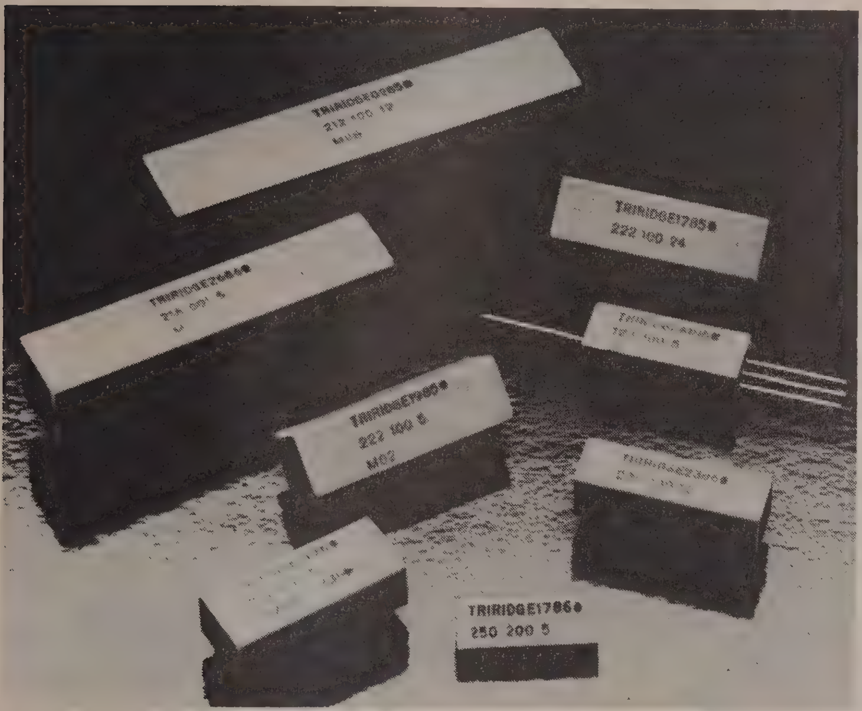
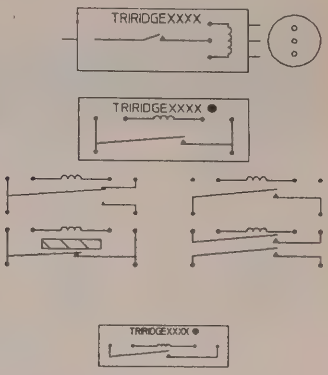
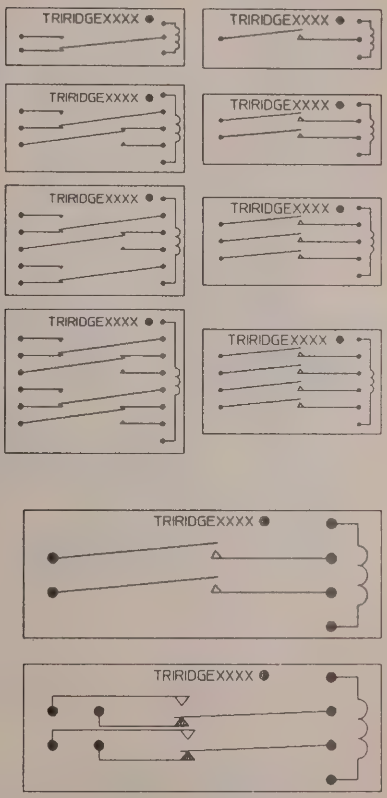

TRIRIDGE1785●
222 100 24
TRIRIDGE1785●
222 100 5
TRIRIDGE1786●
250 200 5


TRIRIDGEXXXX
TRIRIDGEXXXX ●
TRIRIDGEXXXX ●

SCHEMATICS - TOP VIEW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TRIRIDGEXXXX ●

Axial Lead Small:
101 - High Sensitivity - 1 thru 3 Pole
Radial Lead Small:
203 - High Sensitivity - 1.0 x 15(25.4 x 3.81)
205 - High Sensitivity - 1.0 x .13(25.4 x 3.17)
220 - High Sensitivity - 1.0 x .10(25.4 x 2.54)
222 - High Dielectric - .4 (10.16) C to C
230 - 1-4 Pole True 100 VDC Switching Form C
1.0 x .10(25.4 x 2.54)
260 - Like 220 Series, Parallel Coil Pins
Radial Lead Miniature:
226 & 228 Dip Pluggable .30 x .10(25.4 x 7.62)
250 - High Sensitivity - 1.0 x .10(25.4 x 2.54)
Radial Lead Large.
216 - General Purpose - Options To 50 W
212 - GP High Sensitivity - Options To 50 W

*FULLY MOLDED * LATCHING * DUAL COIL *

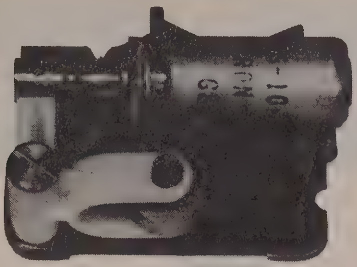
TRIRIDGE CORP. is enjoying it's 25th year as a manufacturer of QUALITY REED RELAYS Extensive use of Computer controlled Manufacturing and Testing, with Total Quality Management assures Efficient Production of REED RELAYS, on time, at Quality Levels you expect. Call, Fax, or Mail your requirements. Be assured of prompt courteous service. For urgent requirements, individual data sheets are sent via Fax.

SOLENOIDS

Manufacturer	Starting EEM Page No.	Model/Series	Linear			Box	Rotary	Proportional (Servo)	Magnetic Latching
			Frame Type						
			C	D	Tubular				
Bicron Electronics	B•1627	Custom	√	√	√				√
Communications Instruments	B•1628	Custom	√		√	√			
Deltrol Controls	B•1630	C	√						
		D		√					
		MED			√				
Densitron Corp.	B•1631				√		√	√	
Dormeyer Industries	B•1632	B4HD	√	√					√
		B11, B18, B20, B21, B22, B25, B24, B41		√		√			√
		C8, C33	√						√
		Laminated		√		√			
		C9, C26, C34	√						√
		P2, P4, P8, P10, P16			√				√
Electro-Mechanisms	B•1636	SP-PO	√	√					
		TSP-TPU			√				
Guardian Electric Manufacturing Co.	B•1638	#2, #2HD, #3HD, #4HD, #11HD, #28HD		√		√			
		#24, #26, #34, #42	√						
		#4, #11, #22, #28		√		√			√
		T3.5x9 —LT12x19			√				
Liberty Controls	B•1644		√	√	√	√			√
Lucas Ledex	B•1647		√	√	√	√	√		√
Magnet-Schultz	B•1652	312		√		√			
		R12 x 12			√				
		GDAY					√		
		547	√						
		GRFY						√	
		312	√	√	√	√	√	√	√
OakGrigsby	B•1654	2E-6S					√		
		34-42				√			
		C7-18/C24-38			√				

LINEAR MOTION SOLENOIDS

INFORMATION



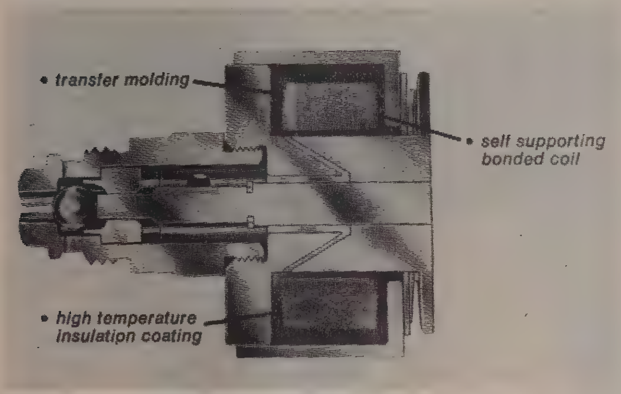
BICRON™

"Excellence Through Teamwork"

IMPORTANT ADVANTAGES FOR YOUR PRODUCT

- High Performance at High/Continuous Duty—Power Levels
- Tough—Durable—Dependable
- Exceptional Force vs. Size
- Harsh Environment Applications
- Mil-S-4040 Capability
- Value Priced
- ISO 9001 Quality System

QUALITY/RELIABILITY DESIGNED INTO BICRON SOLENOIDS:


• transfer molding
• self supporting bonded coil
• high temperature insulation coating

FOR YOUR DESIGN

- Custom Designed Configurations to
- Your Requirements
  - Power
  - Envelope
  - Temperature
  - Submersible
- Your Construction
  - Box Frames
  - C Frames
  - Tubular Frames
  - Poppet Valves
- Your Insulation Systems
  - Including Class H

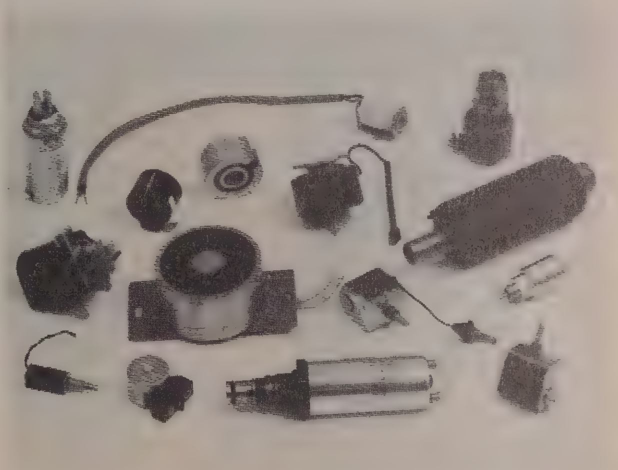
BICRON, established in 1964, is a manufacturer of "Modified Standard" and "Special Solenoids". Our products have found application in the Aerospace, Automotive, Door Hardware, Medical, Military, Off-highway and Trucking markets. The Total Quality Management process at BICRON has enabled us to be certified by numerous customers.

WITH BICRON

- Custom Designed Products at Standard Product Prices
- Personal Indepth Commitment
- Design Engineer Assigned to Your Project Until Completion
- Fast Prototype Deliveries
- Capacity to Meet Your Most Demanding Production Runs
- Proven Computer Aided Designs
- State of the Art Machining and Tooling Facilities
- 25 Years Solenoid Product Know-How

CUSTOM SOLENOIDS

We provide the expertise you expect and the delivery you require.



A selection of products produced for many of our OEM customers.

FOR TECHNICAL ASSISTANCE

CALL 203/824-5125
FAX 203/824-1137

FREE LITERATURE AVAILABLE

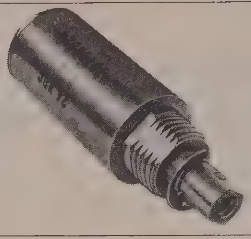
Application and Design Notes
Specification Guidelines

Bicron Electronics Co.

50 Barlow Street
Canaan, CT. 06018

Tubular Solenoids*

PULL-TYPE



D.C. tubular pull-type solenoid is designed to provide up to 90 lbs. of force with a maximum stroke of .500 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 6 to 115 VDC with a continuous duty power level of 2.2 to 54 watts and an intermittent duty power level of 12 to 585 watts.

PUSH-TYPE

D.C. tubular push-type solenoid provides up to 50 lbs. of force with a maximum stroke of .562 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 6 to 115 VDC with a continuous duty power level of 3 to 36 watts and an intermittent duty power level of 9 to 240 watts.

SWITCH-TYPE

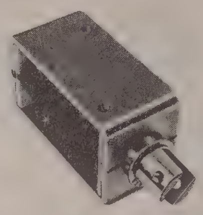
D.C. tubular switch-type solenoid provides up to 120 lbs. of force with a maximum stroke of 1 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 12 VDC to 115 VDC. Each solenoid utilizes two coils, one energized at pull-in for extra force and a holding coil for continuous operation. Intermittent pull-in duty power level is 112 to 700 watts and continuous power level of 3 to 14 watts.

Box & C-Frame Solenoids

BOX-FRAME (PULL-TYPE)

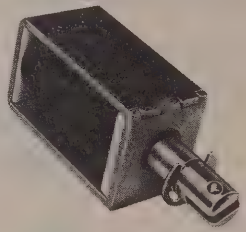


D.C. box-frame pull-type solenoid. Provides up to 170 ozs. force with a maximum stroke of .250 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 6 to 115 VDC with a continuous duty power level of 8 watts and an intermittent duty power level of 18 watts. Pulse-type coils are also available.

BOX-FRAME (PUSH-TYPE)

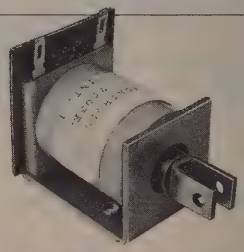


D.C. box-frame push-type solenoid. Provides up to 20 ozs. force with a maximum stroke of 200 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 6 to 115 VDC with a continuous duty power level of 3.0 watts and an intermittent duty power level of 9.0 watts.

C-FRAME



C-frame (open) pull-type solenoid, available for DC or AC operation, is designed to provide up to 65 oz. (D.C.) — 34 oz. (A.C.) with a maximum stroke of .250 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 6 to 115 VDC and 6 to 240 VAC with a continuous duty power level of 5 watts (D.C.) — 7 VA (A.C.) and an intermittent duty power level of 15 watts (D.C.) — 20 VA (A.C.)

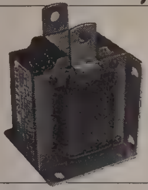
*Formerly Manufactured by WESCO

CII™ Communications Instruments, Inc.
P.O. Box 520 • Fairview, North Carolina 28730
(704) 628-1711 • TELEX 577436 • FAX (704) 628-1439

See Volume B Section 4500 for CII Relays

AC Solenoids*

100 SERIES (PULL-TYPE)



The **100 Type AC** laminated solenoids provide up to 6 lbs. of force with a stroke of .875 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 24 to 230 VAC and power levels of 230 VA to 550 VA.

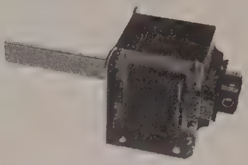
200 SERIES (PULL-TYPE)

The **200 Type AC** laminated solenoids provide up to 20 lbs. of force with a stroke of 1 in.

Actual usable force will depend on the stroke and power level.

Coils are available from 24 to 440 VAC and power levels of 518 VA to1840 VA.

100 & 200 SERIES (PUSH-TYPE)

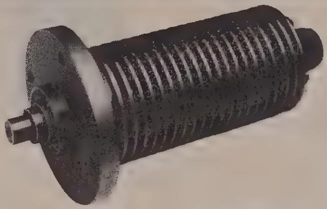


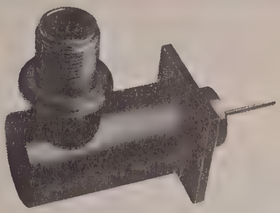
By utilizing a stainless steel shaft the **100 and 200 Series** are available as push-type solenoids. The solenoids provide up to 20 lbs. of force with a stroke of 1 in.

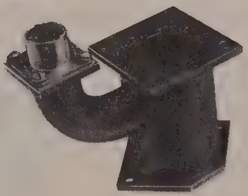
Actual usable force will depend on the stroke and power level.

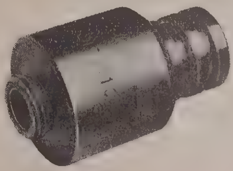
Coils are available from 24 to 440 VAC and power levels of 230 to 1840 VA.

Custom Solenoids*









Communications Instruments, Inc., can provide customized solenoids with many of the following features:

SOLENOID STYLES

- High temperature
- 400 Hz AC
- Commercial AC
- Air frame
- Heavy duty
- Pressure sealed

CONNECTOR STYLES

- Flexible leads
- Connector assemblies
- Right angle AN connectors
- Square flange AN connectors
- Screw terminals
- Solder terminals
- Stud terminals

MOUNTING STYLES

- Round flanges
- Square flanges
- Threaded flanges
- Shaped flanges

PLUNGER STYLES

- Internal threads
- External threads
- Clevice plungers
- Extension plungers

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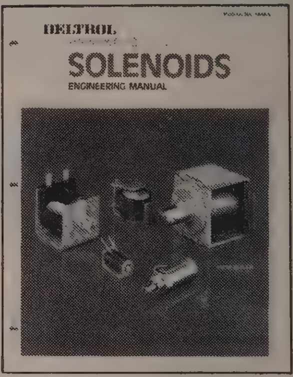
DELTROL SOLENOIDS

SEE SECTION 4500 FOR RELAYS



DELTROL

SOLENOIDS

ENGINEERING MANUAL

Deltrol Controls offers a wide selection of popular solenoid models which produce linear push and pull motion. They are categorized in three frame designs – "C", "D", and "ME" (tubular). Designers specify Deltrol solenoids because of their quality and proven reliability in literally thousands of OEM applications.

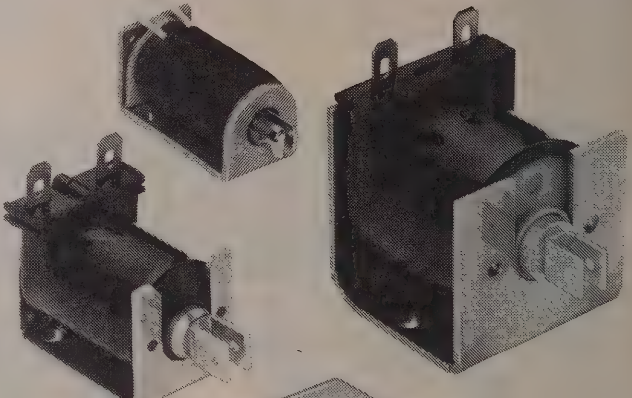
Depending on specific product design requirements, Deltrol will provide "special type solenoids" on request. It is important that complete data on the solenoid be submitted for design proposal requirements. In addition, factory engineering assistance is available when the customer finds it difficult to determine all of the operational requirements of a solenoid which are needed for a particular requirement. Our test laboratory is equipped to make accurate stroke-force, temperature rise or other tests required on a solenoid for special application.

We urge you to call, write or fax your request for our extensive Solenoids Engineering Manual, Bulletin 1846-9.

ALL DELTROL SOLENOIDS ARE MADE IN THE U.S.A.

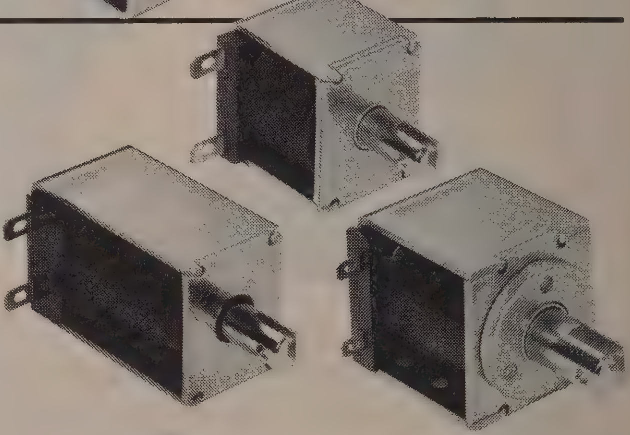
"C" FRAME SOLENOIDS

This category of solenoids is designed primarily for volume applications (appliances, vending machines, valve operators, etc.) where low cost is essential. Many of the types listed incorporate molded coils as a standard feature. Long operational life (in the millions of cycles) can be expected in most applications because of the low friction, high wear capabilities of the plastic plunger guides which are provided. Residual magnetism characteristics are kept to a minimum by using high quality magnetic iron in the frames, plungers and backstops.



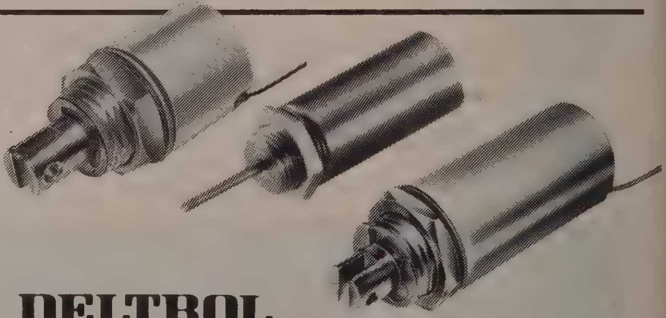
"D" FRAME SOLENOIDS

This group of solenoids is the "standard" of the industry for high quality applications (business machines, tape decks, industrial controls, recorders, etc.) Molded coils are standard on some types and available without premium on others. High permeability iron is used exclusively providing fast, reliable operation and negligible residual magnetism. Hard finish on plungers and low friction metal or plastic guides promote long, reliable life expectancy. "D" frame construction provides excellent magnetic characteristics for high operating efficiency, particularly in DC applications.



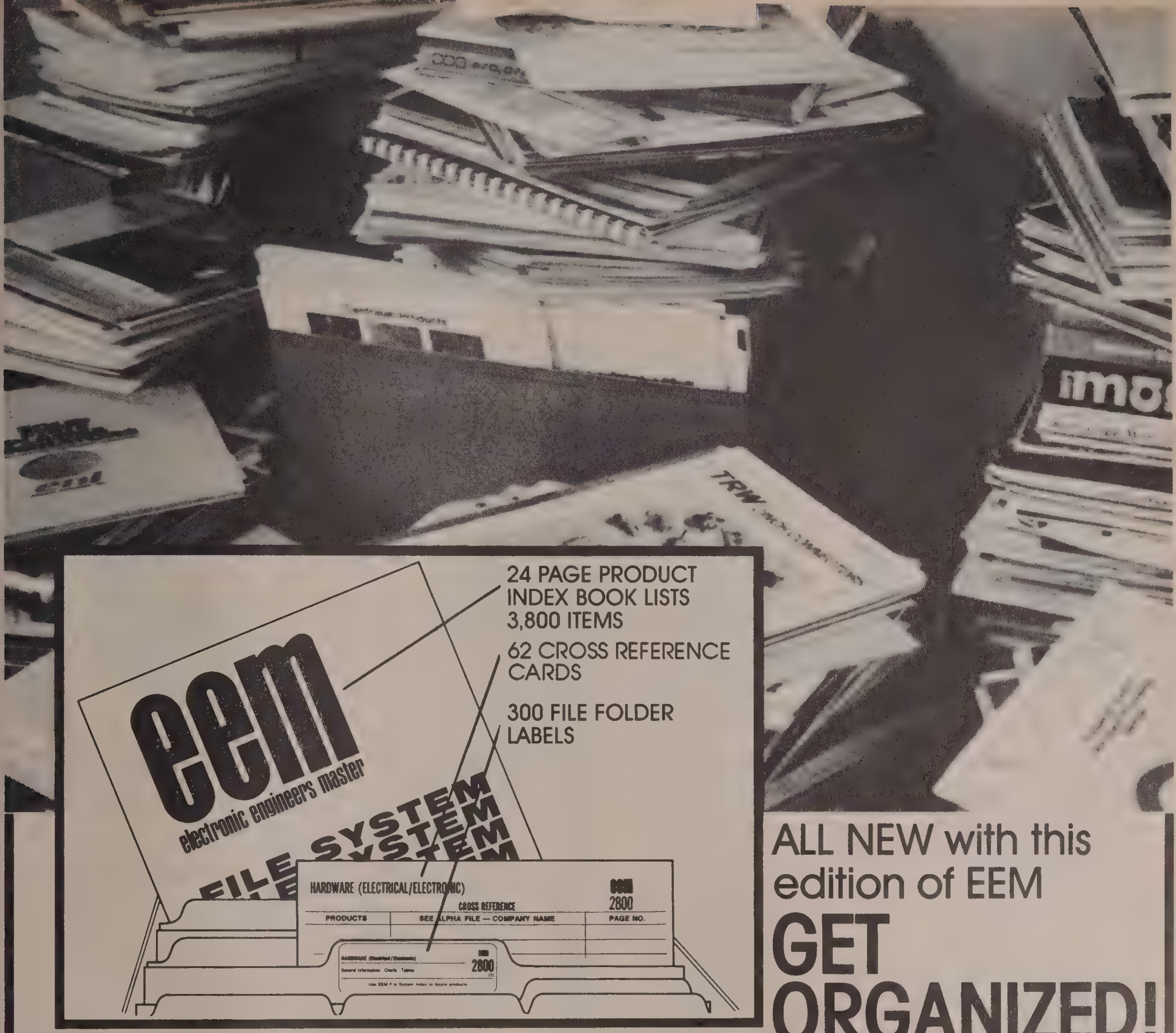
"ME" FRAME SOLENOIDS

For DC applications only. Designed to provide greatest possible force in limited space. Solenoids are completely metal enclosed and are highly resistant to shock, vibration and moisture. All units available in "pull" or "push" types are standard. Stock types incorporate Class B temperature rated insulation. Plunger guides are wear-resistant plastic with optional stainless steel. Low plunger mass and high magnetic power provide fast, accurate response. Easy mounting with threaded bushings and hardware provided.



DELTROL controls
DIVISION OF DELTROL CORP

2745 S. 19th St., Milwaukee, WI 53215,
Phone (414) 671-6800, Fax (414) 671-6809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electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
eem
2800
TRW

ALL NEW with this edition of EEM

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with the System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will be mailed to you under separate cover.

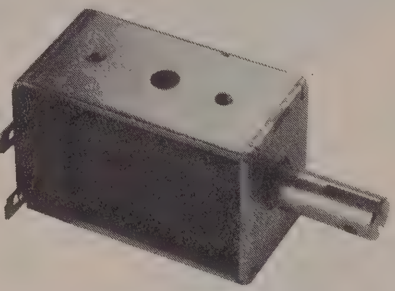
Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

Dormeyer Industries

High Volume Production

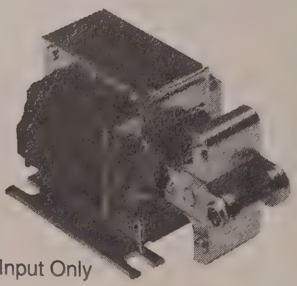
BOX-FRAME SOLENOIDS



- ☐ AC or DC Input Versions
- ☐ Available in Magnetic Latch
- ☐ Moderate-to-Long Life
- ☐ Versatile Mounting
- ☐ Encapsulated Coils Available
- ☐ Wide Range of Sizes
- ☐ Higher Force than C-Frame
- ☐ Suitable for Wide Range of Applications

PART NUMBER	INPUT VOLT.	DUTY CYCLE	COIL RES. (Ohms)	FORCE (oz.) @1/8"	DIMENSIONS (Inches) L. x W. x H.
B4HD-253-M-36	24DC	CONT	57.5	110	2.177 X 1.625 X 1.570
B4HD-753-M-36	24DC	INT	19	140	
B4HD-1-M-36	120AC	CONT	292	27	
B4HD-501-M-36	120AC	INT	19.3	62	
B11-253-M-36	24DC	CONT	73	17	1.860 X 0.937 X 1.182
B11-753-M-36	24DC	INT	30.5	34	
B11-1-M-36	120AC	CONT	192	22	
B11-501-M-36	120AC	INT	79.2	33	
B18-259-A-3	24DC	CONT	119	3	0.750 x 0.765 x 0.750
B18-759-A-3	24DC	INT	93.5	4	
B18-7-A-3	120AC	CONT	1500	2	
B18-507-A3	120AC	INT	964	4	
B20-253-A-3	24DC	CONT	99	4.26	1.140 x 0.937 x 0.812
B20-753-A-1	24DC	INT	49	13.5	
B20-1-A-1	120AC	CONT	580	8	
B20-501-A-1	120AC	INT	338	15	
B21-253-A-1	24DC	CONT	72.3	18	1.203 x 1.312 x 1.312
B21-753-A-1	24DC	INT	28	44	
B21-1-A-1	120AC	CONT	234	16	
B21-501-A-1	120AC	INT	124	30	
B22-253-M-36	24DC	CONT	66	28	1.609 x 1.468 x 1.312
B22-753-M-36	24DC	INT	22	80	
B22-1-M-36	120AC	CONT	119	16	
B22-501-M-36	120AC	INT	45	44	
B24-253-A-1	24DC	CONT	60	32	2.000 x 1.312 x 1.312
B24-753-A-1	24DC	INT	25.4	64	
B24-1-A-1	120AC	CONT	173	6	
B24-501-A-1	120AC	INT	67.2	17	
B25-253-A-1	24DC	CONT	46	60	2.500 x 1.468 x 1.312
B25-753-A-1	24DC	INT	22	82	
B25-1-A-1	120AC	CONT	121	4	
B25-501-A-1	120AC	INT	46	16	
B41-253-A-1	24DC	CONT	46	14	3.051 x 2.028 x 1.732
B41-753-A-1	24DC	INT	14	16	

LAMINATED SOLENOIDS



- ☐ AC Input Only
- ☐ High Force
- ☐ Moderate Life for Dependability
- ☐ Five Sizes
- ☐ Pull Force up to 23 lbs.
- ☐ Encapsulated coils available

PART NUMBER	INPUT VOLT.	DUTY CYCLE	COIL RES. (Ohms)	FORCE (oz.) @1/8"	DIMENSIONS (inches) L. x W. x H.
1000-M-1	120AC	CONT	88	48	1.609 x 1.188 x 1.438
1500-M-1	120AC	INT	58	72	
1001-M-1	240AC	CONT	354	48	
1501-M-1	240AC	INT	240	72	
1250-A-1	120AC	CONT	64	55	1.609 x 1.472 x 1.438
1750-A-1	120AC	INT	40.5	104	
1251-A-1	240AC	CONT	258	55	
1751-A-1	240AC	INT	161	104	
2005-M-1	120AC	CONT	20.5	128	2.500 x 1.811 x 2.060
2255-M-1	120AC	INT	18.3	160	
2006-M-1	240AC	CONT	82	128	
2255-M-1	240AC	INT	73.5	160	
2536-M-1	120AC	CONT	14.9	176	2.500 x 2.062 x 2.060
2786-M-1	120AC	INT	11.9	272	
2537-M-1	240AC	CONT	60	176	
2787-M-1	240AC	INT	48	272	
3000-M-1	120AC	CONT	6.5	256	2.937 x 2.375 x 2.937
3500-M-1	120AC	INT	4.8	448	
3001-M-1	240AC	CONT	26	256	
3501-M-1	240AC	INT	19.3	448	

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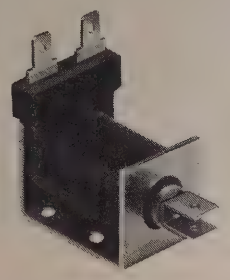
Setting the Standard Since 1945

Custom Designs Available

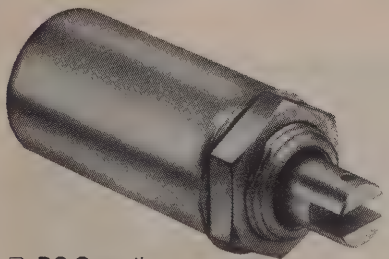
C-FRAME SOLENOIDS



- ☐ Ideal for Most Low Force AC or DC Applications
- ☐ Available in Magnetic Latch
- ☐ Low Cost
- ☐ Wide Range of Sizes
- ☐ Moderate Life with Excellent Electrical Characteristics
- ☐ Encapsulated Coils Available on Most Models

PART NUMBER	INPUT VOLT.	DUTY CYCLE	COIL RES. (Ohms)	FORCE (oz.) @ 1/8"	DIMENSIONS (Inches) L. x W. x H.
C8-271-M-36	24DC	CONT	126	4	1.125 x 0.750 x 0.812
C8-771-M-36	24DC	INT	59	8	
C8-19-M-36	120AC	CONT	840	7.5	
C8-519-M-36	120AC	INT	500	13	
C9-271-M-36	24DC	CONT	69	16	1.062 x 1.375 x 1.406
C9-771-M-36	24DC	INT	37	26	
C9-19-M-14	120AC	CONT	155	23	
C9-519-M-14	120AC	INT	74	46	
C26-271-M-36	24DC	CONT	104	17	1.730 x 0.845 x 1.320
C26-771-M-36	24DC	INT	41.5	35	
C26-19-M-36	120AC	CONT	412	15	
C26-519-M-36	120AC	INT	140	22	
C33-271-M-33	24DC	CONT	76	11	1.363 x 1.312 x 1.140
C33-771-M-33	24DC	INT	37	20	
C33-19-M-33	120AC	CONT	290	14	
C33-519-M-33	120AC	INT	160	22	
C34-271-M-33	24DC	CONT	54	28	1.657 x 1.312 x 1.437
C34-771-M-33	24DC	INT	25	56	
C34-19-M-33	120AC	CONT	128	20	
C34-519-M-33	120AC	INT	55	44	

TUBULAR SOLENOIDS



- ☐ DC Operation
- ☐ Available in Magnetic Latch
- ☐ Bushing Mount
- ☐ Long Life
- ☐ High Reliability
- ☐ High Efficiency
- ☐ Push and Pull Types Standard

PART NUMBER	INPUT VOLT.	DUTY CYCLE	COIL RES. (Ohms)	FORCE (oz.) @1/8"	DIMENSIONS L. x DIA.
P2-1L	12DC	CONT	39	0.75	1.000 x 0.500
P2-101L	12DC	INT	30.5	1.25	
P2-2L	24DC	CONT	168	0.75	
P2-102L	24DC	INT	105	1.25	
P4-1L	12DC	CONT	23.3	9	1.500 x 0.750
P4-101L	12DC	INT	15.3	12	
P4-2L	24DC	CONT	99	9	
P4-102L	24DC	INT	54.5	12	
P8-1L	12DC	CONT	39	.5	2.000 x 0.500
P8-101L	12DC	INT	30.5	.75	
P8-2L	24DC	CONT	168	.5	
P8-102L	24DC	INT	105	.75	
P10-1L	12DC	CONT	23.3	7	2.600 x 0.750
P10-101L	12DC	INT	15.3	12	
P10-2L	24DC	CONT	99	7	
P10-102L	24DC	INT	54.5	12	
P16-1L	12DC	CONT	19.5	20	2.000 x 1.000
P16-101L	12DC	INT	8.4	48	
P16-2L	24DC	CONT	82	20	
P16-102L	24DC	INT	32.9	48	

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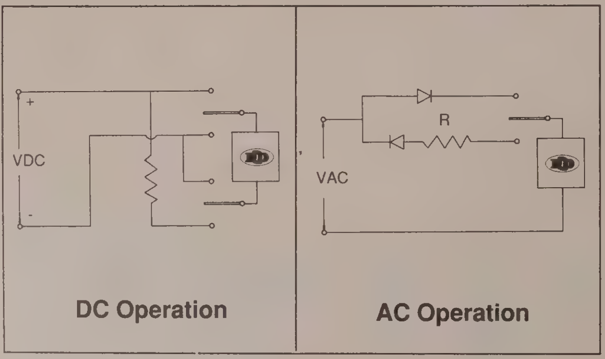
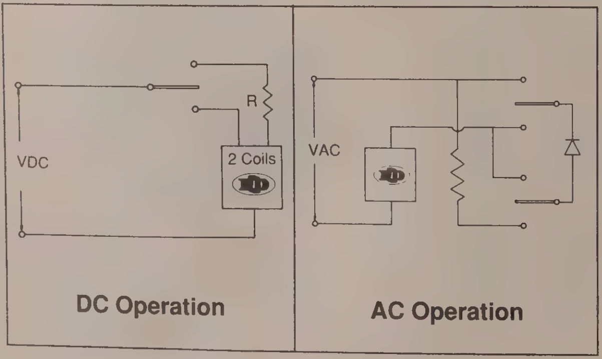
State-of-the Art Magnetic Latching Solenoids

Dormeyer magnetic latching solenoids are available in a variety of styles.

Suggested one coil operation



Suggested two coil operation



Demand is up for energy-saving improvements in powered products. The need to save energy has fueled the electronics industry with the powerful desire to produce more energy-efficient components.

And on the leading edge of the trend is Dormeyer, with the latest and best in Magnetic Latching Solenoid Technology.

A short pulse of power provides the electro-magnet with enough force to pull and hold 20 lbs., saving up to 100% power consumption, depending on the application, while providing a reduction in temperature rise.

Dormeyer's advanced magnetic technology provides 10% more hold and pull force than conventional magnetic latches, with the same life expectancy.

Dormeyer has the flexibility to manufacture custom solenoids that fit exacting requirements. Complete, ready-to-install assemblies are also offered. These products are American-made in Rockville, Indiana.

Applications Include:

- Appliances
- Vending machines
- Business Equipment
- Power distribution
- Disk drives
- Battery-driven Devices
- Security systems
- Fire protection
- Medical equipment, and more

Dormeyer offers a wide range of standard solenoids featuring magnetic latch, with pull forces ranging from 0.4 oz. to 240.0 oz. Tubular, C-frame, and box frame styles are offered. DC or AC input voltage, encapsulated coils, and many termination options are available. All Dormeyer solenoids meet UL and CSA requirements.

Dormeyer is a leading manufacturer offering a variety of quality linear solenoids, including laminated versions which are not available with magnetic latching. The Company produces custom and standard transformers and custom coils as well.

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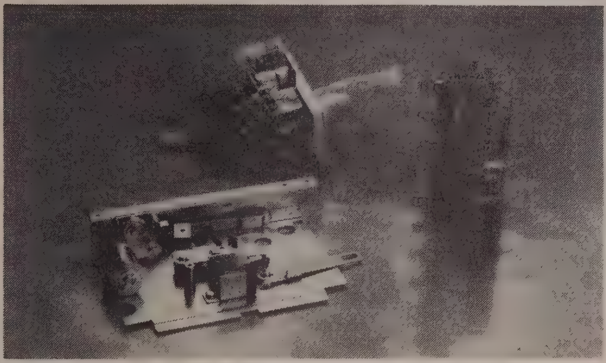
Dormeyer's Versatility

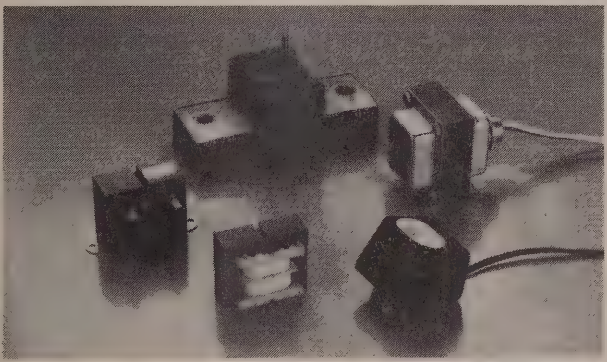


Solenoid Assemblies

Next Level Assemblies/Custom Assemblies

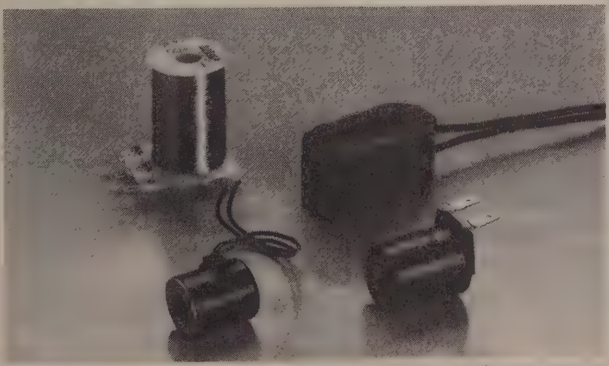
Advantages:

- Lowers Total Acquisition Costs
- Responsibility Falls on One Vendor
- Labor Reduction/Vendor Reduction



Transformers

- Wide Range of AC Input Voltages 120 to 480
- 5 to 55VA
- Multiple Temperature Classes
- UL Listed or Recognized/CSA Certified
- Custom & Standard
- Molded Product Available
- Wide Variety of Termination Options



Coils

- Variety of Finishes Including Molded
- Custom Designs
- Wide Range of Sizes
- Termination Options

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electro-mechanisms
INCORPORATED

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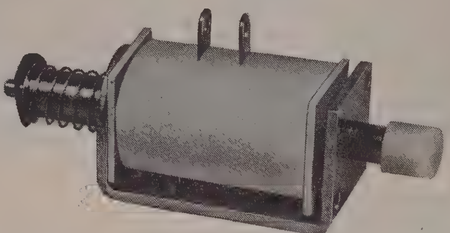
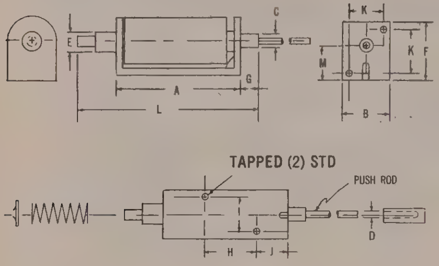
MINI-SOLENOID ACTUATORS



SP SERIES
PUSH TYPE



Wire: .... 155°C Magnet Wire
Termination: .... Heavy Leads — PVC, Type BU, 5". Terminals — Solder Lugs
Tape: .... Mylar
Bobbin: .... 30% Glass Filled Nylon
Tip: .... Delrin
Pushrod: .... Phosphor Bronze
Tol: .... .xxx ±.005

3, 6, 12, 24, 48 VDC

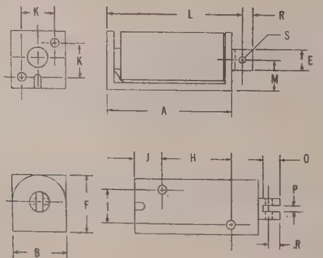
SPECIFICATIONS

Note: Dimension L is shown with solenoid in energized position. Return Spring and Delrin Tip are Standard on all SP Series.

Part No.	A	B	C	D	E	F	G	H	I	J	K	L	M	S	Max. Stroke*	Weight Oz.	Tapped Holes	Wattage Nom.
SP-25	.548	.236	.093	.036	.100	.298	.093	1/4	.136	1/8	*	.84	.180		1/4	.1	1-72	2
SP-37	.820	.360	.125	.051	.150	.430	.125	5/16	1/4	3/16	1/4	1.22	.250		3/8	.3	1-72	3
SP-50	.980	.488	.125	.051	.187	.510	.150	1/2	3/8	7/32	5/16	1.44	.285		1/2	.7	1-72	4.5
SP-62	1.215	.600	.187	.091	.250	.691	.178	5/8	7/16	1/4	7/16	1.732	.391		5/8	1.2	4-40	6
SP-75	1.621	.730	.240	.091	.306	.838	.172	5/8	7/16	1/4	1/2	2.15	.473		3/4	2.7	4-40	9

Standard Coils 155°C, Hi Temp Available * Max Stroke, Standard Pushrod length.

PO SERIES
PULL TYPE



Wire: .... 155°C Magnet Wire
Termination: .... Heavy Leads — PVC, Type BU, 5" Terminals — Solder Lugs
Tape: .... Mylar
Bobbin: .... 30% Glass Filled Nylon
Tip: .... Delrin
Pushrod: .... Phosphor Bronze
Tol: .... .xxx ±.005

SPECIFICATIONS

Note: Dimension L is shown with solenoid in energized position.

Part No.	A	B	E	F	H	I	J	K	L	M	O	P	R	S	Max. Stroke	Weight Oz.	Tapped Holes	Wattage Nom.
PO-25	.548	.236	.100	.298	1/4	.136	1/8	*	.672	.180	.100	.025	.062	.031	1/4	.1	1-72	2
PO-37	.820	.360	.150	.430	5/16	1/4	3/16	1/4	.892	.250	.150	.051	.075	.031	3/8	.3	1-72	3
PO-50	.980	.488	.187	.510	1/2	3/8	7/32	5/16	1.074	.285	.200	.063	.106	.063	1/2	.7	1-72	4.5
PO-62	1.215	.600	.250	.691	5/8	7/16	1/4	7/16	1.340	.391	.200	.063	.094	.063	5/8	1.2	4-40	6
PO-75	1.621	.730	.306	.838	5/8	7/16	1/4	1/2	1.797	.473	.200	.063	.094	.063	3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available.

SPECIALS

ELECTRO-MECHANISMS, INC., is completely equipped, both engineering and production wise, to supply you with variations of our solenoids that you might need for your application. We are also capable of designing special types that you might need within the size range of our products. We would appreciate the opportunity to help you solve design and application problems you may have in the area of miniature solenoid actuators.

The force charts below represent three different duty cycles.

Nominal voltage represents continuous duty.

2X Nominal voltage represents a 25%, intermittent duty cycle 4X Nominal voltage represents a 6% intermittent duty cycle.

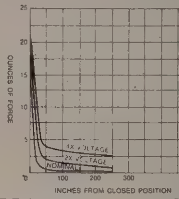
The duty cycle consists of two factors:

1. Percentage of time solenoid is energized in one complete operating cycle.

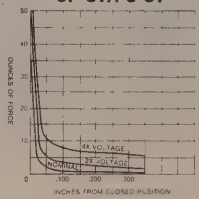
$$\text{(Ref: DUTY CYCLE} = \frac{\text{Time On}}{\text{Time On + Time Off}} \text{ X 100)}$$

2. Length of time of the longest single energization in one complete operating cycle.

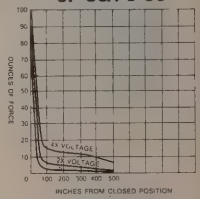
SP-25/PO-25



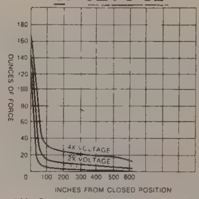
SP-37/PO-37



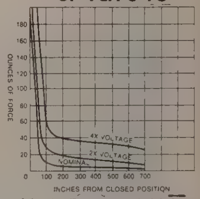
SP-50/PO-50



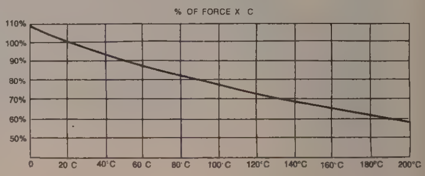
SP-62/PO-62



SP-75/PO-75



All forces shown are at 25° ambient. For use at higher ambient temperatures use the chart below to determine force at any given temperature.



FEATURES

ELECTRO-MECHANISMS micro-miniature solenoids offer you static and impact forces equal to standard solenoids 2 to 3 times the size of these units.

Because of their small size, they have extremely fast reaction time. As fast as 2 msec at 4x nominal voltage.

The unique design of PUSH or PULL action, offers many applications beyond the conventional pull type solenoid.

A complete line of 15 solenoids from ¼" O.D. to 1¼" O.D. allows you to choose the correct solenoid with the force you require, from stock items.

The units are highly reliable with life of many millions of operations.

The solenoids are also available with coils in Class F and Class H for high temperature requirements.

Simplicity of design helps keep the costs down and allows us to pass these savings on to you, our customer.

TYPICAL APPLICATIONS

- Hammers for high speed printers
- Camera shutter actuators
- Locking mechanisms for switches, adding machines and typewriters
- Interpossers for card punching and tape perforation
- Cam actuation
- Pen lifters for plotters
- Event markers for chart recorders
- Key actuators for numerical readouts on typewriters and adding machines
- For life testing different devices
- For indicator flags
- Sensing devices
- Remote switching and actuation

electro-mechanisms INCORPORATED

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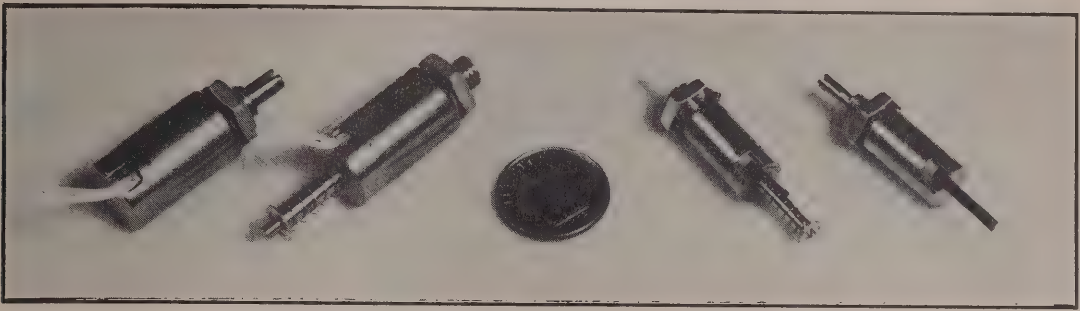
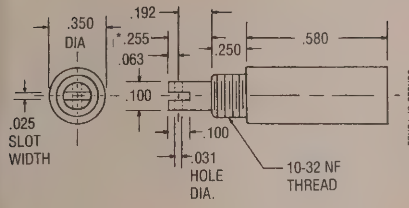
MINIATURE TUBULAR SOLENOIDS



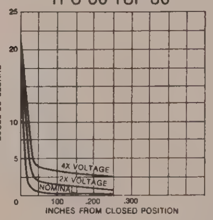
AVAILABLE PUSH (TSP) or PULL (TPO)

.350" DIA. X .580
2 WATTS
MODELS TPO-TSP-30

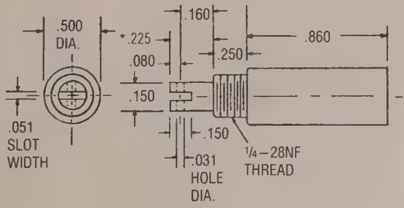

.350
DIA
.192
*.255
.063
.250
.580
.100
.025
SLOT
WIDTH
.100
.031
HOLE
DIA.
10-32 NF
THREAD

FORCE-DUTY CYCLE DC

TPO-30 TSP-30

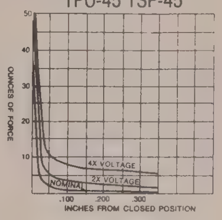


½" DIA. X .875
3 WATTS
MODELS TPO-TSP-45


.500
DIA.
.160
*.225
.080
.250
.860
.150
.051
SLOT
WIDTH
.150
.031
HOLE
DIA.
¼—28NF
THREAD

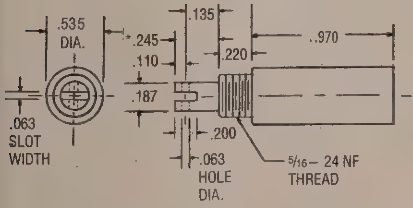
FORCE-DUTY CYCLE DC

TPO-45 TSP-45



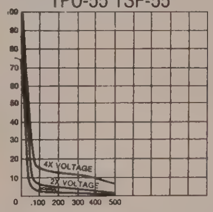
* All forces shown are at 25°C ambient at energized position.

.535" DIA. X 1.00
4.5 WATTS
MODELS TPO-TSP-55

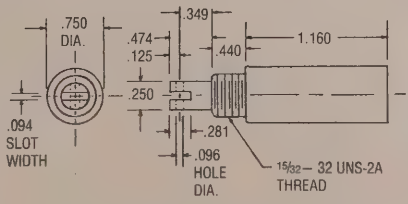

.535
DIA.
.135
*.245
.110
.220
.970
.187
.063
SLOT
WIDTH
.200
.063
HOLE
DIA.
5/16— 24 NF
THREAD

FORCE-DUTY CYCLE DC

TPO-55 TSP-55

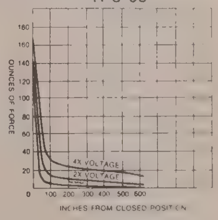


¾" DIA. X 1.160
6 WATTS
MODEL TPO-65

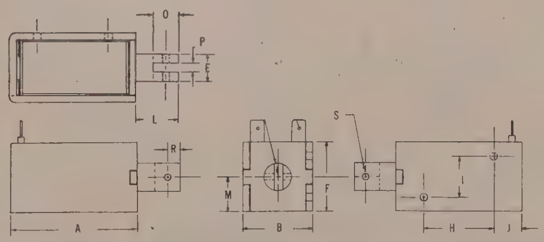

.750
DIA.
.349
.474
.125
.440
1.160
.250
.094
SLOT
WIDTH
.281
.096
HOLE
DIA.
15/32— 32 UNS-2A
THREAD

FORCE-DUTY CYCLE DC

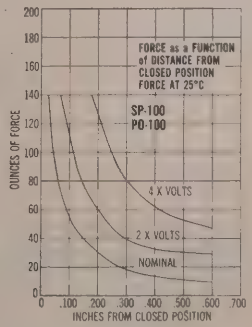
TPO-65



PO-100 SERIES
60° CONICAL
12 WATTS


O
P
E
L
R
S
M
F
I
A
B
H
J

AVAILABLE PUSH TYPE (SP)



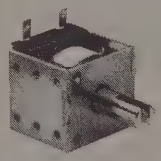
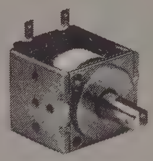
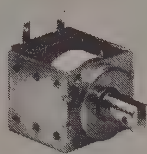
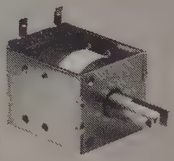
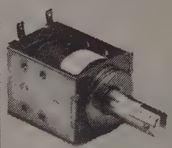
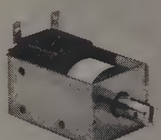
SPECIFICATIONS

Part No.	A	B	E	F	H	I	J	L	M	O	P	R	S	Height of Terms	Max. Stroke	Tapped Holes	Weight Oz.
PO-100	2.270	1.254	.500	1.254	1.115	.750	.530	.700	.627	.375	.143	.168	.100	.365	1	6-32	10

Standard Coils 130°C, Hi Temp Coils Available. * Not Applicable.

GUARDIAN

SOLENOIDS

Series		2	2HD	3HD	4	4HD	11
							
Size (L x W x H)		1.54 x 1.57 x 1.62	1.70 x 1.57 x 1.68	1.74 x 1.57 x 1.62	1.98 x 1.57 x 1.62	2.17 x 1.57 x 1.62	1.84 x .94 x 1.19
Plunger Dia.		.438	.438	.500	.438	.500	.313
Weight oz.	Total	9.5	11.7	10.7	12.6	14.1	5.23
	Plunger	1.1	1.18	1.53	1.6	2.4	.59
A.C. Power (VA)	Int.	44	66	103	60	171	40
	Cont.	13	16.5	20	10	31	12
D.C. Power (W)	Int.	27.5	26.5	28.5	37.5	35.5	22
	Cont.	8.5	9	9.0	10.4	10.5	7.8
Force (oz) A.C. Min. Stroke (In)	Int.	55 @ .12	63 @ .12	88 @ .12	38 @ .12	72 @ .12	25 @ .12
	Cont.	20 @ .12	25 @ .75	26 @ .12	10 @ .12	20 @ .12	13 @ .12
Force (oz) A.C. Min. Stroke (In)	Int.	14 @ .75	22 @ .75	6 @ 1.00	42 @ 1.00	62 @ 1.00	15 @ .75
	Cont.	5 @ .75	9 @ .75	4 @ 1.00	12 @ 1.00	22 @ 1.00	7 @ .75
Force (oz) D.C. Min. Stroke (In)	Int.	96 @ .12	105 @ .12	128 @ .12	110 @ .12	130 @ .12	45 @ .12
	Cont.	45 @ .12	48 @ .12	55 @ .12	60 @ .12	75 @ .12	22 @ .12
Force (oz) D.C. Max. Stroke (In)	Int.	20 @ .50	17 @ .50	25 @ .50	35 @ .75	10 @ 1.00	10 @ .50
	Cont.	2 @.50	5 @ .50	8 @ .50	5 @ .75	1 @ 1.00	2 @ .50
Coil Termination		.187 x .020 QC	.187 x .020 QC	.187 x .020 QC	.187 x .020 QC	.187 x .020 QC	.187 x .020 QC
Mech. Life		10^6	10^6	10^6	10^6	10^6	10^6
Coil Voltages		AC - 120 DC - 12, 24	AC - 120 DC - 24	AC - 120 DC - 24	AC - 120 DC - 12/24/110	AC - 120 DC - 12/24/110	AC - 24, 120 DC - 6/12/24
Material Insulation Class		B	B	B	B	B	B
Breakdown Voltage		1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts
Options		Push Type* Lead Wires	Push Type* Lead Wires	Push Type* Lead Wires	Push Type* Lead Wires Magnetic Latch	Push Type* Lead Wires	Push Type* Lead Wires Magnetic Latch

*Push Type Standard

Int. Duty = 25% Duty Cycle 100 Sec. on Max.

GUARDIAN
Guardian Electric Manufacturing Co.
1425 Lake Avenue • Woodstock, IL 60098
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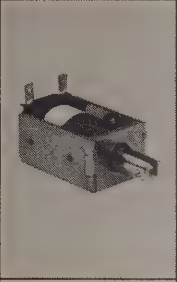
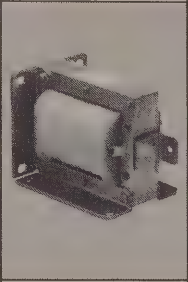
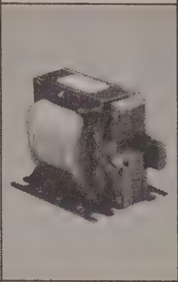
SOLENOIDS

Series		11HD	12	14	16	18	22
							
Size (L x W x H)		2.00 x .94 x 1.25	1.625 x 1.250 x 1.40	2.455 x 1.907 x 2.08	1.625 x 1.218 x 1.437	2.50 x 1.817 x 2.093	1.13 x .75 x .75
Plunger Dia.		.438	.498 x .312	.625 x .500	.375 x .548	.500 x .735	.250
Weight oz.	Total	6.64	5.5	18	9	17	1.6
	Plunger	1.3	1.0	2.6	2	4.5	.22
A.C. Power (VA)	Int.	40	33	180	70	228	9
	Cont.	16	22	63	20	49	5.5
D.C. Power (W)	Int.	20	--	--	--	--	7
	Cont.	7.8	--	--	--	--	3.2
Force (oz) A.C. Min. Stroke (In)	Int.	30 @ .12	49 @ .12	132 @ .12	112 @ .12	336 @ .12	13 @ .06
	Cont.	15 @ .12	30 @ .75	96 @ .12	65 @ .12	152 @ .12	7 @ .06
Force (oz) A.C. Max. Stroke (In)	Int.	14 @ 1.00	12 @ .88	120 @ 1.00	36 @ .75	144 @ 1.00	2.5 @ .50
	Cont.	5 @ 1.00	7 @ .88	112 @ 1.00	18 @ .75	60 @ 1.00	1.25 @ .50
Force (oz) D.C. Min. Stroke (In)	Int.	70 @ .12	--	--	--	--	17 @ .06
	Cont.	35 @ .12	--	--	--	--	10 @ .06
Force (oz) D.C. Max. Stroke (In)	Int.	14 @ .50	--	--	--	--	3 @ .25
	Cont.	5 @.50	--	--	--	--	2 @ .25
Coil Termination		.187 x .020 QC	Lead Wires-22 GA.	Lead Wires-22 GA.	.187 x .020 QC	.203 x .028 Lugs	.110 x .018 QC
Mech. Life		10^6	2.5×10^5	2.5×10^5	2.5×10^5	2.5×10^5	10^6
Coil Voltages		AC - 120 DC - 12, 24	AC - 120A	AC - 120A	AC - 120, 240	AC - 120, 240	AC - 120 DC - 6/12/24
Material Insulation Class		B	B	B	B	B	B
Breakdown Voltage		1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts
Options		Push Type* Lead Wires			Push Type* Lead Wires	Push Type* Lead Wires	Push Type* Lead Wires Magnetic Latch

*Push Type Standard

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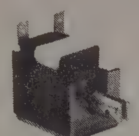
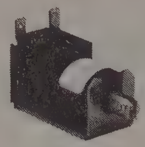
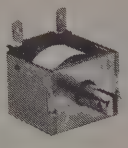
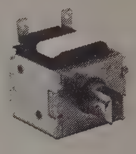
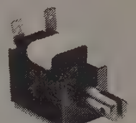
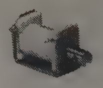
GUARDIAN

SOLENOIDS

Series		24	26	28	28HD	34	42
							
Size (L x W x H)		1.23 x .91 x 1.11	1.73 x .92 x 1.13	1.13 x .94 x 1.19	1.23 x .94 x 1.25	1.13 x .82 x .72	.64 x .30 x .46
Plunger Dia.		.313	.313	.313	.438	.313	.156
Weight oz.	Total	2.41	3.15	3.5	4.67	1.78	.229
	Plunger	.452	.48	.46	.855	.439	.023
A.C. Power (VA)	Int.	14	24	22	28	13	--
	Cont.	7.5	12	8	9	6	--
D.C. Power (W)	Int.	11.8	15.5	13.5	13.5	9	1.9
	Cont.	4.3	5.5	5	5.6	3.8	1.5
Force (oz) A.C. Min. Stroke (In)	Int.	13 @ .12	20 @ .12	26 @ .06	34 @ .06	15 @ .06	--
	Cont.	8 @ .12	10 @ .12	15 @ .06	16 @ .06	8.5 @ .06	--
Force (oz) A.C. Max. Stroke (In)	Int.	6 @ .50	7 @ .75	5 @ .50	8 @ .50	3 @ .50	--
	Cont.	3.75 @ .50	5 @ .75	4 @ .50	4 @ .50	2 @ .50	--
Force (oz) D.C. Min. Stroke (In)	Int.	17 @ .12	22 @ .12	45 @ .06	55 @ .06	22 @ .06	.9 @ .03
	Cont.	6 @ .12	12 @ .12	23 @ .06	25 @ .06	10 @ .06	.75 @ .03
Force (oz) D.C. Max. Stroke (In)	Int.	7.5 @ .25	12 @ .25	12 @ .25	10 @ .25	5 @ .25	.30 @ .07
	Cont.	2 @ .25	4 @ .25	4 @ .25	5 @ .25	2 @ .25	.25 @ .07
Coil Termination		.187 x .020 QC	.187 x .020 QC	.187 x .020 QC	.187 x .020 QC	.187 x .020 QC	.025 Square
Mech. Life		10^6	10^6	10^6	10^6	10^6	10^6
Coil Voltages		AC - 120 DC - 12, 24	AC - 120 DC - 12, 24	AC - 24,120 DC - 6, 12, 24	AC - 24,120 DC - 6, 12, 24	AC - 24,120 DC - 12, 24	DC - 12, 24
Material Insulation Class		B	B	B	B	B	B
Breakdown Voltage		1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts
Options		Push Type Lead Wires	Push Type Lead Wires	Push Type* Lead Wires Magnetic Latch	Push Type* Lead Wires	Push Type* Lead Wires	Push Type* Lead Wires

*Push Type Standard

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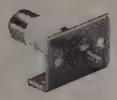
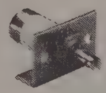
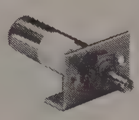
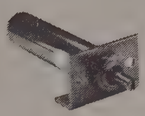
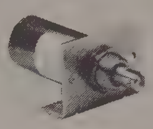
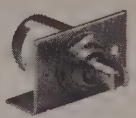
GUARDIAN

SOLENOIDS

Series		T3.5 x 9	T4 x 7	T4 x 12	T4 x 16	T6 x 12	T8 x 9
							
Size (Length x Dia.)		1.18 x .44	.89 x .50	1.51 x .50	2.01 x .50	1.54 x .75	1.17 x 1.00
Plunger Dia.		.156	.188	.188	.188	.250	.438
Weight oz.	Total	.611	.583	.993	1.35	2.34	3.46
	Plunger	.109	.138	.283	.362	.421	1.03
A.C. Power (VA)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
D.C. Power (W)	Int.	5	4.5	6.8	8.1	11.9	14
	Cont.	2.5	2.3	3	3.3	4.9	5
Force (oz) A.C. Min. Stroke (In)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
Force (oz) A.C. Max. Stroke (In)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
Force (oz) D.C. Min. Stroke (In)	Int.	3.5 @ .06	8.5 @ .03	6 @ .06	11 @ .03	14 @ .12	45 @ .06
	Cont.	2.5 @ .06	5 @ .03	4 @ .06	8 @ .03	8.4 @ .12	18 @ .06
Force (oz) D.C. Max. Stroke (In)	Int.	1 @ .25	1 @ .25	1.5 @ .20	3 @.15	3 @ .75	2 @ .50
	Cont.	.5 @ .25	.5 @ .25	.9 @ .20	1.75 @ .15	1 @ .75	.75 @ .50
Coil Termination		Lead Wires 28 GA.	Lead Wires 26 GA.	Lead Wires 26 GA.	Lead Wires 26 GA.	Lead Wires 26 GA.	Lead Wires 26 GA.
Mech. Life		10^6	10^6	10^6	10^6	10^6	10^6
Coil Voltages		DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24
Material Insulation Class		B	B	B	B	B	B
Breakdown Voltage		1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts
Options		Push Type*	Push Type*	Push Type*	Push Type*	Push Type*	Push Type*

*Push Type Standard

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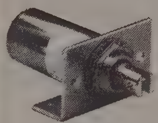
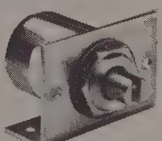
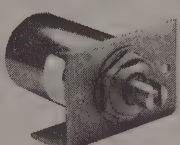
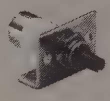
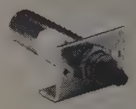
GUARDIAN

SOLENOIDS

Series		T8 x 16	T12 x 13	T12 x 19	LT3.5 x 9	LT4 x 7	LT4 x 12
							
Size (Length x Dia.)		2.04 x 1.00	1.68 x 1.50	2.43 x 1.50	1.15 x .44	.89 x .50	1.51 x .50
Plunger Dia.		.438	.500	.500	.156	.203	.203
Weight oz.	Total	5.8	10.2	14.20	.60	.710	1.1
	Plunger	1.57	1.65	2.20	.10	.145	.205
A.C. Power (VA)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
D.C. Power (W)	Int.	16	21	29	5.7	5	7.6
	Cont.	5.5	7.5	8.5	2.8	2.3	3
Force (oz) A.C. Min. Stroke (In)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
Force (oz) A.C. Max. Stroke (In)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
Force (oz) D.C. Min. Stroke (In)	Int.	40.5 @ .12	104 @ .12	116 @ .12	5 @ .06	5.00 @ .06	8 @ .12
	Cont.	17.7 @ .12	38.4 @ .12	64.5 @ .12	2.75 @ .06	2.5 @ .06	3.5 @ .12
Force (oz) D.C. Max. Stroke (In)	Int.	15 @ .50	20 @ .50	25 @ .75	1.0 @ .25	1 @ .20	3 @ .25
	Cont.	2.5 @ .50	5 @ .50	9 @ .75	.5 @ .25	.50 @ .20	1 @ .25
Coil Termination		Lead Wires 22 GA.	Lead Wires 22 GA.	Lead Wires 22 GA.	Lead Wires 26 GA.	Lead Wires 26 GA.	Lead Wires 26 GA.
Mech. Life		10^6	10^6	10^6	10^8	10^8	10^8
Coil Voltages		DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24
Material Insulation Class		B	B	B	B	B	B
Breakdown Voltage		1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts
Options		Push Type*	Push Type*	Push Type*	Push Type*	Push Type*	Push Type*

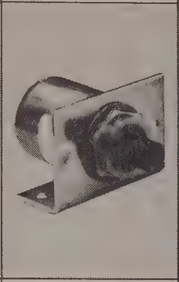
*Push Type Standard

Int. Duty = 25% Duty Cycle 100 Sec. on Max.

GUARDIAN
Guardian Electric Manufacturing Co.
1425 Lake Avenue • Woodstock, IL 60098
Phone: 800/762-0369 FAX: 815/337-0377

GUARDIAN

SOLENOIDS

Series		LT4 x 16	LT6 x 12	LT8 x 9	LT8 x 16	LT12 x 13	LT12 x 19
							
Size (Length x Dia.)		2.01 x .50	1.54 x .75	1.17 x 1.00	2.04 x 1.00	1.63 x 1.50	2.38 x 1.50
Plunger Dia.		.203	.313	.438	.438	.50	.500
Weight oz.	Total	1.43	2.53	3.7	6.4	10.60	14.6
	Plunger	.276	.569	1.1	1.4	1.80	2.2
A.C. Power (VA)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
D.C. Power (W)	Int.	10.3	11.5	15	23.2	27	32
	Cont.	3.5	4.5	5.5	7.5	8.1	9.8
Force (oz) A.C. Min. Stroke (In)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
Force (oz) A.C. Max. Stroke (In)	Int.	--	--	--	--	--	--
	Cont.	--	--	--	--	--	--
Force (oz) D.C. Min. Stroke (In)	Int.	5.5 @ .12	20 @ .12	21 @ .12	55 @ .12	105 @ .12	129 @ .12
	Cont.	2.4 @ .12	7 @ .12	8 @ .12	21 @ .12	35 @ .12	68 @ .12
Force (oz) D.C. Max. Stroke (In)	Int.	2.5 @ .2	1.0 @ .50	3 @ .50	16 @ .50	15 @ .50	18 @ .75
	Cont.	1 @ .25	.5 @ .50	1 @ .50	3 @ .50	5 @ .50	5 @ .75
Coil Termination		Lead Wires 26 GA.	Lead Wires 26 GA.	Lead Wires 22 GA.	Lead Wires 22 GA.	Lead Wires 22 GA.	Lead Wires 22 GA.
Mech. Life		10^8	10^8	10^8	10^8	10^8	10^8
Coil Voltages		DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24	DC - 12, 24
Material Insulation Class		B	B	B	B	B	B
Breakdown Voltage		1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts	1500 Volts
Options		Push Type*	Push Type*	Push Type*	Push Type*	Push Type*	Push Type*

*Push Type Standard

Int. Duty = 25% Duty Cycle 100 Sec. on Max.

GUARDIAN
Guardian Electric Manufacturing Co.
1425 Lake Avenue • Woodstock, IL 60098
Phone: 800/762-0369 FAX: 815/337-0377

Solenoid Selector

(Stroke in inches vs. Force in ounces)

Made in U.S.A.

LIBERTY CONTROLS, INC.

500 Brookforest Avenue, Shorewood IL 60435
Phone 815-725-2241 Fax 815-725-6571

The charts on this page were developed as an aid for solenoid selection and were derived from the typical force curves presented throughout this catalog. These values should not be interpreted as minimum values. Deviations can be expected due to normal manufacturing, and coil winding tolerances.

Due to differences in size, the wattage for continuous, intermittent, and pulse duty coils will be different from one type of solenoid to another.

Although only 3 wattages (duty cycles) are described in the catalog for each type of solenoid, other possibilities are available. Contact Liberty Controls for help in determining a solenoid to fit your application.

CONTINUOUS DUTY DC

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L6	2	1	.5							
L-5	2.5	1	.5							
L-75-1	13	3	1							
L22	13	5	2	1	.5					
L61	14	7	3	2	1					
L-20	22	9	4	2.3	1.5					
L-24	24	11	5	2.7	2	1.5				
L-81	23	14	8	4						
L-75-2	28	14	6	3	2.5					
L-28	31	15	5	3	1					
L-26	33	18	7	4	3	2	1			
L-10-1	64	20	8	4	2	1.5	1			
L-62	37	26	13	7	5.5					
L-11	46	26	10	6	4	3	2			
L-63	56	31	14	8	5	3	2			
L-82	55	40	19	10	5	3	2			
L-10-2	104	56	23	12	8	6	5	2		
L-4	96	56	29	17	12	9	7	5	4	
L-88	120	74	30	15	8	4				
L-90	148	114	62	35	23	17	13	11	8	5
L-15-1	150	96	39	23	11	7	2			
L-15-2	160	128	64	38	24	16	13	9	5	3
L-15-2HD	224	136	70	40	28	19	13	11	8	5
M-82	72	45	24	13	6	4	3			

COIL MAY BE ENERGIZED CONTINUOUSLY

INTERMITTENT DUTY DC

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L-06	4.8	3	2	1						
L-05	7.5	3	.75							
L-22	22	10	3	2	1					
L-75-1	27	10	3	1						
L-61	30	17	7	4.4	2					
L-20	34	21	8	4	2					
L-81	40	27	14	7						
L-24	44	24	11	7	4.5	3.2				
L-28	50	28	11	7	4					
L-26	52	36	21	11	7	4	1			
L-62	56	37	20	11	7					
L-75-2	64	46	28	20	14	11	6	4		
L-11	64	45	24	15	11	8	6			
L-63	84	54	27	15	10	6	4			
L-10-1	96	54	20	9	4	2	1			
L-82	92	70	43	24	14	9	7			
L-10-2	160	118	80	53	35	25	16	12		
L-88	184	136	68	36	20	11				
L-04	213	160	107	75	53	36	27	19	14	
L-90	208	176	131	95	72	56	44	36	28	16
L-15-1	210	178	120	74	48	80	16			
L-15-2	210	184	138	110	80	62	48	38	28	16
L-15-2HD	275	256	192	144	104	74	53	38	28	16
M-82	100	78	48	26	14	9	7			

25% DUTY CYCLE MAXIMUM ON TIME 1 MINUTE

PULSE DUTY DC

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L6	9	7.5	6.5	5						
L-5	15	7	1.5							
L22	38	25	11	6	3					
L-75-1	56	30	10	3						
L20	60	47	24	13	7					
L-61	67	51	27	14	8					
L-24	68	52	32	20	13	8				
L-75-2	68	52	34	26	21	14	10	6		
L-26	74	62	43	30	22	17				
L-28	83	70	23	13						
L-11	90	80	53	42	37	34				
L-81	104	85	64	33						
L-10-1	158	122	66	32	15	8	3			
L-82	136	117	90	62	40	26	16			
L-62	172	142	89	43	27					
L-63	168	147	105	67	45	28	16			
L-10-2	175	150	120	96	70	58	40	26	16	3
L-04	240	208	163	128	98	79	60	46	32	
L-88	241	180	94	71	40					
L-15-1	230	202	150	112	80	50	28	16		
L-90	266	230	188	154	126	106	94	89	68	40
L-15-2	250	224	198	164	144	120	100	82	66	24
L-15-2HD	336	312	272	235	200	160	115	88	69	32
M-82	150	130	96	59	30	26	16			

10% DUTY CYCLE MAXIMUM ON TIME 100ms

CONTINUOUS DUTY AC

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1- 1/4
L22	5.5	4	2.5	1.5	.5					
L-20	10	7	5	3.5	2					
L-61	10	7	5	4	2					
L-90	12	9	7	7	7	8	8	9	9	7
L-24	14	10	7	6	4	2				
L-28	15	11	7	4.5	2					
L-26	16	12	9	8	6	5	3			
L-04	17	12	9	9	10	10	10	10	8	3
L-82	17	12	10	10	11	11	11			
L-11	18	13	10	10	10	8	6			
L-81	19	13	9	5						
L—63	20	15	13	13	11	9	6			
L-88	24	18	14	11	8					
L-62	24	19	15	13	10					

COIL MAY BE ENERGIZED CONTINUOUSLY (If plunger is seated)

INTERMITTENT DUTY AC

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L-22	10	6	4	2	1.5					
L-20	20	14	9	7	4					
L-61	22	15	12	9	5					
L-24	26	19	14	11	8	5				
L-26	25	19	15	13	11	9	6			
L-28	29	20	14	9	4					
L-90	27	22	18	17	18	19	20	21	21	17
L-81	34	23	15	8						
L-11	33	25	20	18	18	16	13			
L-82	46	31	26	26	28	29	28			
L-88	49	36	28	23	17	10	4			
L-63	56	44	38	36	34	27	18			
L-62	64	55	42	36	26					
L-04	74	64	51	50	50	53	53	50	45	18

25% DUTY CYCLE 1 MINUTE MAXIMUM ON TIME (If plunger is seated)

PULSE DUTY AC

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L-22	19	14	9	6	3					
L-61	44	21	24	20	11					
L-20	48	36	26	19	11					
L-24	52	38	30	25	18					
L-11	54	42	34	32	30	27	23			
L-28	62	46	34	21	11					
L-26	72	53	43	39	36	30	20			
L-90	80	58	47	45	46	47	50	51	51	43
L-81	90	61	41	25						
L-82	96	66	53	52	54	55	51			
L-63	103	80	70	67	60	50	34			
L-04	106	74	61	65	67	68	72	70	60	25
L-62	117	91	76	66	48					
L-88	138	101	76	63	47	31	13			

10% DUTY CYCLE MAXIMUM ON TIME 100ms

LIBERTY
CONTROLS, INC.

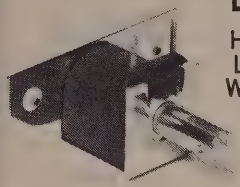
500 Brookforest Avenue, Shorewood IL 60435
Phone 815-725-2241 Fax 815-725-6571

Made in U.S.A.

Solenoids

Latching, Open Frame & Tubular Solenoids

L-05



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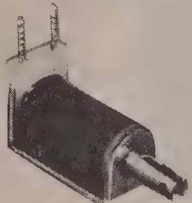
L-06



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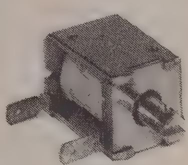
L-22



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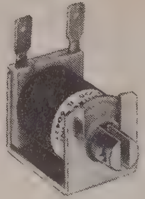
L-61



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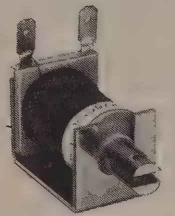
L-24



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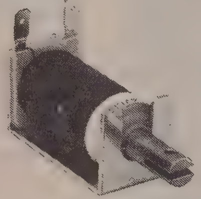
L-26



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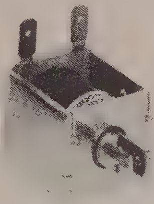
L-20



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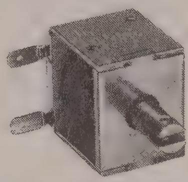
W=.81

L-28



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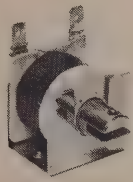
L-62



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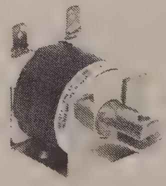
L-63



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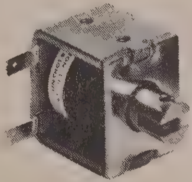
L-81



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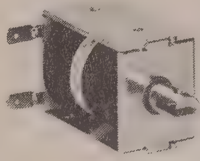
L-11



H=1.19
L=1.84
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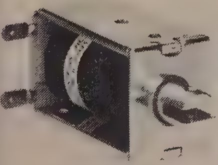
L-82



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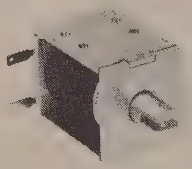
L-04



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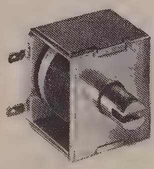
L-88



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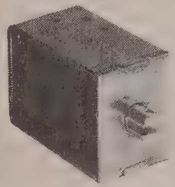
L-90



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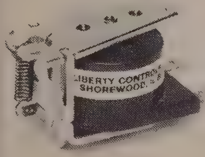
L-200



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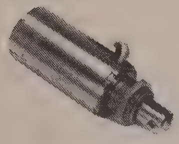
L-75-1



DIA .75
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L-75-2
DIA .75
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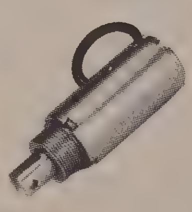
L-10-1



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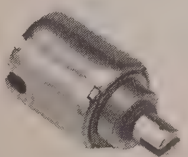
L-10-2
DIA 1.0
L=1.5

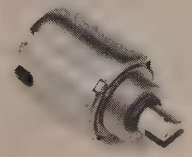
L-15-1



DIA 1.5
L=1.63

L-15-2
DIA 1.5
L=2.38

L-15-2 HD



DIA 1.5
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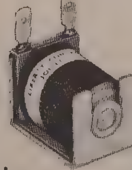
L-65



H=.810
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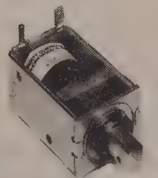
W=.75

Clicker

M-82



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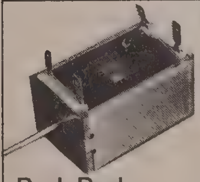
Latching Solenoid

M-82PP



H=1.22
L=2.01
W=1.00

Push Push
Latching Solenoid

Contact Liberty Controls for help with the specification, and for complete part numbers. Push type solenoids available in all series shown. Dimensions shown are in inches

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

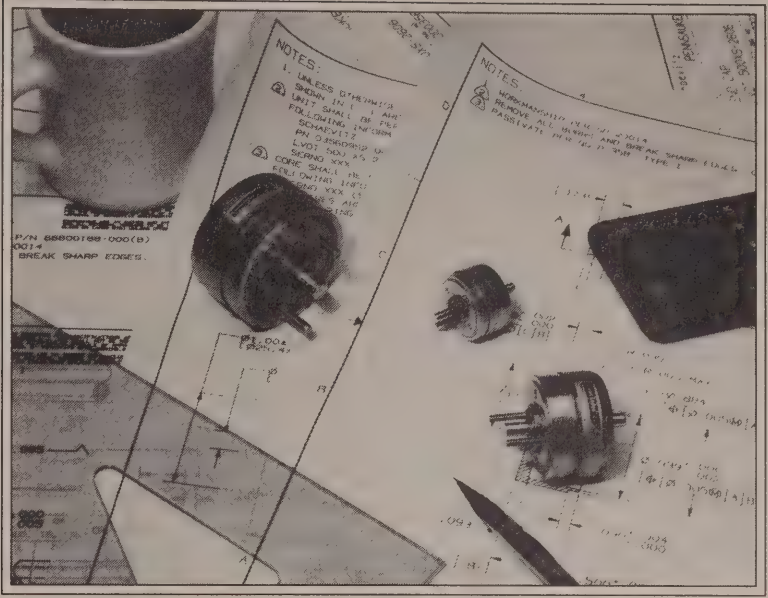
W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Problem:

Need a solenoid for a project, and you're out of time.



Solution:

Ledex stock prototypes

- *The industry's largest variety of solenoids*
- *Over 400 designs*
- *Same day shipment available*

Don't rely on design guide procedures to evaluate a solenoid for your project. Use the quick, cost-effective way– order a stock Ledex prototype.

We offer over 400 stock models to cover almost any solenoid application:

- **Rotary solenoids**– up to 117 lb-in. Choose from hundreds of stock models or custom designs for prototype work.
- **Tubular solenoids**– force ratings to 11.5 lbs at 0.30". Push and pull models rated life is 25 million actuations.
- **Low profile solenoids**– force to 30 lbs at 0.30" stroke. Push/pull, flat face, or conical designs built for high force to size, and fast response.
- **Brushless Torque Actuators**– field proven at over 100 million cycles. Quick, shock-free operation.
- **Soft Shift® solenoids**– proportional control as well as on-off. Rated for up to 50 lbs of force.
- **Open frame solenoids**– pull force to 7.5 lbs at 1.0 in stroke. 42 models offer economical, long-term service.
- **Magnetic latching solenoids**– maintain energized position without current draw.

More than inventory...

We provide the added services that give you the exact product you want– quickly, easily, economically.

Unique customer specifications

- 80% of Ledex solenoids are designed to customer specifications
- We offer a short order prototyping service which can deliver custom prototypes in 2 weeks or less, for a small service charge

Quick Delivery

- Same day delivery on most stock models

No credit hassels

- Use your Visa or Mastercard and save time

MasterCard VISA

Quality...our measure of leadership

- Ledex has received numerous awards for exceeding on-time deliveries with zero rejects
- Our goal is to achieve zero defects

Refer to the following pages for more details and specifications on many Ledex solenoid designs.

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Rotary Solenoids

- *Millisecond-fast, high torque actuation*
- *Nine sizes from 3/4" to 3-3/8" diameter*
- *Clockwise or counterclockwise strokes*
- *Choice of economical bobbin wound coil, standard precision coil, or elongated precision coil for lower power consumption*
- *Variety of standard configurations and modifications available*

Bobbin Coil Selection

Size	Diameter (inches)	Height[1] (inches)	Stroke	Direction		Holding Torque (lb-in)	Available Torque (lb-in)				
				CW	CCW		100% Duty	50% Duty	25% Duty	10% Duty	5% Duty
1B	1.000	0.625	25°	•	•	*	*	0.2	0.3	0.6	1.0
			35°	•	•	*	*	*	*	*	*
			45°	•	•	*	*	0.1	0.2	0.3	0.6
2B	1.125	0.656	25°	•	•	*	0.2	0.5	0.8	1.5	1.8
			35°	•	•	*	0.1	0.4	0.6	1.2	1.4
			45°	•	•	*	0.1	0.2	0.4	0.8	0.9
3B	1.325	0.875	25°	•	•	0.9	0.4	0.7	1.3	2.7	3.2
			35°	•	•	0.6	0.3	0.6	1.0	2.0	2.3
			45°	•	•	0.4	0.2	0.4	0.8	1.4	1.7
			67½°	•	•	0.4	0.1	0.2	0.4	0.7	0.8
4B	1.562	0.953	25°	•	•	2.0	0.7	1.4	2.5	4.0	4.6
			35°	•	•	*	0.4	1.0	1.7	2.8	3.2
			45°	•	•	1.0	0.3	0.8	1.3	2.1	2.5
			55°	•		*	*	*	*	*	*
			67½°	•	•	*	0.3	0.6	1.2	2.3	*
			95°	•	•	*	0.2	0.5	0.8	1.4	*
5B	1.875	1.203	25°	•	•	4.0	1.8	3.5	5.8	8.3	10.0
			35°	•	•		0.9	2.1	4.1	6.9	8.3
			45°	•	•	3.0	0.7	1.7	3.2	5.0	6.0
			67½°	•	•		0.5	1.1	2.0	3.3	4.0
			95°	•	•	2.0	0.2	0.4	0.9	1.6	1.9

Precision Standard Coil Selection

Size	Diameter (inches)	Height[1] (inches)	Stroke	Direction		Holding Torque (lb-in)	Available Torque[2] (lb-in)				
				CW	CCW		100% Duty	50% Duty	25% Duty	10% Duty	5% Duty
5S	1.875	1.047	25°	•	•	5.0	1.9	4.1	7.3	12.1	13.2
			35°	•	•	*	1.2	2.6	4.5	7.8	9.2
			45°	•	•	3.0	0.7	1.7	3.4	6.3	6.9
			67½°	•	•	*	0.5	1.2	2.2	3.9	4.9
			95°	•	•	2.0	0.2	0.5	1.0	1.9	2.6
6S	2.312	1.343	25°	•	•	9.0	4.6	8.9	16.2	27.8	30.6
			35°	•	•	*	3.4	6.5	12.0	18.6	20.5
			45°	•	•	6.0	1.7	3.5	6.5	11.0	12.1
			67½°	•	•	*	1.6	3.1	5.6	8.8	9.7
			95°	•	•	3.0	0.9	1.7	3.3	5.2	5.7
7S	2.750	1.766	25°	•	•	20.0	11.0	23.8	33.2	42.4	46.6
			35°	•	•	*	6.0	12.0	22.0	38.0	42.0
			45°	•	•	13.0	5.0	8.8	16.4	29.8	32.8
			67½°	•	•	*	2.5	5.1	9.8	17.5	19.3
			95°	•	•	6.0	1.5	3.5	6.4	10.5	11.6
8S	3.375	2.156	25°	•	•	34.0	16.0	37.0	60.0	98.0	117.0
			35°	•	•	*	12.0	24.0	39.0	64.0	77.0
			45°	•	•	22.0	10.0	19.0	34.0	54.0	65.0
			67½°	•	•	*	4.2	10.0	17.0	29.0	35.0
			95°	•	•	12.0	3.5	6.1	10.0	17.0	20.0

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[1] Without armature cover

[2] Torque values shown are for Standard Life units (1 million actuations life rating). Long Life models provide approximately 10% less torque, but offer 50 to 100 million actuations life rating. Long Life models are only available in strokes up to 45°.

* Consult factory

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Rotary Solenoids

Precision Elongated Coil Selection

Size	Diameter (inches)	Height[1] (inches)	Stroke	Direction		Holding Torque (lb-in)	Available Torque (lb-in)				
				CW	CCW		100% Duty	50% Duty	25% Duty	10% Duty	5% Duty
0E	0.750	0.580	25°	•	•	*	*	0.1	0.2	0.4	0.5
			45°	•	•	*	*	0.4	0.1	0.2	0.3
1E	1.000	0.625	25°	•	•	0.3	*	0.2	0.4	0.8	1.1
			35°	•	•	*	*	*	*	*	*
			45°	•	•	0.2	*	0.1	0.2	0.4	0.6
2E	1.125	0.656	25°	•	•	0.5	0.2	0.4	0.7	1.4	1.7
			35°	•	•	*	0.2	0.3	0.5	1.1	1.3
			45°	•	•	0.3	0.1	0.2	0.4	0.7	0.9
3E	1.312	0.797	25°	•	•	0.9	0.4	0.8	1.4	2.7	3.2
			35°	•	•	0.7	0.3	0.6	1.0	2.0	2.3
			45°	•	•	0.6	0.2	0.4	0.8	1.4	1.8
			67½°	•	•	0.5	0.1	0.2	0.4	0.7	0.9
4E	1.562	0.953	25°	•	•	2.0	0.9	1.7	3.1	4.5	5.2
			35°	•	•	*	0.6	1.1	2.0	3.1	3.5
			45°	•	•	1.0	0.4	0.9	1.6	2.6	3.1
			55°	•		*	*	*	*	*	*
			67½°	•	•	*	0.2	0.4	0.8	1.6	1.9
			95°	•	•	0.9	0.2	0.3	0.6	1.0	1.2
5E	1.875	1.203	25°	•	•	5.0	2.1	5.2	8.1	11.4	13.2
			35°	•	•	*	1.7	3.2	5.1	7.6	8.6
			45°	•	•	3.0	1.2	2.2	3.8	5.9	7.2
			55°	•	•	*	1.0	1.8	3.1	4.9	5.9
			67½°	•	•	*	0.8	1.5	2.5	3.9	4.6
			75°		•	*	0.7	1.3	2.2	3.5	4.1
			95°	•	•	2.0	0.3	0.7	1.2	2.0	2.6
			110°	•	•	*	0.2	0.5	1.0	1.6	2.0
6E	2.250	1.547	25°	•	•	9.0	6.3	11.6	17.5	26.0	27.8
			35°	•	•	*	4.6	8.5	12.5	17.4	18.6
			45°	•	•	6.0	2.4	4.6	7.1	10.5	10.7
			55°	•		*	2.3	4.3	6.4	9.4	9.7
			67½°	•	•	*	2.2	4.0	5.8	8.3	8.8
			95°	•	•	3.0	1.2	2.3	3.4	4.9	5.2
			110°	•	•	*	1.0	2.0	2.9	4.2	4.5
7E	2.750	2.031	25°	•	•	20.0	13.6	24.1	31.9	39.6	44.0
			35°	•	•	*	7.2	13.7	23.3	35.6	41.0
			45°	•	•	13.0	5.6	10.1	17.7	27.9	33.0
			55°	•		*	*	*	*	*	*
			67½°	•	•	*	3.0	5.9	10.5	16.4	19.0
			95°	•	•	6.0	2.2	3.8	5.9	8.2	8.9
8E	3.375	2.484	25°	•	•	34.0	20.0	39.2	62.0	105.0	122.0
			35°	•	•	*	14.0	25.4	44.9	62.0	74.0
			45°	•	•	22.0	11.4	20.9	34.8	52.3	64.0
			67½°	•	•	*	5.3	10.8	17.8	28.1	33.0
			95°	•	•	12.0	3.8	6.5	10.5	16.3	19.0

[1] Without armature cover

[2] Torque values shown are for Standard Life units (1 million actuations life rating). Long Life models provide approximately 10% less torque, but offer 50 to 100 million actuations life ratin g. Long Life models are only available in strokes up to 45°.

* Consult factory

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Tubular Solenoids

- *New STA Series has enhanced design features and improved performance*
- *Push and pull models*
- *Strokes up to 2-1/2"*
- *Life rating of 25 million actuations*
- *Prototypes on the shelf*

Series	Solenoid Type	Package Dimensions (in)		Maximum Stroke	Nominal Stroke	Force (lbs) @ Nominal Stroke and Specified Duty Cycle			
		Dia.	Length	(in)	(in)	100%	50%	25%	10%
STA Series	Pull	0.52	1.05	0.50	0.10	0.06-0.13	0.14-0.25	0.31-0.48	0.69-0.94
STA Series	Push	0.52	1.05	0.50	0.10	0.13-0.19	0.25-0.31	0.44-0.56	0.81-1.00
STA Series	Pull	0.77	1.56	0.70	0.20	0.25-0.38	0.50-0.80	1.10-1.50	2.20-2.75
STA Series	Push	0.77	1.56	0.70	0.20	0.38-0.50	0.75-1.00	1.25-1.63	2.13-2.69
STA Series	Pull	1.02	2.05	0.70	0.30	0.50-0.75	1.00-1.88	2.00-2.90	4.00-5.20
STA Series	Push	1.02	2.05	0.70	0.30	0.75-0.90	1.50-1.75	2.60-3.00	4.80-5.20
Standard	Pull	1.25	2.25	0.75	0.40	1.00	2.00	4.00	6.50
Standard	Pull	1.50	2.50	0.75	0.40	1.00	2.50	5.20	9.80
Standard	Pull	1.75	4.71	2.50	1.00	1.25	2.50	3.75	6.50

Soft Shift® Solenoids

- *Variable speed control*
- *High starting force*
- *1 million actuation life rating*

Size	Package Dimensions (in)		Maximum Stroke	Force (lbs) @Maximum Stroke and Specified Duty Cycle			
	Dia.	Length	(in)	100%	50%	25%	10%
2EP	1.125	0.996	0.16	1.0	1.4	2.0	3.8
3EP	1.312	1.232	0.25	1.0	1.9	2.3	4.3
4EP	1.562	1.471	0.30	2.0	3.0	4.3	7.5
5EP	1.875	1.935	0.40	3.0	4.5	7.0	12.5
6EP	2.250	2.214	0.42	7.0	9.6	16.0	29.5

Low Profile Solenoids

- *Space-saving, low profile linear actuation*
- *Ideal for high force, short stroke applications*
- *Push/pull, flat face, or conical designs built for high force to size*
- *Fast response*

	Package Dimensions		Stroke Range	Nominal Stroke	Force (lbs) @ Nominal Stroke at Specified Duty Cycle @ 20°C			
Size*	Dia.	Length	(in)	(in)	100%	50%	25%	10%
0EC	0.750	0.500	0–0.150	0.060	0.19	0.44	0.94	2.06
1EF	1.000	0.530	0–0.070	0.020	1.00	2.70	5.70	11.50
1EC	1.000	0.530	0–0.240	0.080	0.25	0.50	1.25	3.20
2EF	1.125	0.580	0–0.750	0.030	2.00	3.50	7.00	13.50
2EC	1.125	0.580	0–0.240	0.100	0.25	1.00	2.00	3.75
3EF	1.312	0.690	0–0.750	0.040	2.50	5.00	11.00	20.00
3EC	1.312	0.690	0–0.300	0.120	0.80	2.00	3.80	5.60
4EF	1.562	0.835	0–0.120	0.060	3.00	6.50	12.00	25.00
4EC	1.562	0.835	0–0.250	0.150	1.00	2.25	5.50	11.50
5SF	1.875	0.880	0–0.140	0.080	3.00	9.50	17.00	39.00
5EC	1.875	1.035	0–0.400	0.200	2.50	5.00	10.00	21.00
6SF	2.250	1.145	0–0.180	0.080	10.00	20.00	40.00	80.00
6EC	2.250	1.330	0–0.400	0.200	6.00	13.00	24.00	43.00
7SF	2.750	1.625	0–0.360	0.100	20.00	35.00	63.00	120.00
7EC	2.750	1.780	0–0.700	0.300	9.00	18.00	33.00	54.00
8SF	3.375	1.830	0–0.400	0.120	37.00	80.00	145.00	240.00
8EC	3.375	2.165	0–0.700	0.300	27.00	52.00	90.00	145.00

* EC sizes have conical face plungers; EF and SF sizes have flat face plungers.

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Brushless Torque Actuators

- *Controlled velocity and position*
- *Quiet, shock-free operation*
- *100 million plus cycle life*
- *High-speed cycle rate*
- *No axial stroke*
- *Low power consumption*
- *Completely enclosed ball bearing construction*
- *Right or left hand strokes available*

Size	Package Dimensions (in)		Maximum Stroke	Gross Starting Torque (lb-in) at Specified Duty Cycle			
	Dia.	Length	(degrees)	100%	50%	25%	10%
2EV	1.188	0.719	45	2.5	4.5	8.2	16.0
3EV	1.375	0.890	45	4.5	9.0	14.0	27.0
4EV	1.625	1.055	45	0.5	0.9	1.6	2.9
5EV	1.937	1.265	45	1.3	2.4	3.7	6.0
6EV	2.312	1.625	45	3.5	5.6	8.5	13.0

Open Frame Solenoids

- *Pull forces to 15 pounds*
- *Strokes to 1 inch*
- *38 models offer economical, long-term service*
- *Magnetically latching models remain latched without energy – ideal for locking mechanisms*

Model	Dimensions (in)	Force (lbs) at Continuous Duty @ Specified Stroke (in)			
	W x H x L	0	0.039	0.079	0.157
TDS-03A	0.31 x 0.39 x 0.59	0.22	0.01	0.004	—
TDS-04C	0.39 x 0.47 x 0.98	0.66	0.09	0.07	0.02
TDS-05B	0.51 x 0.59 x 0.78	0.55	0.17	0.08	0.02
TDS-05C	0.39 x 0.59 x 1.22	0.77	0.18	0.07	0.02
TDS-06A	0.63 x 0.79 x 1.0	1.32	0.29	0.15	0.04
TDS-06K	0.51 x 0.59 x 1.22	1.10	0.22	0.13	0.04
TDS-06U	0.59 x 0.79 x 1.18	1.32	0.44	0.24	0.09
TDS-06UB	0.57 x 0.65 x 1.58	1.98	0.31	0.20	0.08
TDS-07A	0.55 x 0.63 x 1.18	1.10	0.24	0.11	0.03
TDS-08A	0.79 x 1.02 x 1.45	3.09	1.01	0.60	0.26
TDS-08B	0.87 x 0.98 x 1.02	2.20	0.77	0.42	0.18
TDS-08BS	0.71 x 0.87 x 0.98	1.10	0.35	0.20	0.07
TDS-08C	0.94 x 1.14 x 1.14	3.53	0.99	0.64	0.31
TDS-08G	0.57 x 0.75 x 1.61	2.20	0.51	0.26	0.11
TDS-09SL	0.95 x 0.91 x 1.83	4.41	1.52	0.93	0.44
TDS-010A	0.94 x 1.14 x 1.57	3.75	1.83	1.17	0.57
TDS-10E	1.06 x 1.18 x 2.08	4.19	2.05	1.57	0.75
TDS-10G	1.02 x 1.18 x 1.14	3.75	0.46	0.35	0.24
TDS-10M	1.42 x 1.59 x 1.97	5.73	3.53	2.76	1.76
TDS-10S	0.79 x 1.02 x 1.10	3.53	0.31	0.22	0.13
TDS-10SL	0.79 x 1.02 x 1.45	3.75	1.43	0.88	0.40
TDS-12C	1.18 x 1.50 x 2.52	7.05	3.97	3.44	2.31
TDS-12E	1.06 x 1.18 x 2.08	6.39	2.65	1.87	0.99
TDS-12M	1.42 x 1.57 x 1.97	6.17	3.86	3.20	.87
TDS-12SB	0.94 x 1.14 x 1.57	3.75	1.43	0.90	0.40
TDS-15A	1.73 x 2.03 x 3.05	13.45	8.16	7.39	5.95
TDS-15B	1.73 x 2.03 x 2.62	8.38	6.39	5.73	4.41
TDS-16A	1.42 x 1.60 x 2.60	1.02	5.29	4.41	3.24
TDS-16B	2.05 x 2.28 x 3.27	12.13	9.26	8.60	7.50
TDS-F08B	1.23 x 0.71 x 1.33	0.55	0.17	0.09	0.02
TDS-M01	0.27 x 0.51 x 0.76	1.87	—	—	—

Magnetically Latching Open Frame Solenoids

Model	Dimensions (in) W x H x L
TDS-K04A	0.31 x 0.39 x 0.59
TDS-K06B	0.39 x 0.47 x 0.98
TDS-K07A	0.55 x 0.63 x 1.18
TDS-K07W*	0.55 x 0.63 x 1.38
TDS-10SL	0.79 x 1.02 x 1.45
TDS-K12E	1.06 x 1.18 x 2.09
TDS-K12SB	0.95 x 1.14 x 1.58

* TDS-K07W is a bidirectional latching model with plunger extensions at both ends of the unit.

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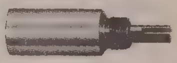
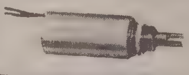
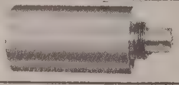
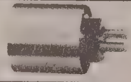
SOLENOIDS

MADE IN THE USA

Box-Frame Solenoids (Pull Version) (Part Numbers Designated) Push Version Also Available.

	Type	Volts	Duty	Ohms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches H	x L	x W
	312-6005	24VDC	Cont.	144	22@1/32"	2@1/4"	3/4	1 5/32	3/4
	312-6006	24VDC	Int.	60	28@1/32"	4@1/4"	3/4	1 5/32	3/4
	312-6011	120VAC	Cont.	390	12@1/32"	2.5@1/4"	3/4	1 5/32	3/4
	312-6012	120VAC	Int.	100	20@1/32"	4@1/4"	3/4	1 5/32	3/4
	5U5-6053	24VDC	Cont.	114	14@1/16"	2.5@3/8"	15/16	1 1/4	27/32
	5U5-6054	24VDC	Int.	52	27@1/16"	5@3/8"	15/16	1 1/4	27/32
	5U5-6059	120VAC	Cont.	500	10@1/16"	4.5@3/8"	15/16	1 1/4	27/32
	5U5-6060	120VAC	Int.	310	17@1/16"	8.5@3/8"	15/16	1 1/4	27/32
	5U7-6065	24VDC	Cont.	85	15@1/8"	3@1/2"	15/16	1 3/4	27/32
	5U7-6066	24VDC	Int.	33	32@1/8"	7@1/2"	15/16	1 3/4	27/32
	5U7-6071	120VAC	Cont.	250	11@1/8"	7.5@1/2"	15/16	1 3/4	27/32
	5U7-6072	120VAC	Int.	140	18@1/8"	12@1/2"	15/16	1 3/4	27/32
	809-6101	24VDC	Cont.	104	12@1/8"	2@1/2"	1 3/16	1 1/8	15/16
	809-6102	24VDC	Int.	50	22@1/8"	3@1/2"	1 3/16	1 1/8	15/16
	809-6107	120VAC	Cont.	400	12@1/8"	5@1/2"	1 3/16	1 1/8	15/16
	809-6108	120VAC	Int.	220	24@1/8"	7@1/2"	1 3/16	1 1/8	15/16
	827-6113	24VDC	Cont.	72	24@1/8"	4@5/8"	1 3/16	1 7/8	15/16
	827-6114	24VDC	Int.	32	40@1/8"	8@5/8"	1 3/16	1 7/8	15/16
	827-6119	120VAC	Cont.	200	12@1/8"	6@5/8"	1 3/16	1 7/8	15/16
	827-6120	120VAC	Int.	85	20@1/8"	13@5/8"	1 3/16	1 7/8	15/16
	940-6137	24VDC	Cont.	50	78@1/8"	8@3/4"	1 5/8	2 3/16	1 7/16
	940-6138	24VDC	Int.	15	140@1/8"	18@3/4"	1 5/8	2 3/16	1 7/16
	940-6143	120VAC	Cont.	53	24@1/8"	15@3/4"	1 5/8	2 3/16	1 7/16
	940-6144	120VAC	Int.	15	100@1/8"	65@3/4"	1 5/8	2 3/16	1 7/16

Tubular Solenoids (Pull Version) (Part Numbers Designated) Push Version Also Available.

	Type	Volts	Duty	Oms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches Length	x Dia.
	R7X9-6171	12VDC	Cont.	80	5@1/32"	1.2@5/32"	1 1/8	7/16
	R7X9-6172	12VDC	Int.	14	9@1/32"	2.5@5/32"	1 1/8	7/16
	R7X9-6173	24VDC	Cont.	260	5@1/32"	1.2@5/32"	1 1/8	7/16
	R7X9-6174	24VDC	Int.	57	9@1/32"	2.5@5/32"	1 1/8	7/16
	R8X7-6362	12VDC	Cont.	55	2.5@1/16"	1@3/16"	7/8	1/2
	R8X7-6363	12VDC	Int.	20	6@1/16"	1.5@3/16"	7/8	1/2
	R8X7-6364	24VDC	Cont.	240	2.5@1/16"	1@3/16"	7/8	1/2
	R8X7-6365	24VDC	Int.	80	6@1/16"	1.5@3/16"	7/8	1/2
	R8X12-6372	12VDC	Cont.	40	7@1/32"	1.5@1/4"	1 1/2	1/2
	R8X12-6373	12VDC	Int.	10	14@1/32"	4@1/4"	1 1/2	1/2
	R8X12-6374	24VDC	Cont.	160	7@1/32"	1.5@1/4"	1 1/2	1/2
	R8X12-6375	24VDC	Int.	38	14@1/32"	4@1/4"	1 1/2	1/2
	R12X12-6211	12VDC	Cont.	41	6.5@1/8"	1.2@5/8"	1 1/2	3/4
	R12X12-6212	12VDC	Int.	6	20@1/8"	6@5/8"	1 1/2	3/4
	R12X12-6213	24VDC	Cont.	165	6.5@1/8"	1.2@5/8"	1 1/2	3/4
	R12X12-6214	24VDC	Int.	25	20@1/8"	6@5/8"	1 1/2	3/4
	R16X16-6231	12VDC	Cont.	26	21@1/8"	6.5@5/8"	2	1
	R16X16-6232	12VDC	Int.	3.8	56@1/8"	20@5/8"	2	1
	R16X16-6233	24VDC	Cont.	105	21@1/8"	6.5@5/8"	2	1
	R16X16-6234	24VDC	Int.	15	56@1/8"	20@5/8"	2	1
	R24X13-6243	24VDC	Cont.	85	50@1/8"	5@5/8"	1 5/8	1 1/2
	R24X13-6244	24VDC	Int.	14	150@1/8"	20@5/8"	1 5/8	1 1/2
	R24X19-6253	24VDC	Cont.	59	80@1/8"	8@1"	2 3/8	1 1/2
	R24X19-6254	24VDC	Int.	10	140@1/8"	32@1"	2 3/8	1 1/2

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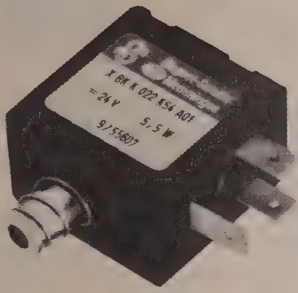

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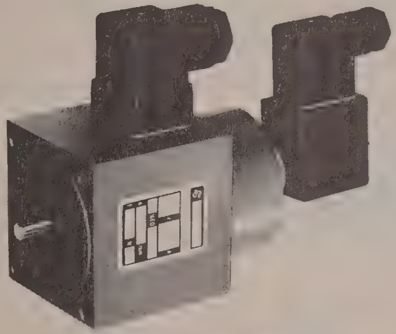

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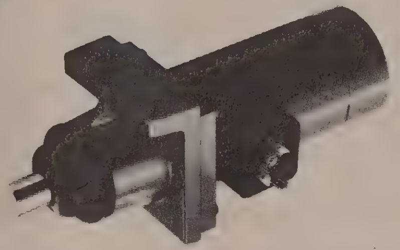

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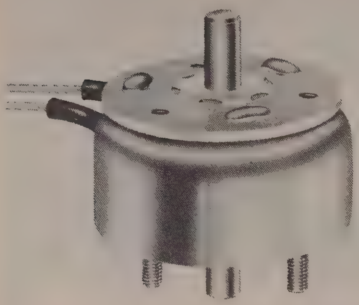
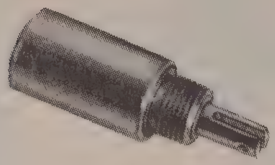


Rotary Solenoids

- Rapid response, high torque actuation
- Eight sizes available
- Right or left stroke from 25° to 95°
- Torque output to 30 lb./in.
- Modifications available

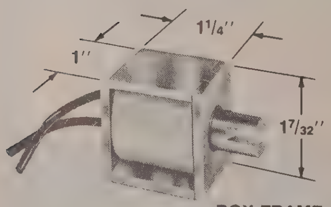
			Torque at 25° Stroke		Torque at 35° Stroke		Torque at 45° Stroke		Torque at 67 1/2° Stroke		Torque at 95° Stroke	
Type	O.D. (in.)	Height (in.)	100% Duty	5% Duty	100% Duty	5% Duty	100% Duty	5% Duty	100% Duty	5% Duty	100% Duty	5% Duty
2E	1.125	.656	0.22	1.71	0.17	1.31	0.11	0.89				
3B	1.312	.875	0.37	3.20	0.28	2.40	0.16	1.70	0.09	0.80		
3E	1.312	.796	0.38	3.21	0.27	2.31	0.17	1.82	0.10	0.89		
5B	1.875	1.203	1.89	10.04	1.00	8.35	0.75	6.01	0.55	4.02	—	1.90
5E	1.875	1.203	1.80	11.92	0.90	8.32	0.65	6.22	0.47	4.42	0.20	2.35
5S	1.875	1.046	2.00	13.25	1.00	9.25	0.73	6.91	0.52	4.91	0.23	2.61
6E	2.250	1.546	4.32	27.60	3.15	18.50	1.57	10.90	1.45	8.80	0.82	5.10
6S	2.250	1.343	4.80	30.70	3.50	20.60	1.75	12.10	1.62	9.80	0.92	5.70



Tubular Solenoids

- Provide 10 million cycles
- Push or pull types
- Spring return available
- Nine sizes available
- Pull up to 1 1/4" stroke
- Modifications available

						Force (ounces) @Stroke (inches)	
Type	O.D. (in.)	Length (in.)	Duty	Ohms @12VDC	Ohms @24VDC	Min.	Max.
C7-18	7/16	1 1/8	Cont.	72.0	288.0	1.5@1/8"	0.5@1/4"
			Int.	14.4	58.0	6.0@1/8"	2.0@1/4"
C8-14	1/2	7/8	Cont.	60.0	240.0	0.8@1/8"	—
			Int.	20.6	82.0	3.0@1/8"	0.5@1/4"
C8-24	1/2	1 1/2	Cont.	41.0	165.0	3.0@1/8"	0.2@1/2"
			Int.	9.6	38.5	6.0@1/8"	2.5@1/2"
C8-32	1/2	2	Cont.	36.0	145.0	2.5@1/8"	0.8@3/4"
			Int.	7.2	29.0	8.0@1/8"	3.8@3/4"
C12-24	3/4	1 1/2	Cont.	41.0	165.0	7.0@1/8"	0.5@3/4"
			Int.	6.5	26.0	21.0@1/8"	3.0@3/4"
C16-18	1	1 1/8	Cont.	36.0	144.0	10.0@1/8"	0.2@1/2"
			Int.	7.6	30.0	35.0@1/8"	4.0@1/2"
C16-32	1	2	Cont.	26.0	105.0	20.0@1/8"	1.0@3/4"
			Int.	3.8	15.0	65.0@1/8"	13.0@3/4"
C24-26	1 1/2	1 5/8	Cont.	20.6	82.0	50.0@1/8"	1.0@3/4"
			Int.	82.0	14.0	140.0@1/8"	10.0@3/4"
C24-38	1 1/2	2 3/8	Cont.	14.5	58.0	90.0@1/8"	8.0@3/4"
			Int.	2.4	9.6	180.0@1/8"	45.0@3/4"



BOX FRAME

Box Frame Solenoids

- A.C. and D.C. available
- Leads or terminals available
- Pull up to 3 3/4# at 1" stroke
- Nine sizes available
- Modifications available

FLAT PACK SOLENOIDS AND SOLENOID SELECTROS ARE ALSO AVAILABLE.

							Force (ounces) @Stroke (inches)	
Type	Height (in.)	Length (in.)	Width (in.)	Volts	Duty	Resist. Ohms	Min.	Max.
34	3/4	49/64	3/4	24VDC	100%	120.0	10@1/32"	1@1/4"
					25%	33.6	35@1/32"	4@1/4"
35	3/4	1 3/16	3/4	24VDC	100%	91.0	17@1/16"	1@3/8"
					25%	22.7	35@1/16"	7@3/8"
36	1 7/32	1 25/64	1	120VAC	100%	285.00	23@1/16"	9@7/8"
					25%	70.0	80@1/16"	32@5/8"
37	15/16	1 5/8	13/16	24VDC	100%	60.0	32@1/16"	1@3/4"
					25%	13.2	70@1/16"	6@3/4"
38	1 53/64	1 5/8	1 9/16	24VDC	100%	71.6	56@1/8"	5@1/2"
					25%	18.2	154@1/8"	22@1/2"
				120VAC	100%	123.0	24@1/8"	8@1/2"
					25%	30.8	75@1/8"	38@1/2"
39	1 53/64	2 1/8	1 9/16	24VDC	100%	67.3	73@1/8"	6@5/8"
					25%	16.1	159@1/8"	28@5/8"
				120VAC	100%	97.7	18@1/8"	10@5/8"
					25%	24.7	67@1/8"	39@5/8"
40	1 53/64	2 5/8	1 9/16	24VDC	100%	53.0	80@1/8"	5.5@7/8"
					25%	13.4	150@1/8"	29.5@7/8"
				120VAC	100%	86.4	12@1/8"	5.75@7/8"
					25%	20.7	52@1/8"	26.5@7/8"
41	1 7/32	1 1/4	1	24VDC	100%	74.5	19@1/8"	4@3/8"
					25%	17.5	62@1/8"	23@3/8"
				120VAC	100%	452.0	12@1/8"	4@3/8"
					25%	114.0	45@1/8"	21@3/8"
42	1 7/32	2	1	24VDC	100%	79.0	26@1/8"	4@1/2"
					25%	19.4	70@1/8"	20@1/2"
				120VAC	100%	123.0	24@1/8"	12@1/2"
					25%	31.0	21@1/8"	7@1/2"

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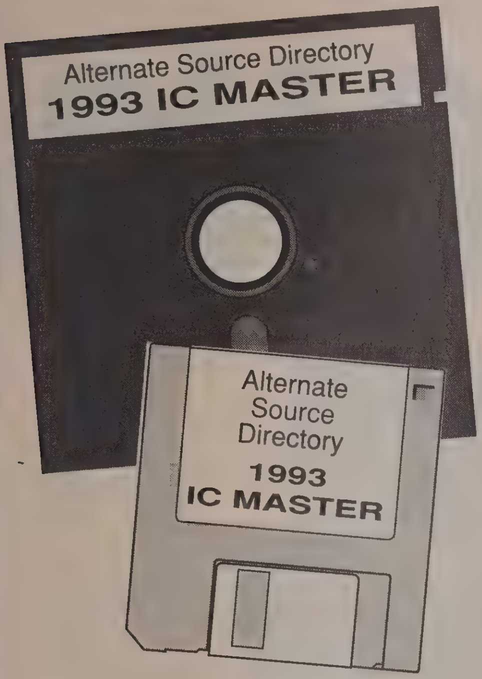

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Published annually in March

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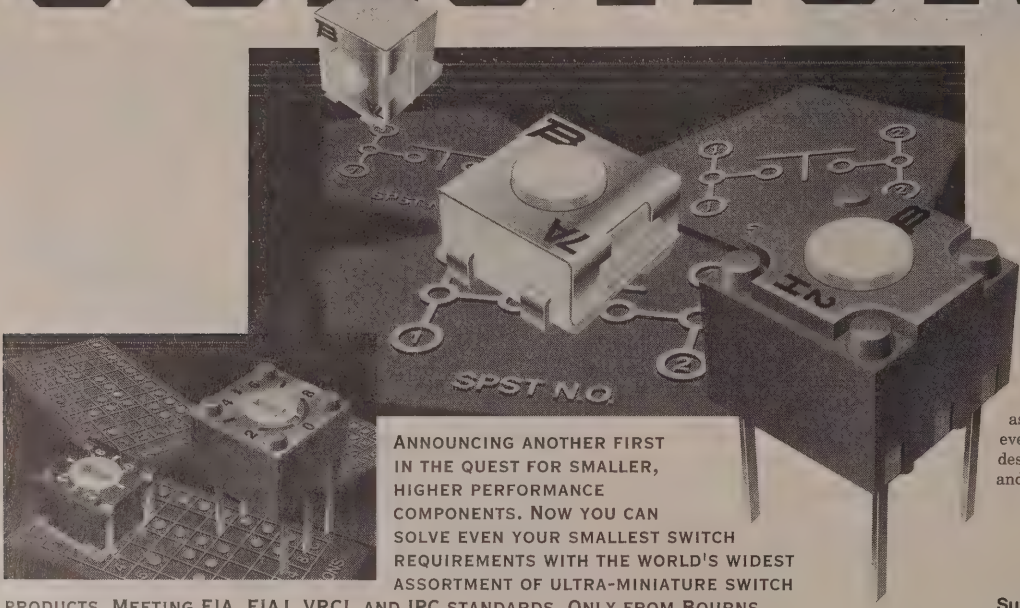

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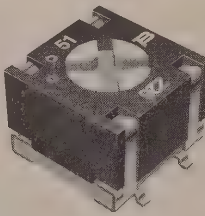

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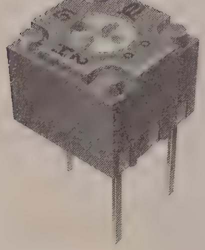

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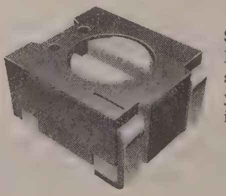

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BOURNS INC

Dedicated to Innovative Solutions

United States: (909) 781-5500; FAX: 909-781-5700; **Switzerland:** 042-33 33 33, Telex: 868 722, FAX: 042-33 05 10; **Benelux:** 070-387 44 00, Telex: 32 023, FAX: 070-387 62 30; **Germany:** 0711-22 93 0, FAX: 0711-29 15 68; **France:** 01-40 03 36 04, Telex 220 381, FAX 01-40 03 36 14, **Ireland:** 021-35 70 01, Telex: 75 904, FAX: 021-35 74 43; **United Kingdom:** 0276-69 23 92, Telex: 859 735, FAX: 0276-69 10 37; **Singapore:** (65) 738-0290; FAX: 65-733-7960; **Hong Kong:** (852) 7360308, FAX. 852-3170836; **Korea** (82) 2-556-3619, FAX: 82-2-556-9016; **Japan:** (03) 3221-9726; FAX: (03) 3239-2817

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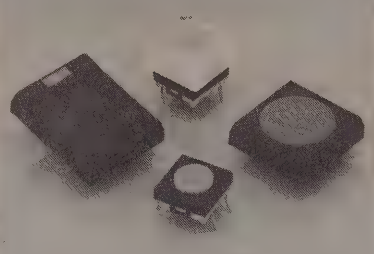
SWITCHES

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton						Reed	Rocker/ Paddle		Rotary		Slide	Snap Action	Thumbwheel	Toggle	Mercury	Features
				Momentary Action		Positive Action		Interlock												
				Lighted	Non-Lighted	Lighted	Non-Lighted	Lighted	Non-Lighted		Lighted	Non-Lighted	Single Section	Multi-Section						
Aleph International	B•1662		√							√						√			√	Explosion proof, high voltage, power, RF, sealed. *Other types:* opto switches, opto interrupter switches, opto reflective switches, opto microswitches, proximity siwtches, level switches, actuator-type opto sensors
AME Corp.	B•1663			√		√		√					√	√				√		
American Control Technology	B•1665	√		√	√												√			Illuminated, sealed, coded. *Other types:* Intelligent thumbwheel, pushbutton switches. Programmable interactive switches. Multi-function.
AMP Incorporated	B•1666	√†	√†												√†					Sealed, coded. *Other types:* Post and DIP(§W) shunts.
APM Hexseal	B•1669			√		√		√			√		√	√				√		Illuminated, sealed.
Arcolectric Corp.	B•1670		√	√		√					√				√	√		√		Illuminated, power, sealed.
Aries Electronics	B•1673	√																		
Aromat Corp.	B•1674															√†				Sealed.
Bourns, Inc.	B•1675				√§†								√§†	√§†						RF, sealed, touch, coded, (all surface mount and wave solderable. *Other types:* Selector, rotary, key, tactile.
Burgess-SAIA	B•1681				√		√							√		√				Explosion proof, key lock, sealed.
C & K Components	B•1684	√§†	√†	√§†	√§†						√†	√†	√	√	√†		√	√§†		Illuminated, keylock, power, sealed, coded.
Capitol Switch	B•1687																			
Carlingswitch	B•1688				√		√				√	√	√	√				√		Illuminated, high voltage, power, sealed, touch.
Cherry Electrical Products	B•1693			√	√											√	√			
Cole Instruments	B•1699												√	√		√				Explosion proof, high voltage, key lock, power, sealed, coded.
Comus International	B•1700																		√	Sealed. *Other types:* Non-Mercury tilt switches.
Crosspoint/Info-Lite	B•1701																			*Other types:* Matrix program pinboards.
Crouzet Controls	B•1702											√				√	√	√		
CTS Electrocomponents	B•1704	√†																		
CUI/Stack, Inc.	B•1706	√		√	√	√	√				√	√	√	√	√	√		√		Sealed.
CW Industries	B•1707			√		√					√		√		√	√		√		

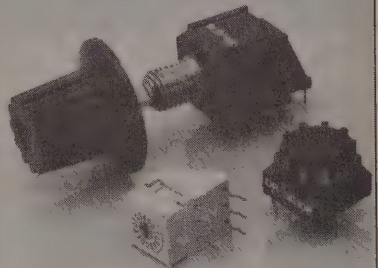
§ Surface Mount
† Wave Solderable

KEYS TO SUCCESS



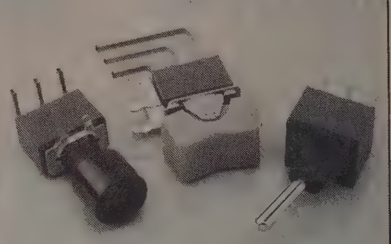
Dome contact, low profile keypad switches. Lighted & non-lighted, round & square. Sub-surface mounting types. Up to 5 million actuations.

FLAWLESS LOGIC



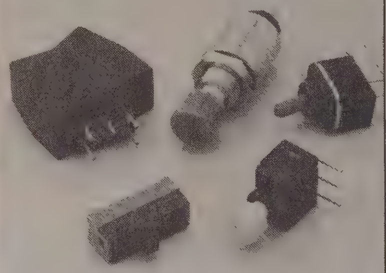
Real or complement coded, decimal or hexidecimal dip rotaries. Screwdriver, shaft or dial actuation. Washable.

WASH AND GO



NKK washables lead the way with the industry's widest range of circuits, actuators, terminals & accessories. Micro thru std. sizes.

LITTLE GIANTS



NKK pioneered the smallest. Toggles, rocker, pushbutton, slides. Washables, SMDs, anti-static & STC contacts available.

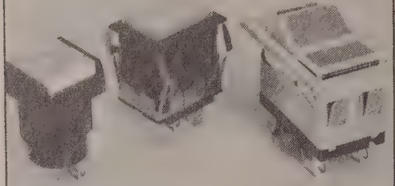
FREE DESIGN TOOL

nkk switches

LIGHT FANTASTICS

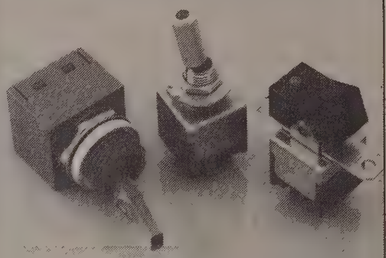
Tiny, but bright. Low-profile snap-in or panel mounting. Numerous actuators, circuits, ratings, terminals and colors.

WAYS TO GLOW



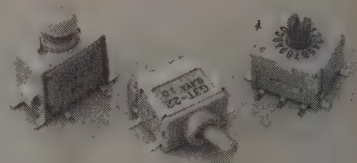
Round, square, rectangle shapes. In all popular colors. Wide choice of terminals, circuits, lamp types & accessories.

POINTS OF LIGHT



Lighted toggle and paddle tips add style and function to designs. Several actuator and circuit options.

STAY ON TOP



The latest surface mount technology. Washable, vapor phase solderable toggles, pushbuttons and dip rotaries. Gull-winged terminals.

DESIGN PARTNERS

We have exactly what every design engineer needs — over one million switch options and more than 40 years of switch know-how. Before you start your design-in, call for our 456-page Design Guide, then call on our experience. Make sure your design-ins go flawlessly. Make NKK your design partner right from the start.

Call NKK Switches,
(602) 991-0942
7850 E. Gelding Dr.,
Scottsdale, AZ 85260
FAX (602) 998-1435.

nkk® switches

SWITCHES (cont'd)

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton						Reed	Rocker/ Paddle		Rotary		Slide	Snap Action	Thumbwheel	Toggle	Mercury	Features
				Momentary Action		Positive Action		Interlock												
				Lighted	Non-Lighted	Lighted	Non-Lighted	Lighted	Non-Lighted		Lighted	Non-Lighted	Single Section	Multi-Section						
Digitran	B•1708		√														√			Decade explosion proof, illuminated, sealed, touch, coded. *Other types:* Pushbutton coded, secure lighted, NVIS compatible.
Direct Sound Corp.	B•1709			√		√					√				√			√		Illuminated, sealed. *Other types:* Multi-push switches.
Dow-Key Microwave	B•1710																			*Other types:* Microwave & RF switches & relays.
Durakool, Inc.	B•1711														√			√	√	Power, sealed.
E-Switch	B•1722		√	√	√	√	√	√	√		√	√	√		√			√		Illuminated, key lock, sealed
EAO Switch Corp.	B•1713		√	√	√	√	√	√	√							√				Illuminated, keylock, power, sealed.
Electro-Mech Components	B•1714			√		√		√												Explosion proof, power, sealed.
Electroswitch	B•1716												√	√		√				Illuminated, high voltage, key lock, power.
Elma Electronics	B•1718		√	√	√	√	√						√	√	√	√		√		Illuminated, key lock, sealed, coded.
E-T-A Circuit Breakers	B•1721					√	√			√	√									Circuit breakers/ Switch combo
Fifth Dimension	B•1725																		√	*Other types:* Tilt, impulse, proximity.
Grayhill Inc.	B•1729	√§†			√		√						√	√						*Other types:* Optically coupled rotary encoder.
Hamlin	B•1734									√									√	High voltage. *Ratings/approvals:* UL File # E47258.
Hasco Components International Co.	B•1735									√										
Hermetic Switch Inc.	B•1737									√										Explosion proof, high voltage, power, RF, sealed.
IDEC	B•1738			√		√											√			Illuminated, key lock.
Illinois Lock	B•1742																			Key lock.
ITT Schadow	B•1744			√†	√§†	√†	√†	√	√											
ITW Switches	B•1746		√	√†	√†	√†	√†				√		√	√	√§†	√				Illuminated, power, sealed.
IVO Industries Inc.	B•1756																√			Coded.
Janco Corp.	B•1758			√		√		√					√	√						High voltage, key lock, power, RF, sealed, coded.
Lamb Industries	B•1760	√§†		√	√	√	√		√		√	√			√	√		√		Illuminated, high voltage, power, sealed, coded (Surface mount and wave solderable.) *Other types.* Water proof rockers, module type water proof tactile.

§ Surface Mount
† Wave Solderable

SWITCHES (cont'd)

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton						Reed	Rocker/ Paddle		Rotary		Slide	Snap Action	Thumbwheel	Toggle	Mercury	Features
				Momentary Action		Positive Action		Interlock												
				Lighted	Non-Lighted	Lighted	Non-Lighted	Lighted	Non-Lighted		Lighted	Non-Lighted	Single Section	Multi-Section						
Lucas Ledex Inc.	B•1766												√	√						
McGill Electrical	B•1767										√					√		√		Illuminated, power, sealed.
Mepcopal	B•1770	√			√								√§†		√§†					Sealed, coded. (§W)
Micro Switch	B•1772		√		√						√					√		√		Illuminated, high voltage, key lock, power, sealed.
MORS/ASC	B•1778	√	√	√		√		√			√				√	√		√		Illuminated, power, sealed, touch, coded. *Other types:* DIP rotary.
NKK Switches of America	B•1782			√	√§†						√	√†	√§†	√	√	√		√§†		Illuminated, key lock, power, sealed, coded.
Oak Grigsby	B•1790			√	√			√	√				√	√	√					Illuminated, key lock, power, sealed, coded.
Omega Engineering	B•1796												√	√						*Other types:* Thermocouple low contact resistance.
Oslo Controls	B•1797			√		√					√									Illuminated, high voltage, key lock, power.
Otto Controls	B•1798				√		√		√		√	√				√		√		
Pres-Air-Trol	B•1800				√		√													Explosion proof, power, sealed.
RDI Electronics	B•1801				√†		√†		√†			√†			√	√		√		Sealed, touch. (§W)
Ross Engineering Corp.	B•1802													√						High voltage, power, RF. *Other types:* High current.
Schurter Inc.	B•1803			√		√								√		√				Illuminated, high voltage, power, sealed.
SECMA	B•1804			√		√									√			√		Illuminated, sealed. *Other types:* SMD, modular.
Shallco	B•1808												√	√		√				Decade, high voltage, key lock, sealed, coded.
SOLICO/MEC	B•1812			√														√		Illuminated, sealed, touch.
Standex Electronics	B•1810									√										
Switchcraft Inc.	B•1813		√	√				√			√				√			√		Illuminated.
T-Bar Inc.	B•1814			√														√		Sealed.
Tech Laboratories	B•1815												√	√		√	√	√		Decade, power, sealed, coded.
Veetronix	B•1816				√			√		√										Illuminated, sealed, touch, coded.

§ Surface Mount
† Wave Solderable

PRESSURE SWITCHES

Manufacturer	Starting EEM Page No.	Type					Sensor Type					Switch Mechanism		Features					
					Gauge														
		Atmospheric	Absolute	Differential	Vacuum	Pressure	Diaphragm	Piston	Bourdon Tube	Bellows	Other	Momentary	Snap Action	Current Capabilities	Hysteresis	Seal Contacts	Wet Proof	Explosion Proof	Indicator
Aleph Int'l.	B•1662											√	√			√	√	√	
Burgess-SAIA	B•1681										√	√	√			√	√	√	
ITW Switches	B•1746											√	√						
Lamb Industries	B•1760	√		√	√	√	√					√		√			√		
Omega	B•1796	√	√	√	√	√	√		√		√	√	√	√		√	√		√
Pres-Air-Trol	B•1800			√	√	√	√					√	√					√	

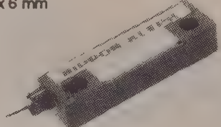
ALEPH INTERNATIONAL

1026 Griswold Avenue • San Fernando, CA 91340
Telephone: (800) 423-5622 • (818) 365-9856
Fax: (818) 365-7274

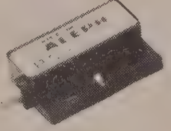
SENSORS & SWITCHES

PROXIMITY SENSORS

PS-5XX,DSM2: 1.2 x .40 x .20 in.
32 x 10 x 6 mm



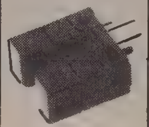
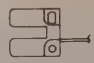
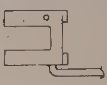
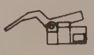
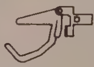
PS-3150 } .90 x .55 x .23 in.
PS-3251 } 23 x 14 x 6 mm



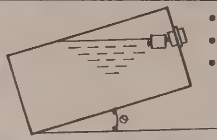
PS-6XXX:1.18 x .70 x .23 in.
30 x 18 x 6 mm

	CONTACT FORM	
Miniature	N O	PS-500
	N C	PS-510
	SPDT	PS-520
	Latching	DS-M2
General	N O	PS-3150
	N C	PS-3251
High power	N O	PS-6132
	N C	PS-6231
	SPDT	PS-6341
	NO(Mercury)	PS-6503

UL Models Available

			CONTACT FORM	
.78 X 39 X .78 in. 20 x 10 x 20 mm 		General purpose 0.200" sensing slot	N C	PS-7711 Wire Leads
			N C	PS-7702 Connector
2.2 x 1.4 x 2.7 in. 56 x 38 x 69 mm		Large type (for elevtor applications) 1" sensing slot	N C	PS-0015
		1.77 x 1.70 x 0.79 in 45 x 43 x 20 mm Counterweight (snap mount)	N C	AS-001
		2.28 x 1.77 x 0.91 in 58 x 45 x 23 mm	N C	AS-101

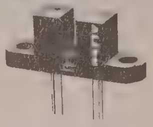
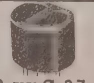
LEVEL SENSORS

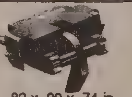
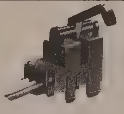


- Top/Bottom/Side mount models
- Single and multiple floats
- Wide range of contact options - SPST (NC/NO), SPDT, multiple contact arrangements
- Variety of materials-stainless steel, brass, polypropylene, Nylon 6 and others
- Standard and custom parts
- High power (50W) contacts available

• ESL-002	OFF for float rise
• ESL-003	ON for float rise

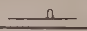
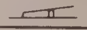
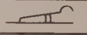
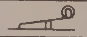
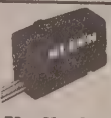
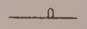
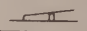
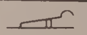
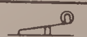
OPTO SENSORS

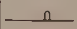
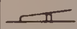
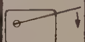
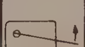
		OUTPUT	
 1.0 x .23 x .39 in. 25 x 6 x 10 mm	• Screw mount • High sensitivity • Industry standard package • 0.1"sensing slot	Tr	OJ-1402
		DTr	OJ-1406
		IC	OJ-1401
		IC-OC	OJ-1405
 1.3 x .43 x .70 in. 34 x 11 x 18 mm	• Screw mount • Open collector, Photo IC output • 0.2 sensing slot	IC-OC	OJ-3705
		IC-OC (Reversed output)	OJ-3703
 H=3 mm Ø=3.7 mm H=0.11 in., Ø=0.14 in.	• PCB mount • Ceramic case • GaAlAs IR LED • Miniature	Tr	OM-2222
		DTr	OM-2323

		OUTPUT	
 .77 x .45 x .82 in 19.5 x 11.5 x 21 mm	• Selectable actuator style • 5 different termination styles • 3 different output styles • Snap action mount	Tr	OS-5202
		IC	OS-5201
 .82 x .90 x .74 in 21 x 23 x 19 mm	• Snap action mount • Space saver • Low actuating force • Spring loaded actuators	Tr	OS-5602
 .74 x .90 x .82 in 19 x 23 x 22 mm	• Snap action mount • Top side actuator • Low actuating force • Counterweight actuator	Tr	OS-5002
		Tr-R	OS-5002-2
		IC	OS-5001

OPTO MICROSWITCHES

Solid state alternative to mechanical snap switches

V Type	 1.1 x .39 x .63 in, 28 x 10 x 16 mm	• Long life • Digital output • Open collector (also available with pull-up resistor)		OB-210512
				OB-210532
				OB-210552
				OB-210572
S Type	 .78 x .23 x .51 in 20 x 6 x 13 mm	• Miniature, Long life • Selectable supply voltage of 5V to 24VDC with RF and RL resistor values • Industry standard		OB-600112
				OB-600132
				OB-600152
				OB-600172

J Type	 .51 x .23 x .24 in 13 x 6 x 7 mm	• Subminiature • High reliability • PCB-mount type • Industry standard package		OB-703213
				OB-703233
C Type	 1.2 x .66 x. 66 in 31 X17 X17 mm	• Rotary type • Long life (100 M operations min) • Low operating force • Industry standard package		OR-300112 Clockwise rotation
				OR-310112 Counter-clockwise rotation

Free evaluation samples and design assistance to qualified OEM Designers

SWITCH SEALS

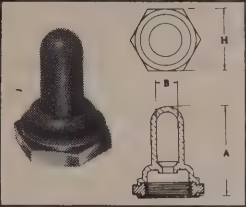
Backed by over 25 years of engineering solutions — for an ever-changing and demanding market.

The wide demand for custom-molded panel and switch seals, threaded inserts bonded to rubber, O-rings, boots and seals, etc., translated is really a demand for talent and know-how to handle the engineering and molding of particularly thorny or unusual custom requirements that frequently plague industry. AME meets the demand. . . with experience, service and unique production techniques.

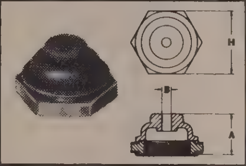
CUSTOM ENGINEERED PRECISION MOLDED ELASTOMERS

- Color filters for incandescent lamps
- Rubber to metal bonding
- Clear silicone products
- Self-sealing hex nuts
- Self-sealing washers
- Extrusions
- O-rings
- Boots
- Gaskets
- Seals
- Conductive rubber
- Die cutting

TOGGLE SWITCH SEALS*

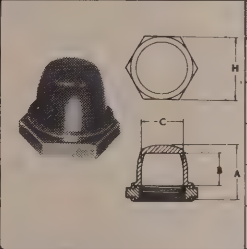


Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1100	M5423/01-01	15⁄32-32 UNS-2B	in.	.86	.22	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(21.84)	(5.59)	(15.88)	
1102	None	15⁄32-32 UNS-2B	in.	.86	.22	.625 Hex	
			mm	(21.84)	(5.59)	(15.88)	
1103	None	15⁄32-32 UNS-2B	in.	.90	.22	.625 Hex	Nut-Brass, Rubber-Neoprene, 50 Durometer Black
			mm	(22.86)	(5.59)	(15.88)	
1105	M5423/05-01	¼-40 UNS-2B	in.	.50	.064	.375 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 30 Gray
			mm	(12.70)	(1.63)	(9.53)	



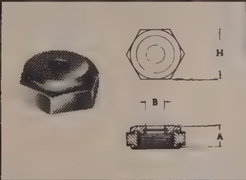
Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1101	M5423/02-01	15⁄32-32 UNS-2B	in.	.40	.09	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(10.16)	(2.29)	(15.88)	
1104	None	⅝-24 UNEF-2B	in.	.75	.09	.812 Hex	
			mm	(19.05)	(2.29)	(20.62)	
1106	M5423/11-01	¼-40 UNS-2B	in.	.25	.05	.375 Hex	
			mm	(6.35)	(1.27)	(9.53)	

PUSH BUTTON SWITCH SEALS*



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	C	H	Material Specifications
2100	M5423/07-01	15⁄32-32 UNS-2B	in.	.55	.32	.42	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(13.97)	(8.13)	(10.67)	(15.88)	
2101	None	½-32 UNS-2B	in.	.46	.29	.41	.750 Dia.	
			mm	(11.68)	(7.37)	(10.41)	(19.05)	
2102	M5423/07-02	15⁄32-32 UNS-2B	in.	.72	.48	.42	.625 Hex	
			mm	(18.29)	(12.19)	(10.67)	(15.88)	
2103	M5423/10-01	¼-32 UNEF-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	
2104	M5423/10-02	¼-40 UNS-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	

ROTARY SWITCH & POTENTIOMETER SEALS



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	Size of Shaft B	H	Material Specifications
3100	M5423/09-02	⅜-32 UNEF-2B	in.	.22	.250	.500 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(5.59)	(6.35)	(12.70)	
3101	M5423/09-01	⅜-32 UNEF-2B	in.	.22	.125	.500 Hex	
			mm	(5.59)	(3.18)	(12.70)	
3102	M5423/09-04	15⁄32-32 UNS-2B	in.	.22	.250	.625 Hex	
			mm	(5.59)	(6.35)	(15.88)	

*FOR A COMPLETE LISTING OF ALL STYLES AVAILABLE, INCLUDING ROUND BASE SEALS, PLEASE CONTACT THE FACTORY.

MANY OTHER SIZES AND TYPES AVAILABLE

Pressure capabilities: Internal Pressure
1 Atmosphere, 15 psi (103.4 kPa)
External Pressure
2 Atmospheres, 30 psi (206.8 kPa)

For Part #1106 — Internal pressure
.7 Atmosphere, 10 psi (69 kPa)
External pressure
1.4 Atmospheres, 20 psi (138 kPa)

Endurance: Exceeds 100,000 actuations (depending on environment).

Useful life: 20 years to unlimited (depending on environment).

Switch Seals are designed and manufactured to meet or exceed applicable military specifications.

FAX (201) 263-8199

Switch Seals

An elastomeric boot which seals, thus protecting a switch and internal components against hazardous foreign elements. AME's one piece switch seal is constructed of a flexible rubber boot element bonded during molding to a threaded metal insert that fully encapsulates the switch and bushing to the panel.

This assembly replaces the panel mounting nut and seals the mounting hole making it watertight. It protects against moisture, oil, dirt, dust, most solvents, many acids (see elastomer selection guide).

Switch seals provide vibration resistant mounting and act as double insulation with no interference to switch movement.

CAST URETHANE & SILICONE

AME supplies cast urethane and silicone products precision engineered to meet your most demanding requirements.

If you need high tensile/tear strength, excellent resistance to abrasion and high impact capability, our cast urethane is ideally suited for the job. Superb temperature resistance to the damaging sub-zero cold or searing heat extremes is found in the cast silicone custom engineered by AME Corporation.

AME CORPORATION

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Towaco, NJ 07082-0195
(201) 263-1700

SWITCH SEALS

MINIGLOSSARY
BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In

(CC)	Communication Control
(FE)	Format Effector
(IS)	Information Separator

DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon

<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

The world's first intelligent man/machine interface in a DIP . . .

Provides all of the display and switch functions you'll ever need in a single compact device. Stackable and cost-effective.

The secret? A single LSI chip with state-of-the-art CMOS logic. Developed jointly with GE/RCA. Logic that combines a single-character alphanumeric display, thumbwheel switch and pushbutton switch functions in one easy-to-use component. A true peripheral device with a RAM-like CPU interface.

An intelligent thumbwheel switch that will put you miles ahead of the competition. With capabilities they can only dream about. Unless, of course, you tell them.

In a simple application you might directly replace those out-dated mechanical thumbwheel switches. A typical cookbook design. And without a host CPU.

In a more sophisticated application you might use a host processor to provide programmable control over man/machine interactions. Such as formula selection and entry, display of messages, user friendly menus, or a mix of some or all of these capabilities. The possibilities are limited only by your imagination.

No matter how simple or how complex your application is, no other interactive component has so much to offer and is so easy to use.

Concerned about availability? Standard parts are typically off-the-shelf. We've even set up a second source so that you'll receive an uninterrupted supply.

Got a deadline to meet? Our technical support team will help get you on the air in record time. Or maybe one of our off-the-shelf intelligent thumbwheel assemblies will fit the bill.

Whether you need to make a decision fast, or you're just thinking about down the road. Our microcontroller-based evaluation kit will provide you with instant evaluation, complete documentation and everything else you need to get started. Order one right now and experience intelligent interaction.

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EVALUATION/DESIGNER'S KIT

This handy low-cost kit will save you weeks of time. The kit includes everything you need for evaluating, prototyping and designing with this new technology. A MUST for your engineering lab.

Includes a microcontroller programmed to demonstrate the many functions and capabilities of these devices.

The kit includes:

- 15 assorted intelligent thumbwheels
- A microcontroller-based evaluation board with all components (includes a preprogrammed Signetics S87C751 microcontroller)
- Technical data sheets and specifications
- Application notes

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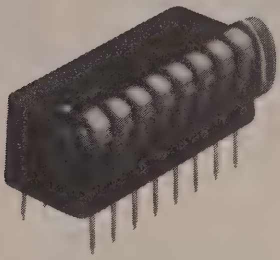
AMERICAN CONTROL TECHNOLOGY, INC., 1447 HOLMES ROAD, ELGIN, IL 60123-1203
PHONE: (708) 468-6000 FAX: (708) 468-8959

Printed Circuit Board Switches and Shunts

Single Pole Single Throw Side Actuated



Contact Lead Spacing—.100 x .300 [2.54 x 7.62]

Lead Length—.140 [3.57] below mounting surface

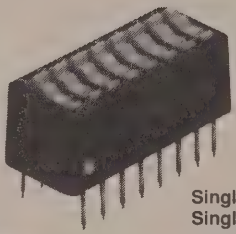
No. of Switch Positions	SPST Side Actuated Part No.	
	Unsealed[1]	Sealed
2	1-435802-0	1-435802-3
3	435802-2	1-435802-4
4	435802-3	1-435802-5
5	435802-4	1-435802-6
6	435802-5	1-435802-7
7	435802-6	1-435802-8
8	435802-1	435802-9
9	435802-7	1-435802-9
10	435802-8	2-435802-0
12	—	2-435802-2

[1] All switches are bottom sealed.

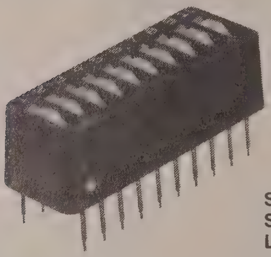
DIP Switches Standard 7100 Series

Contact Lead Spacing—.100 x .300 [2.54 x 7.62]

Lead Length—.140 [3.57] below mounting surface



Single Pole
Single Throw



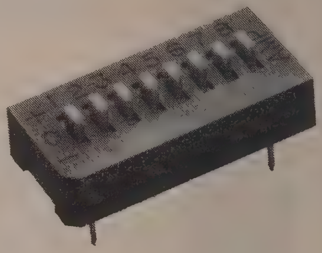
Single Pole
Single Throw
Low Profile

No. of Switch Positions	SPST Standard Profile Part No.		SPST Low Profile Part No.[2]	
	Unsealed[1]	Sealed	Unsealed[1]	Tape-Sealed
2	2-435640-9	3-435640-3	435668-1	2-435668-6
3	3-435640-0	3-435640-4	435668-2	3-435668-3
4	435640-2	3-435640-5	435668-3	3-435668-4
5	435640-3	3-435640-6	435668-4	3-435668-5
6	435640-4	3-435640-7	435668-5	2-435668-5
7	435640-1	3-435640-8	435668-6	2-435668-7
8	435640-5	3-435640-9	435668-7	2-435668-8
9	435640-6	4-435640-0	435668-8	2-435668-9
10	435640-7	4-435640-1	435668-9	3-435668-0
12	3-435640-2	4-435640-3	1-435668-1	3-435668-2

[1] All switches are bottom sealed.

[2] UV sealed switches are also available.

Trinary Slide Switch 7800 Series



Materials:

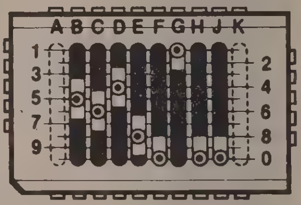
Case and Base—Glass-filled polyester, 94V-0 rated

Slide—Polyester, 94V-0 rated

Spring Contacts and Leads—Copper alloy, plating in accordance with AMP Product Specification 108-7047

8 Pos. Part No. 436172-3
9 Pos. Part No. 436172-2

AMP Mini-Matrix Slide Switches



Materials:

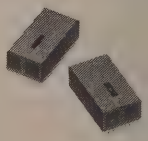
Structural Plastic—Glass-filled thermoplastic, 94V-0 rated

Column and Row Buses—Copper alloy, contact areas gold plated

Slide Springs and Contacts—Beryllium copper, gold plated

Switch Configuration	Switch Part Number
10 x 10	436270-1

Tandem Spring Shunts



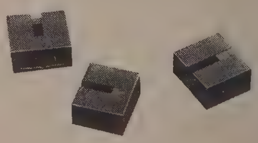
.100 [2.54] Centerline

Part No. 530153-2 (Black)[1]

.000030 [0.00076] Gold Inlay in contact area

[1] Other colors available.

2 mm Mini-Shunt



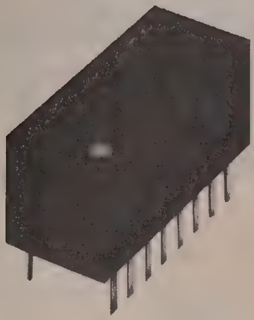
.079 [2.00] Centerline

Part No. 382575-2 (Strip of 10)

.000015 [0.00038] Gold plate in contact area

For more information request Catalog 82162

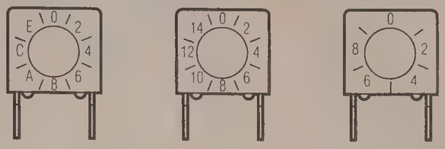
Preprogrammed Printed Circuit Board Switches



Contact Lead Spacing—
.100 x .300 [2.54 x 7.62]

Lead Length—.120 [3.05] below mounting hole

Stamping Legend



Style I Style II Style III

Switch Type	Actuator	Stamping Legend Style[1]	Bottom Sealed	Removable Tape Seal on Actuator	Switch Part No.
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	I	Yes	No	53137-5
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	II	Yes	No	53137-6
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	I	Yes	Yes	54792-1
Hexadecimal w/Complement (16 Position)	Screwdriver Slot	II	Yes	Yes	54792-2
BCD w/Complement (10 Position)	Screwdriver Slot	III	Yes	No	53919-2
BCD w/Complement (10 Position)	Screwdriver Slot	III	Yes	Yes	54778-1
BCD w/Complement (10 Position)	Extended Shaft	None	No	No	54308-1
Hexadecimal w/Complement (16 Position)	Extended Shaft	None	No	No	54959-1
Input/Output (2 Position)	Lever	None	No	No	53921-1

[1] All switches marked with epoxy ink unless otherwise specified

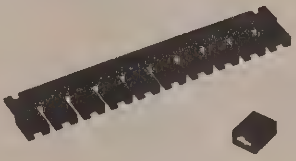
Post Shunts 2-Position, Low Profile Shunts

.100 [2.54] Centerline

Part No. 531220-2
.000015 [0.00038] Gold Plate[1]

Part No. 531220-3
.000030 [0.00076] Gold Plate[1]

Part No. 531220-1
.000100 [0.00254] Tin Plate



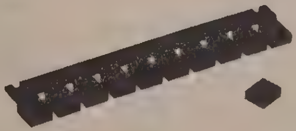
[1] In contact area

.200 [5.08] Centerline

Part No. 531230-2
.000015 [0.00038] Gold Plate[1]

Part No. 531230-3
.000030 [0.00076] Gold Plate[1]

Part No. 531230-1
.000100 [0.00254] Tin Plate



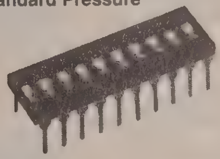
[1] In contact area

DIP Shunts 7600 Series

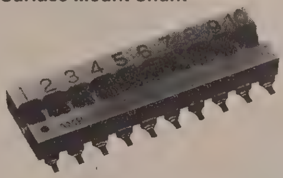
Contact Lead Spacing—
.100 x .300 [2.54 x 7.62]

Lead Length—.140 [3.57] below mounting hole

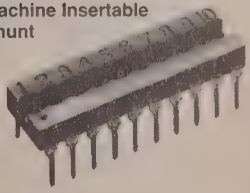
Standard Shunt Standard Pressure



Surface Mount Shunt



Machine Insertable Shunt



No. of Positions	Standard Shunt	Machine Insertable Shunt	Surface Mount Shunt
2	435704-2	—	382341-2
3	435704-3	—	382341-3
4	435704-4	436860-3	382341-4
5	435704-5	—	382341-5
6	435704-6	436860-5	382341-6
7	435704-7	436860-6	382341-7
8	435704-8	436860-7	382341-8
9	435704-9	—	382341-9
10	1-435704-0	436860-9	1-382341-0
12	1-435704-2	1-436860-1	1-382341-2

eem

MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

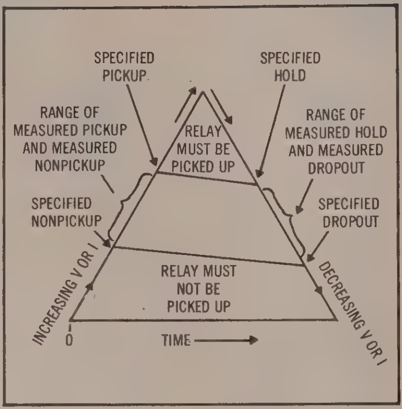
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.


SPECIFIED PICKUP
SPECIFIED HOLD
RANGE OF MEASURED PICKUP AND MEASURED NONPICKUP
RELAY MUST BE PICKED UP
RANGE OF MEASURED HOLD AND MEASURED DROPOUT
SPECIFIED NONPICKUP
SPECIFIED DROPOUT
RELAY MUST NOT BE PICKED UP
INCREASING V OR I
DECREASING V OR I
0
TIME

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

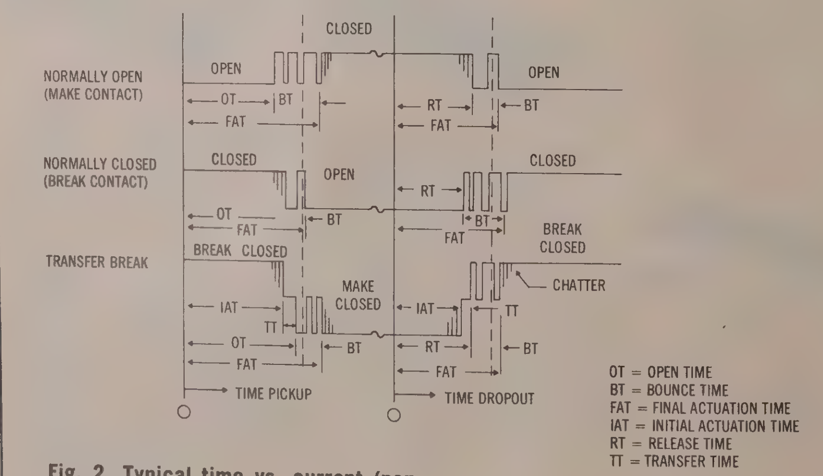

CLOSED
NORMALLY OPEN (MAKE CONTACT)
OPEN
OT
BT
FAT
RT
BT
FAT
OPEN
NORMALLY CLOSED (BREAK CONTACT)
CLOSED
OPEN
RT
CLOSED
OT
BT
FAT
BT
FAT
BREAK CLOSED
TRANSFER BREAK
BREAK CLOSED
MAKE CLOSED
CHATTER
IAT
TT
IAT
TT
OT
BT
RT
BT
FAT
FAT
TIME PICKUP
TIME DROPOUT
OT = OPEN TIME
BT = BOUNCE TIME
FAT = FINAL ACTUATION TIME
IAT = INITIAL ACTUATION TIME
RT = RELEASE TIME
TT = TRANSFER TIME

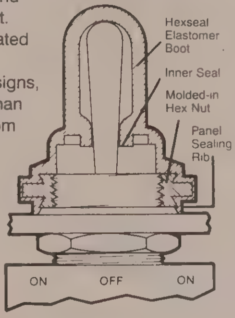
Fig. 2. Typical time vs. current (non-inductive load)

SWITCH SEALING

EXTERNAL ENVIRONMENTAL PROTECTION

HEXSEALS™

These boots contain their own molded-in-hex-nut, and serve mechanically as both a seal and mounting nut. The silicone rubber from which the boots are fabricated also serves as a vibration absorber. Aesthetically, Hexseals blend with the most demanding panel designs, and are available in a wide variety of colors (other than standard colors). Hexseals provide the same freedom of activation as the basic switch, and in no way interfere with its operation. To attenuate spurious signals from either entering or leaving equipment through the switch mounting hole, APM has designed a number of EMI/RFI boots with built-in knitted Monel wire, a rugged material ideally suited to this purpose. All Hexseals feature a panel sealing rib to prevent contamination from penetrating the mounting hole.



Material	Silicone rubber (Snapseel, Neoprene) Per ZZ-R-765 Class III
Temperature	-94 F° to +400 F° -70C° to +205 C°
Shelf Life	25 years
Resistant to	Salt spray, weather, sunlight, ozone and most acids
Mil Spec	Most Hexseal products - Are QPL approved under MIL-B-5423

Metric Sizes Available

Toggle Switch Boots

COMPLETELY COVERS TOGGLE
Thread sizes from 1/4-40NS-2B 5/8-32 UNS-2B
Armor and RF1/EMI Shielding Boots version also available

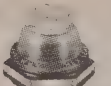
TOGGLE OF SWITCH PROTRUDES
Thread sizes from 1/4-40 NS-2B to 15/32-32 NS-2B

BACK OF PANEL MOUNTED BOOTS-COMPLETELY COVERS TOGGLE (FLUSH MOUNTED)
Toggle of switch products version also available

Push button Switch Boots

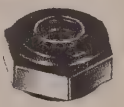
COMPLETELY COVERS PLUNGER
Thread sizes from 8-40 NS-2B to 5/8-24 NEF-2B

ARMORED SEAL FOR PUSH BUTTON SWITCHES
Thread sizes 15/32-32 NS-2B



BUTTON OF SWITCH PROTRUDES
Thread sizes from 7/16-32 UN-2B to 1/2-32 NS-2B
Used primarily for push-pull circuit breakers

Rotary Shaft Switch Boots



NON-LOCKING
Thread sizes from 1/4-28NF-2B to 5/8-24NEF-2B

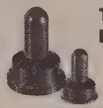
LOCKING
Thread sizes from 1/4-32NS-2 to 3/8-32NS-2

RFI/EMI SHIELDING
Thread sizes from 1/4-32NEF-2B to 1/2-32NS-2B

SnapSeel™ Commercial Switch Boots

Black neoprene boot. Operating temp.: -65° F to +300° F.
Available in push-button, toggle, and rotary models

PUSH BUTTON BOOTS

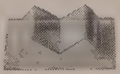


TOGGLE SWITCH BOOTS

ROTARY SHAFT SEALS

Rocker Switch & Circuit Breaker Boots

ROCKER SWITCH SINGLE POLE
Height .359" (9.13mm)



ROCKER SWITCH (LIGHTED) DOUBLE POLE
Height .297" (7.54mm)

ROCKER SWITCH (LIGHTED) SINGLE POLE
Height .297" (7.54mm)

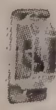
Indicator & Lighted Switch Boots (transparent)

INDICATOR SEAL
Height .359" (9.13mm)
A gasket rib on the underside of this product makes a complete seal against the panel

LIGHTED PUSH-BUTTON SEAL
Customized clear silicone rubber covers that provide dust-tight, splash-proof protection for LPB switches and visual displays.

Circuit Breaker Boots (transparent)

Fits most circuit breakers such as Heinemann Elec., Texas Inst., Wood Elec., AIRPAX, & Carlingswitch



SINGLE SWITCH HANDLE
Height sizes from 7/8" to 1-1/22"

DOUBLE SWITCH HANDLE
Height sizes from 7/8" to 1"

TRIPLE SWITCH HANDLE
Height sizes from 7/8" to 1"

APM HEXSEAL

APM-HEXSEAL CORP.

44 HONECK STREET • ENGLEWOOD, NJ 07631
TEL: (201) 569-5700 • FAX: (201) 569-4106

THE CLEAN FIGHTERS℠

MINIATURE LAMP & FASTENER SPECIFIERS, PLEASE NOTE:

■ Designing push button switches or illuminated products, or any product that requires filtered illumination? Ask about SiliKromes™ Lamp Color Filters.

■ Self-Sealing Fasteners - Screw, bolt nut, and rivet versions available that control pressures up to 6000 psi (internal or external)

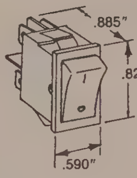
Arcolectric

ROCKER SWITCHES

8500 HIGH INRUSH SERIES

12A 125-250VAC 6A 6-28VDC
150A Inrush capability
6(4)A 250VAC T100

Electrical approvals: UL, CSA, VDE, BEAB, OVE, SEMKO, DEMKO, NEMKO, KEMA, UTE, F.I., SEV



Terminals: .187" tab style, .031" thick
Body/rocker color: black matte
Rocker lens actuator:
transparent polycarbonate

Panel cut out required:
.756" x .508"
Panel thickness:
.029" - .118" snap-in mounting

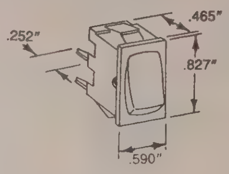
Model	Legend	Circuit
SINGLE POLE NON-LIGHTED		
H8500VBBB		On-Off
H8500VBBB	1-0	On-Off
DOUBLE POLE NON-LIGHTED		
H8550VBBB		On-Off
H8550VBBB	1-0	On-Off
SINGLE POLE LIGHTED 125VAC Neon Lamp *		
H8503VBBA2		On-Off
H8503VBBG2		On-Off
H8503VBBR2		On-Off
DOUBLE POLE LIGHTED 125VAC Neon Lamp *		
H8553VBBA2		On-Off
H8553VBBG2		On-Off
H8553VBBR2		On-Off

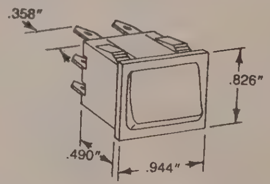
* Neon lamp built inside rocker actuator
A2 = Amber G2 = Green R2 = Red

8600 MINIATURE SERIES

The 8600 series offers a variety of circuits with 10 Amp 250VAC international approvals: UL, CSA, VDE, BEAB, SEMKO, DEMKO, NEMKO, OVE, UTE, KEMA, SEV, F.I.

10A 125-250VAC 10A 6-28VDC
1/4HP 125 VAC 1/2 HP 250VAC
10A (4) A 250VAC T90





Terminals: .187" tab style, .031" thick
Body/rocker color: black matte

Panel cut out required:
SP .756" x .508" DP .756" x .862
Panel thickness:
.029" - .118" snap-in mounting

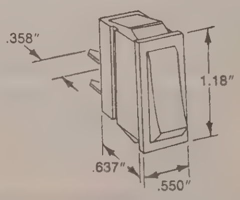
Model	Legend	Circuit
SINGLE POLE		
H8600VBBB		On-Off
H8600VBBB	1-0	On-Off
H8601VBBB		(On)-Off
H8610VBBB		On-On
DOUBLE POLE		
H8650VBBB		On-Off
H8650VBBB	1-0	On-Off
H8660VBBB		On-On

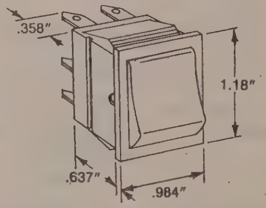
( ) indicates momentary action

1300/1350 HIGH INRUSH SERIES

The 1300/1350 series is capable of handling demanding applications featuring a 200A inrush capability. Electrical approvals: UL, CSA, BEAB, VDE, SEMKO, NEMKO, DEMKO, KEMA, OVE, SEV, F.I.

16A 125-250VAC
20A 6-28VDC
16(4)A 250VAC T85
150A inrush capability IEC65





Terminals: .250" tab style, .031" thick
Body/rocker color: black matte

Panel cut out required:
SP .480" x 1.07" DP .870" x 1.07"
Panel thickness:
.029" - .130" snap-in mounting

Model	Legend	Circuit
C1300AABB		SP On-Off
C1300AABB	1-0	SP On-Off
C1350AABB		DP On-Off
C1350AABB	1-0	DP On-Off

OPTIONS

1. SP cut outs: "B" .433" x 1.18", "R" .550" x 1.12".
2. DP cut outs: "B" .870" x 1.18", "T" .870" x 1.10".
3. Custom colors.
4. Protective splash proof covers.
5. Lighted versions.
6. Single pole switch in DP body size.

SEE PAGE B•1132-1133, SECTION 2460 FOR INDICATOR LIGHTS.

A FULL LINE CATALOG OF DRAWINGS AND SPECIFICATIONS AVAILABLE FREE OF CHARGE

Arcolectric Corporation 9001 Canoga Ave., Canoga Park, CA 91304
FAX: 818-700-9541 • FAX: 818-700-2809 • PH: 818-700-1933

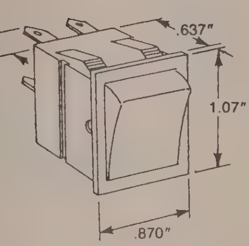
Arcolectric

ROCKER/TOGGLE SWITCHES

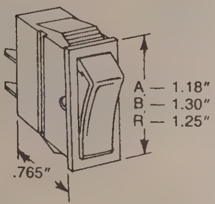
1500/5503 SERIES

This series offers a new "SOFT" contoured lens/rocker shape. Internationally approved. 16A 125-250VAC 1/2HP 125VAC 1HP 250VAC.

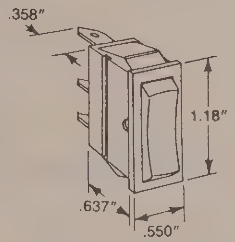
Electrical approvals: UL, CSA, BEAB, VDE, SEMKO, DEMKO, NEMKO, KEMA, F.I., UTE, SEV, OVE.
Electrical ratings may vary depending on circuit and or approval agency.
Consult factory for details.



1553A



1500A



5503A

Terminals: .250" tab style, .031" thick
Body/rocker color: black matte
Rocker lens actuator:
transparent polycarbonate
( ) Indicates Momentary Action

Panel cut out required:
SP .480" x 1.07" DP .870" x 1.07"
Panel thickness:
.029" - .098" Snap-in mounting

Model	Circuit
SINGLE POLE NON-LIGHTED	
C1500AABB	On-Off
C1501AABB	(On)-Off
C1510AABB	On-On
C1520AABB	On-Off-On
C1522AABB	(On)-Off-(On)
DOUBLE POLE NON-LIGHTED	
C1550AABB	On-Off
C1560AABB	On-On
C1570AABB	On-Off-On
C1572AABB	(On)-Off-(On)
SINGLE POLE LIGHTED 125VAC Neon Lamp *	
C5503AABA2	On-Off
C5503AABG2	On-Off
C5503AABR2	On-Off
DOUBLE POLE LIGHTED 125VAC Neon Lamp *	
C1553AABA2	On-Off
C1553AABG2	On-Off
C1553AABR2	On-Off

* Neon lamp built inside rocker actuator
A2 = Amber • G2 = Green • R2 = Red

OPTIONS

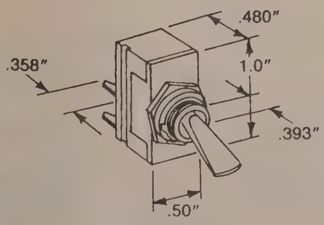
1. Single pole panel cut out size "B" .433" x 1.18".
2. Single pole panel cut out size "R" .550" x 1.12".
3. Double pole panel cut out size "B" .870" x 1.18".
4. Custom colors.
5. Protective splash-proof covers for DP size.
6. Alternative terminals.
7. Gold contacts.
8. Lamp voltages.
9. Additional circuits available.
10. Legend imprinting.

1700 TOGGLE SERIES

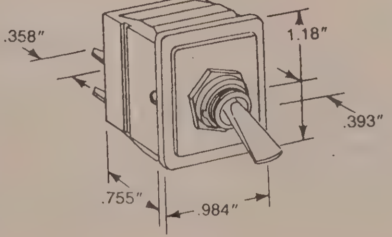
The 1700-1800 series toggle switches are fully insulated and rated up to 20A 250VAC 1HP. Paddle handles are black nylon.
20A 125-250VAC 16(4) 250VAC T85
1/2 HP 125VAC 1 HP 250VAC

Ratings vary depending on circuit and electrical approval agency. Electrical approvals: UL, CSA, VDE, BEAB, KEMA, SEMKO, DEMKO, NEMKO, F.I., OVE, SEV

Model	Circuit
C1700H	SP On-Off
C1801H	SP (On)-Off *
C1710H	SP On-On
C1720H	SP On-Off-On
C1750H	DP On-Off
C1760H	DP On-On
C1770H	DP On-Off-On



C1700H



C1750H

Terminals: .250" tab style, .031" thick

Panel cut out required: .50" dia.
Panel thickness: .1378"
( ) Indicates momentary action

SEE PAGE B•1132-1133, SECTION 2460 FOR INDICATOR LIGHTS.

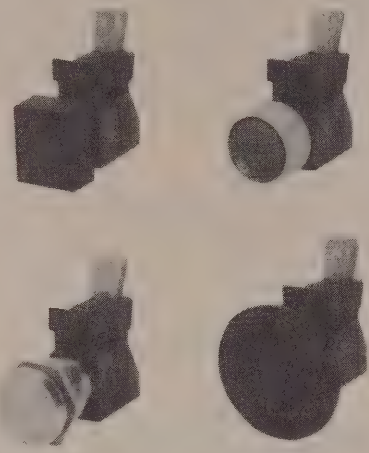
A FULL LINE CATALOG OF DRAWINGS AND SPECIFICATIONS AVAILABLE FREE OF CHARGE

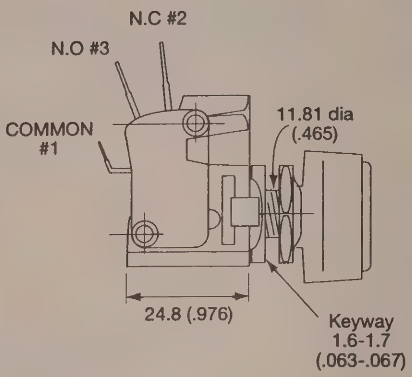
Arcolectric Corporation 9001 Canoga Ave., Canoga Park, CA 91304
FAX: 818-700-9541 • FAX: 818-700-2809 • PH: 818-700-1933

Arcolectric

PUSH BUTTON SWITCHES

PUSH BUTTON SWITCHES




N.C #2
N.O #3
COMMON #1
11.81 dia (.465)
24.8 (.976)
Keyway 1.6-1.7 (.063-.067)

15A 125-250Vac 1/2 Hp
15(4) A 250Vac T85
-30C -+ 85C

380A SERIES

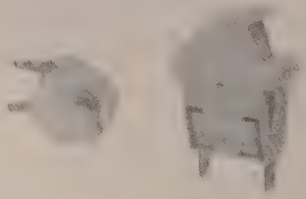
Alternate SPDT
Push for On
Push for Off

380M SERIES

Momentary
SPDT
NO or NC

ADDITIONAL ARCOLECTRIC PRODUCTS

PUSHBUTTON DOOR SWITCH

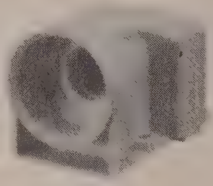


COIN OPERATED SNAP SWITCH

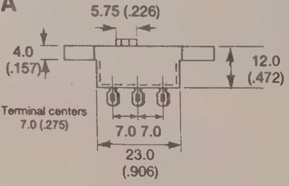
JOYSTICK SWITCH

INDICATOR LIGHTS FOR 5.8, thru 30.5 mm mounting diameters

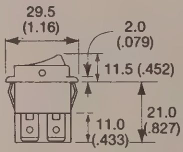
COMBINED/SWITCH LAMPHOLDER



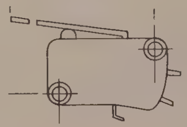
A


5.75 (.226)
4.0 (.157)
12.0 (.472)
Terminal centers 7.0 (.275)
7.0 7.0
23.0 (.906)

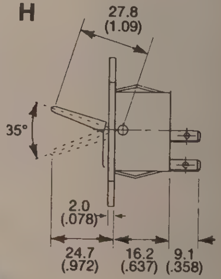
D


29.5 (1.16)
2.0 (.079)
11.5 (.452)
21.0 (.827)
11.0 (.433)

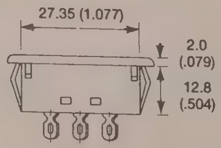
E



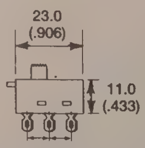
H


27.8 (1.09)
35°
2.0 (.078)
24.7 (.972)
16.2 (.637)
9.1 (.358)

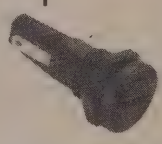
B


27.35 (1.077)
2.0 (.079)
12.8 (.504)

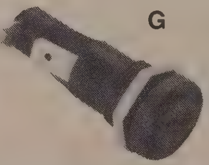
C


23.0 (.906)
11.0 (.433)

F



G



SEE PAGE B•1132-1133, SECTION 2460 FOR INDICATOR LIGHTS.

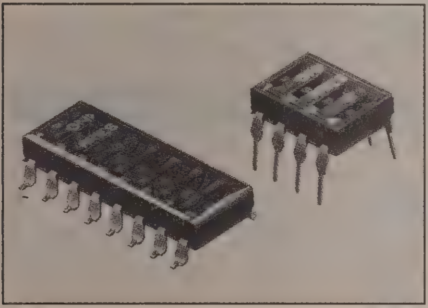
A FULL LINE CATALOG OF DRAWINGS AND SPECIFICATIONS AVAILABLE FREE OF CHARGE

Arcolectric Corporation 9001 Canoga Ave., Canoga Park, CA 91304
FAX: 818-700-9541 • FAX: 818-700-2809 • PH: 818-700-1933

DIP Switches

Aries DIP switches cover the range from premium performance to low-cost applications, and represent the most advanced engineering ever designed into a DIP switch. Designed for exceptional reliability and versatility, all Aries DIP switches incorporate advanced design concepts, highest quality materials, precision manufacture and stringent testing to ensure unrivaled product excellence.

The Series 700 DIP DuraSwitch™: Premium Switch Performance at Standard Switch Prices



The culmination of years of product engineering and refinements, Aries Series 700 DIP DuraSwitches represent the most advanced engineering ever designed into a DIP switch. These switches incorporate a combination of manufacturing advances, design features and operating benefits that yield premium switch performance at standard switch prices.

Application Versatility

To meet virtually every application need, Aries offers its Series 700 in both surface mount and thru-hole versions. The surface mount switches are available with either "J" or gull-wing leads; thru-hole switches feature solder tail terminations.

All versions feature a low profile design — with a height of just .170 (4,71). And, these switches can be stacked end-to-end for added configuration versatility.

The Series 700 is available in 4 thru 10 and 12 positions. Operating temperature is -40° to +100°C, with temperature resistance to 260°C for 10 seconds, making it suitable for infrared soldering.

Fully Sealed Assembly

To ensure highest reliability and long life even in hostile environments, the Series 700 DIP DuraSwitch features fully sealed construction. The molded cover is ultrasonically welded to the base with insert molded and dual sealed terminals. The slider contact features an insert molded slider. KAPTON* (polyimide) sealing tape is furnished as standard with the surface mount version.

Auto Insertion Compatible

The Series 700 is fully compatible with auto insertion equipment. The switches are machine insertable via reel or tube feed and can be furnished for tape and reel packaging per EIA-481-A specifications.

Highest Quality Materials

Base, Cover and Slider: Glass filled high temperature thermoplastic. UL940V-O rated PPS base and cover rated at 500° F (260°C).

Slider Contact: Beryllium Copper alloy with a minimum of 20 μinches selective gold over nickel plating.

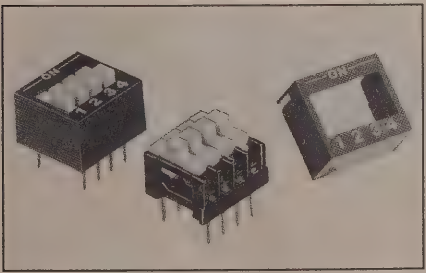
Terminal: Copper alloy with selective 20 μinches gold over nickel plating, and tin plating on leads.

And More...

There are even more features that help make this superior switch series the ultimate DIP switch value:

- Redundant bifurcated slider contacts with self-cleaning wiping action for positive performance every time.
- Each slider features a pre-loaded spring and overstress protection with a solid, positive detent
- Recessed slider travel of .045 (1,14)
- Fully automated assembly and 100% tested
- Competitively priced
- Factory pre-programming available.

Aries Series RA DIP Switches



For outstanding performance in an economy switch, Aries complements its Series 700 DIP DuraSwitch line with the Series RA DIP switch. Available in 2 thru 10 positions, this switch can be furnished as SPST, SPDT, DPST and multiple pole, multiple throw models. These wave solderable switches feature an optimum pressure/wipe contact system with selectively gold-plated contacts, and a snap-on cover.

NOTE: Aries specializes in custom design and production. In addition to the standard products shown on this page, special materials, platings, sizes, and configurations can be furnished, depending on quantities. Consult factory for details.

* KAPTON is a Trademark of Dupont

ARIES®
ELECTRONICS, INC.

ARIES ELECTRONICS, INC.
P.O. Box 130 Frenchtown, NJ 08825
(908) 996-6841 FAX (908) 996-3891

ARIES ELECTRONICS (Europe)
Unit 3, Furtho Court, Towcester Rd.
Old Stratford, Milton Keynes, England MK19 6AQ
Tel.: +44-908-260007 FAX +44-908-260008

Turquoise Switch – Next Generation Snap Action Switch

Introducing the turquoise switch—high environmental resistance

Suitable for automatic wave soldering and cleaning

Tough enough to resist dust, water splash and corrosion

- Elastomer double molding technology, an industry first, and ultrasonic swaging technology contribute to uniform sealing in high production quantities.
- Two sealed types available.

IP50 type, dust protected

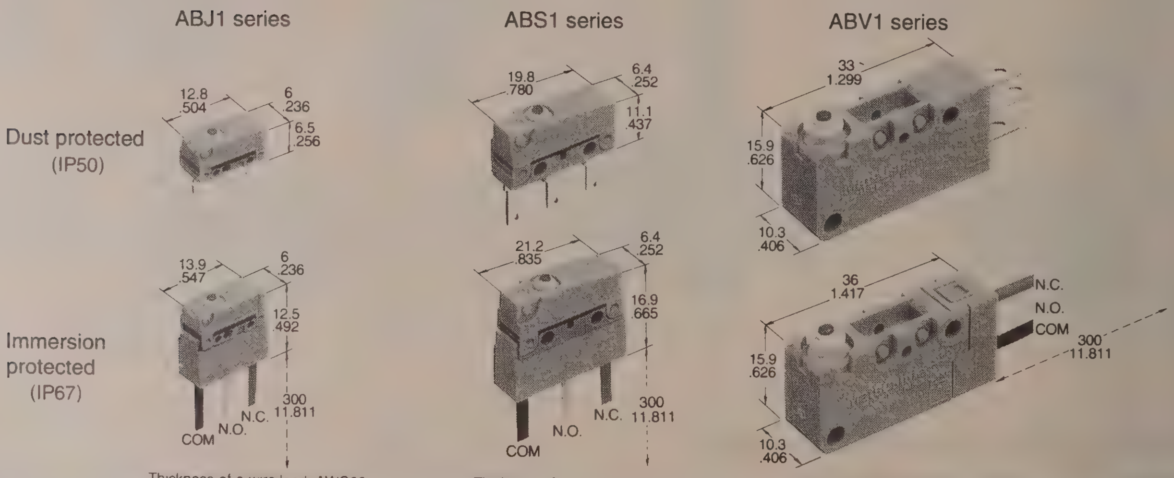
Size, shape and spacing of the terminals are the same as conventional non-sealed switches.
Suitable for use in non-condensing environments.

IP67 type (NEMA type 6), immersion protected

Leads attached.
Suitable for rain-tight applications.
(Its construction keeps water from entering at a depth of 1 meter for 30 minutes.)

Three Basic Models

mm inch


ABJ1 series
ABS1 series
ABV1 series
Dust protected (IP50)
Immersion protected (IP67)
12.8 .504
6 .236
6.5 .256
19.8 .780
6.4 .252
11.1 .437
33 1.299
15.9 .626
10.3 .406
13.9 .547
6 .236
12.5 .492
300 11.811
COM
N.O.
N.C.
21.2 .835
6.4 .252
16.9 .665
300 11.811
COM
N.O.
N.C.
36 1.417
15.9 .626
10.3 .406
N.C.
N.O.
COM
300 11.811

Thickness of a wire lead AWG22

Thickness of a wire lead: AWG20

Thickness of a wire lead: AWG18

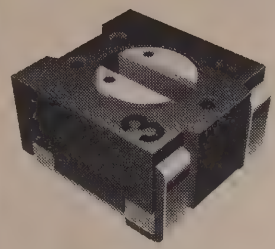
Type	Protection grade	Terminal					Actuator						
		Soldering	PC board	TAB #110	TAB #187	Lead wire	Pin plunger	Hinge lever	Short hinge lever	Long hinge lever	Simulated roller lever	Roller lever	Short roller lever
ABJ1 series	Dust protected (IP50)	●	●				●	●			●		
	Immersion protected (IP67)						●	●			●		
ABS1 series	Dust protected (IP50)	●	●	●			●	●	●	●	●	●	
	Immersion protected (IP67)					●	●	●	●	●	●	●	
ABV1 series	Dust protected (IP50)				●		●	●			●	●	●
	Immersion protected (IP67)					●	●	●			●	●	●

Marlboro, MA
(508) 481-1995
New Providence, NJ
(908) 464-3550
Orlando, FL
(407) 855-1075
Richardson, TX
(214) 235-0415
Elk Grove Village, IL
(708) 593-8535
San Jose, CA
(408) 433-0466
Garden Grove, CA
(714) 895-7707
Mississauga, Ontario
(416) 624-3777

Advanced switching technology.
Aromat®

BOURNS, INC., • 1200 COLUMBIA AVENUE, RIVERSIDE, CA 92507-2114
(909) 781-5500 • FAX: (909) 781-5700

ULTRA-MINIATURE ROTARY SWITCHES



Model 7813
SMD
3mm Square
SPDT
Sealed

- **Tape and reel packaged**
- **50 or 2000 cycle rotational and seal life**
- **Withstands 260° soldering heat**
- **Low level signal switch**
- **Compatible with all surface mount manufacturing processes**

Electrical Characteristics

Contact Rating	
Maximum Current	100mA max.
Maximum Voltage	24V
Contact Timing	Non-shorting
Contact Resistance	2 ohms max.
Insulation Resistance	100 megohms min. (DC500V)
Dielectric Strength	250 VAC

General Specifications

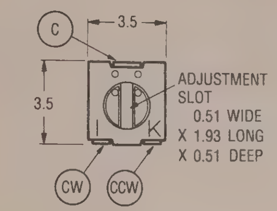
Circuit Type	SPDT
Operating Temperature Range	-55°C to +125°C
Storage Temperature Range	-55°C to +125°C
Seal Test	85°C Fluorinert*

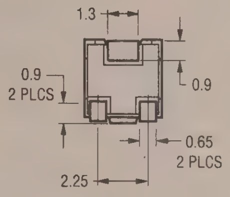
Mechanical Specifications

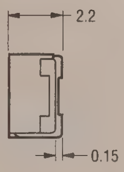
Mechanical Angle	245° ± 15°
Positions	2
Adjustment Torque	50g. cm max.
Stop Strength	200g. cm min.
Switching Angle	45° ± 5°
Rotational Life	
-051	50 Cycles
-023	2000 Cycles
Max. Soldering Heat	260°C, 5 seconds

*Fluorinert™ is a registered trademark of 3M Co.

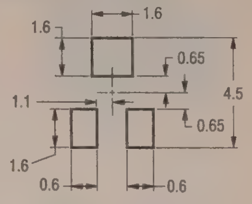
7813J



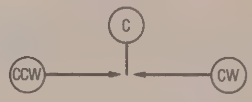




RECOMMENDED PCB LAYOUT



TOLERANCES: ±2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4



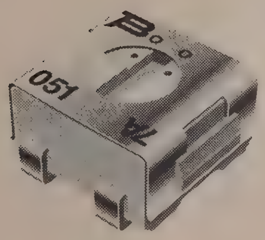
HOW TO ORDER

7813 J - 001 - 051 E

Model
Terminal
Switch Style
001 = SPDT
Rotational Life
Embossed Tape
E = 1000 pcs. / 180mm Reel (Standard)

Consult factory for other available options.

Specifications are subject to change without notice.



Model 7814
SMD
4mm Square
SPDT
Sealed

- **50 or 2000 cycle rotational life**
- **J-hook, gull-wing and through hole**
- **Compatible with all surface mount soldering processes**

Electrical Characteristics

Contact Rating	
Maximum Current	100mA max.
Maximum Voltage	24V
Contact Timing	Non-shorting
Contact Resistance	2 ohms max.
Insulation Resistance	100 megohms min. (DC500V)
Dielectric Strength	250 VAC

General Characteristics

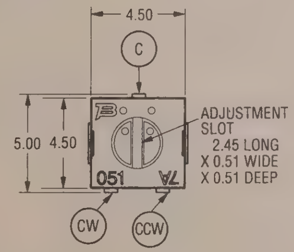
Circuit Type	SPDT
Operating Temperature Range	-55°C to +125°C
Storage Temperature Range	-55°C to +125°C
Seal Test	85°C Fluorinert*
Vibration	20G TRS
Shock	100G TRS

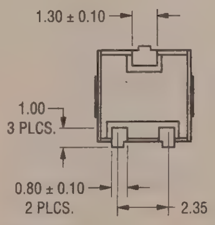
Physical Characteristics

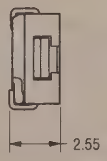
Mechanical Angle	240° ± 15°
Positions	2
Adjustment Torque	180g. cm max.
Stop Strength	300g. cm min.
Switching Angle	45° ± 5°
Rotational Life	
-051	50 Cycles
-023	2000 Cycles
Max. Soldering Heat	260°C, 10 seconds
Stop Strength	300g-cm typical
Pushover Strength (S Style)	2 kilograms minimum
Weight	Approximately 0.2 gm.
Marking	Manufacturer's trademark, life code and date code
Standard Packaging	
J & G	500 pcs. /180mm reel
S	200 pcs. /180mm reel
H	50 pcs. / tube

*Fluorinert™ is a registered trademark of 3M Co.

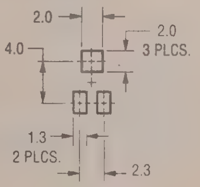
7814J



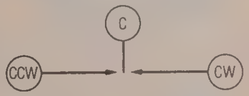




RECOMMENDED PCB LAYOUT



TOLERANCES: ±2 EXCEPT WHERE NOTED DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4



HOW TO ORDER

7814 J - 001 - 051 E

Model
Terminal
Switch Type
001 = SPDT
Rotational Life
Embossed Tape Designator

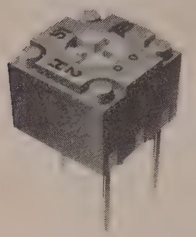
Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS INC

BOURNS, INC., • 1200 COLUMBIA AVENUE, RIVERSIDE, CA 92507-2114
(909) 781-5500 • FAX: (909) 781-5700

ULTRA-MINIATURE ROTARY SWITCHES



Model 7823
1/4" Square
SPDT
Sealed

- 5 standard terminal styles
- Single pole double throw
- Tape & reel packaging available
- Vertical and horizontal adjust styles

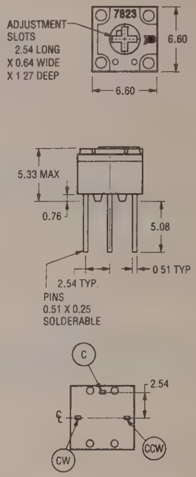
Electrical Characteristics
Contact Rating
Maximum Current .....100mA max.
Maximum Voltage 24V
Contact Timing ....Non-shorting
Contact Resistance ....2 ohms max.

General Characteristics
Circuit Type ....SPDT
Operating Temperature Range
............................-55°C to +125°C
Storage Temperature Range
............................-55°C to +125°C
Seal Test ....85°C Fluorinert*

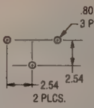
Physical Characteristics
Mechanical Angle...........245° ± 15°
Positions...2
Switching Angle.................45° ± 5°
Rotational Life
-023 ....2000 Cycles
Standard Packaging....50 pcs./tube

*Fluorinert™ is a registered trademark of 3M Co.

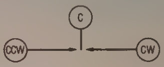
7823P


ADJUSTMENT SLOTS
2.54 LONG
X 0.64 WIDE
X 1 27 DEEP
7823
6.60
6.60
5.33 MAX
0.76
5.08
0 51 TYP
2.54 TYP.
PINS
0.51 X 0.25
SOLDERABLE
C
2.54
℄
CW
CCW

RECOMMENDED PCB LAYOUT


.80 DIA.
3 PLCS
2.54
2.54
2 PLCS.

TOLERANCES: ±2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



HOW TO ORDER

7823 P - 001 - 023
Model
Terminal
Switch Type
001 = SPDT
Rotational Life

Specifications are subject to change without notice.

Model 7829
1/4" Round
SPDT
Sealed

- SMT and through-hole styles
- Sealed design
- Vertical and horizontal styles
- Single pole double throw

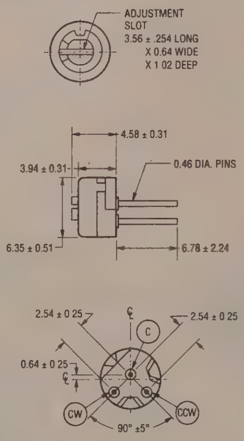
Electrical Characteristics
Contact Rating
Maximum Current .....100mA max.
Maximum Voltage 24V
Contact Timing ....Non-shorting
Contact Resistance ....2 ohms max.

General Characteristics
Circuit Type ....SPDT
Operating Temperature Range
............................-55°C to +125°C
Storage Temperature Range
............................-55°C to +125°C
Seal Test ....85°C Fluorinert*

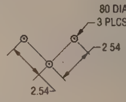
Physical Characteristics
Mechanical Angle...........245° ± 15°
Positions...2
Switching Angle.................45° ± 5°
Rotational Life
-051 ....50 Cycles
-023 ....2000 cycles
Standard Packaging....50 pcs./tube

*Fluorinert™ is a registered trademark of 3M Co.

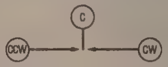
7829H


ADJUSTMENT SLOT
3.56 ± .254 LONG
X 0.64 WIDE
X 1 02 DEEP
4.58 ± 0.31
3.94 ± 0.31
0.46 DIA. PINS
6.35 ± 0.51
6.78 ± 2.24
2.54 ± 0 25
℄
2.54 ± 0 25
C
0.64 ± 0 25
℄
CW
CCW
90° ±5°

RECOMMENDED PCB LAYOUT


80 DIA
3 PLCS.
2 54
2.54

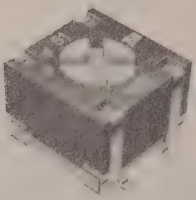
TOLERANCES: ±2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



HOW TO ORDER

7829 H - 001 - 051
Model
Terminal
Switch Type
001 = SPDT
Rotational Life

Specifications are subject to change without notice.



Model 7835
SMD
5mm Square
SPDT
Sealed

- SMD design or through-hole
- Packaged in 16MM wide embossed tape, compatible with automatic placement equipment
- Recommended for reflow solder processing only

Electrical Characteristics
Contact Rating
Maximum Current .....100mA max.
Maximum Voltage 24V
Contact Timing ....Non-shorting
Contact Resistance ....2 ohms max.

General Characteristics
Circuit Type ....SPDT
Operating Temperature Range
............................-55°C to +125°C
Storage Temperature Range
............................-55°C to +125°C
Seal Test ....85°C Fluorinert*

Physical Characteristics
Mechanical Angle ......270° Nominal
Positions...2
Switching Angle.................45° ± 5°
Rotational Life
-051 ....50 Cycles
Standard Packaging
...................500 pcs./180mm reel

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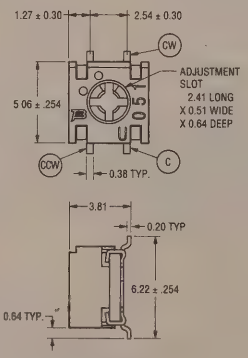
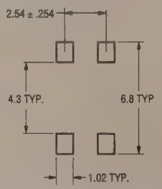
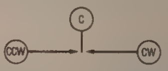
7835W


1.27 ± 0.30
2.54 ± 0.30
CW
ADJUSTMENT SLOT
2.41 LONG
X 0.51 WIDE
X 0.64 DEEP
5 06 ± .254
051
CCW
C
0.38 TYP.
3.81
0.20 TYP
6.22 ± .254
0.64 TYP.

RECOMMENDED PCB LAYOUT


2.54 ± .254
4.3 TYP.
6.8 TYP
1.02 TYP.

TOLERANCES: ±2 EXCEPT WHERE NOTED. DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4.



HOW TO ORDER

7835 W - 001 - 051 E
Model
Terminal
Switch Type
001 = SPDT
Rotational Life
Embossed Tape Designator

Consult factory for other available options.

Specifications are subject to change without notice.

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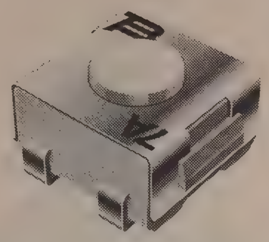
ULTRA-MINIATURE KEY SWITCHES



Model 7914

SMD
4mm Square
Sealed
Key Switch

- **J-hook, gull-wing and pinned configurations**
- **Compatible with all surface mount soldering processes**
- **Meets EIA / EIAJ / IPC / VRCI SMD standard outline dimensions**
- **Compatible with popular vacuum pick-and-place equipment**

Electrical Characteristics

Contact Rating
Maximum Current .....100mA max.
Maximum Voltage 24V
Contact Resistance
........................100 Milliohms max.
Insulation Resistance
.......100 megohms min. (DC500V)
Dielectric Strength ....250 VAC

General Characteristics

Circuit Type.............Normally open
Operating Temperature Range
............................-55°C to +125°C
Storage Temperature Range
............................-55°C to +125°C
Seal Test ....85°C Fluorinert*
Vibration 20G
Shock 100G

Mechanical Characteristics

Pushover Strength (S Style)
...................2 kilograms minimum
Cycle life, loaded
.........................10,000 actuations
Contact resistance
......................100 milliohms max.

Physical Characteristics

Marking...........Manufacturer's code and date code
Standard Packaging
J, G & S ....100 pcs. / tube
H...........................100 pcs. / tube

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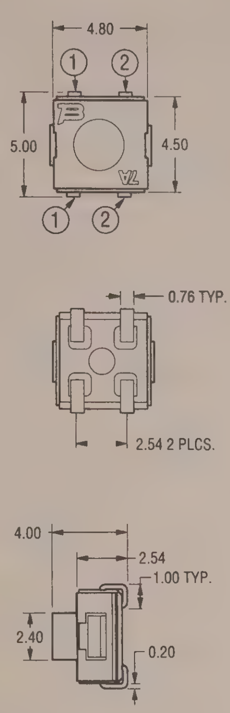
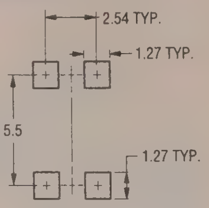
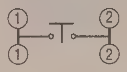
7914J



RECOMMENDED PCB LAYOUT





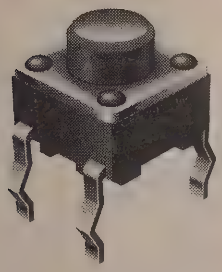
SPST N.O.

TOLERANCES: ±.2 EXCEPT WHERE NOTED
DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4

HOW TO ORDER

7914 G - 1 - 000 E
Model
Terminal
Switch Type
-001 = Std. N.O.
Product Code
Embossed Tape Designator
(Option Applicable to Styles J, G and S only - Consult Factory)

Specifications are subject to change without notice.



Model 7906

6mm Square
Single Pole
Single Throw
Washable
Key Switch

- **Low level signal switch**
- **With or without ground terminal**
- **Vertical or horizontal actuation**
- **Wave solderable**

Electrical Characteristics

Contact Rating
Maximum Current 20mA
Maximum Voltage.............15 VDC
Contact Resistance
.......................100 milliohms max.
Insulation Resistance
.........50 megohms min. (100VDC)
Dielectric Strength ....250 VAC
Contact Bounce........3ms max. (on)
10ms max. (off)

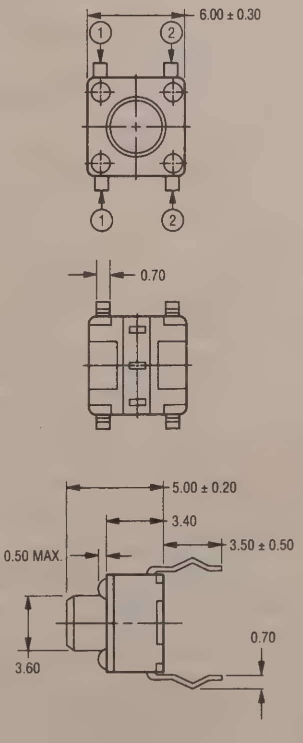
General Characteristics

Switch Type ....(N.O.) SPST
Operating Temperature Range
.............................-20°C to +70°C
Storage Temperature Range
.............................-40°C to +85°C

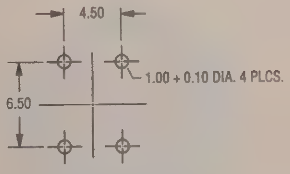
Mechanical Characteristics

Operating Force ....100gf ±40gf
Push Stroke ....0.25mm ±0.1
Operating Life...100,000 Actuations
Max. Soldering Heat............260°C, 5 seconds

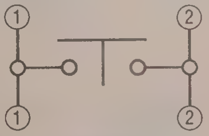
7906H-1



RECOMMENDED PCB LAYOUT



TOLERANCES: ±2 EXCEPT WHERE NOTED
DIMENSIONS IN MILLIMETERS. TO CONVERT TO INCHES DIVIDE BY 25.4



PUSH-ON

HOW TO ORDER

7906 H - 1 - 000 R
Model
Terminal
Switch Type
-1 Standard
-2 Ground Terminal
Option
Option Tape & Reel Packaging
Std. Packaging ....500 pcs./Bag
Tape ....1000 pcs./Reel

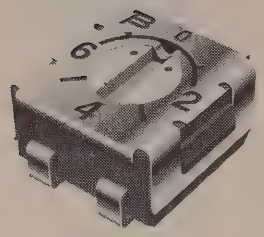
Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS INC

BOURNS, INC., • 1200 COLUMBIA AVENUE, RIVERSIDE, CA 92507-2114
(909) 781-5500 • FAX: (909) 781-5700

ULTRA-MINIATURE CODED SWITCHES



Model 7744

4mm SMD Square Sealed Coded Switch

- **Rugged lead frame construction**
- **Binary coded 8 or 10 position**
- **Compatible with all SMD soldering processes**
- **Patent pending**

Electrical Characteristics
Contact Rating
Maximum Current .....100mA max.
Maximum Voltage 24V
Contact Resistance
......................100 milliohms max.
Insulation Resistance
............................1000 megohms
Dielectric Strength ....250 volts

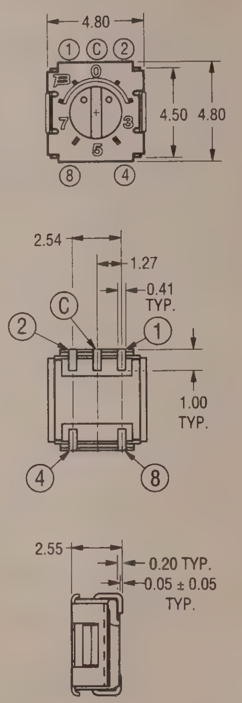
General Characteristics
Switch Type ....Binary
Operating Temperature Range
...........................-55°C to +125°C
Storage Temperature Range
...........................-55°C to +125°C
Seal Test ....85°C Fluorinert*

Mechanical Characteristics
Positions ....8 or 10
Adjustment Torque
..........................220 gm-cm. max.

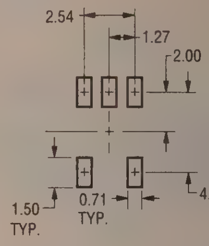
Environmental Characteristics
Shock 100G
0.1 ms. max. discontinuity
Vibration 30G
0.1 ms. max. discontinuity
Thermal Shock (5 cycles)
...........................-55°C to +125°C
Contact Resistance
......................150 milliohms max.
Humidity
Insulation Resistance
.........................10 megohms min.
Contact Resistance
......................150 milliohms max.
Actuation Life ...10,000 steps no load
Contact Resistance
......................150 milliohms max.
Maximum Soldering Heat.......260°C,
5 seconds
Standard Packaging .....50 pcs./ tube

*Fluorinert™ is a registered trademark of 3M Co.

7744J-10



RECOMMENDED PCB LAYOUT



10 POSITIONS

	1	2	4	8	C
0					X
1	X				X
2		X			X
3	X	X			X
4			X		X
5	X		X		X
6		X	X		X
7	X	X	X		X
8				X	X
9	X			X	X

8 POSITIONS

	1	2	4	C
0				X
1	X			X
2		X		X
3	X	X		X
4			X	X
5	X		X	X
6		X	X	X
7	X	X	X	X

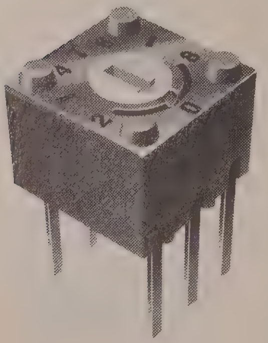
HOW TO ORDER

7744 J - 001 - 008

Model
Terminals
Switch Type
001 = Std. (Binary)
Number of Positions
008 = 8 Positions
010 = 10 Positions

Consult factory for other available options.

Specifications are subject to change without notice.



Model 7723

SMD/Thru-Hole 6mm Square SPDT Sealed Detented Binary

- **Miniature industrial coded switch**
- **Vertical adjust**
- **Binary coded 8 or 10 position**

Electrical Characteristics
Contact Rating
Maximum Current .....100mA max.
Maximum Voltage 24V
Contact Resistance ....5 ohms max.
Insulation Resistance
............................1000 megohms
Dielectric Strength ....300 volts

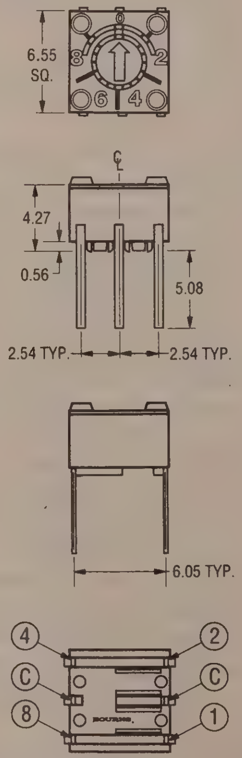
General Characteristics
Switch Type ....Binary
Operating Temperature Range
...........................-55°C to +125°C
Storage Temperature Range
...........................-55°C to +125°C
Seal Test ....85°C Fluorinert*

Mechanical Characteristics
Positions ....8 or 10
Adjustment Torque..........220 gm-cm

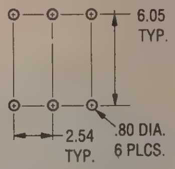
Environmental Characteristics
Shock 100G
0.1 ms. max. discontinuity
Vibration 30G
0.1 ms. max. discontinuity
Thermal Shock (5 cycles)
...........................-55°C to +125°C
Contact Resistance ..5 ohms max.
Humidity
Insulation Resistance
.........................10 megohms min.
Contact Resistance....5 ohms max.
Actuation Life ...10,000 steps no load
Contact Resistance ....5 ohms max.
Maximum Soldering Heat.......260°C,
5 seconds
Standard Packaging .....50 pcs./ tube

*Fluorinert™ is a registered trademark of 3M Co.

7723P-010



RECOMMENDED PCB LAYOUT



10 POSITIONS

	1	2	4	8	C
0					X
1	X				X
2		X			X
3	X	X			X
4			X		X
5	X		X		X
6		X	X		X
7	X	X	X		X
8				X	X
9	X			X	X

8 POSITIONS

	1	2	4	C
0				X
1	X			X
2		X		X
3	X	X		X
4			X	X
5	X		X	X
6		X	X	X
7	X	X	X	X

HOW TO ORDER

7723 P - 001 - 008

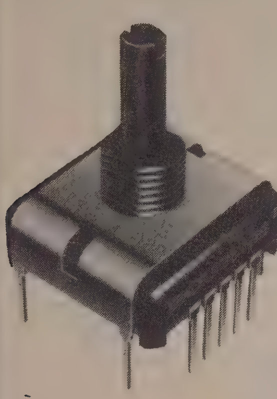
Model
Terminals
Switch Type
001 = Std. (Binary)
Number of Positions
008 = 8 Positions
010 = 10 Positions

Consult factory for other available options.

Specifications are subject to change without notice.

BOURNS, INC., • 1400 NORTH 1000 WEST STREET, LOGAN, UTAH 84321
(801) 750-7200 • FAX: (801) 750-7253

SLIMLINE LOGIC SWITCH

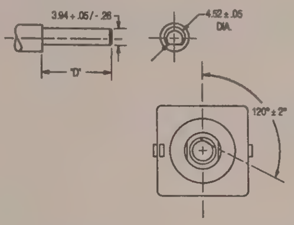


PC Series

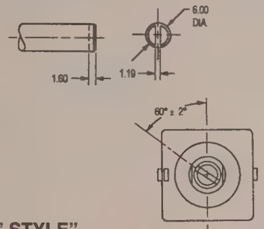
- **Low Profile Package**
- **Low Cost**
- **Multiple Shaft/Bushing Options**
- **PC Board Mounting**
- **SPST Low Current Switch**
- **Shaft Detents Available**

Electrical Characteristics
Potentiometer
Standard Resistance Range
Linear Tapers...500 ohms to 2.5 megohms
Audio Tapers...1K ohms to 500K ohms
Resistance Tolerance (All Tapers)...±20%
Independent Linearity...±5% (linear taper)
Absolute Minimum Resistance
..............................5 ohms maximum
Effective Electrical Angle.........270° ± 5°
Dielectric Withstanding Voltage
.................MIL-STD-202, Method 301
Sea Level.............1,000 VAC minimum
70,000 feet............500 VAC minimum
Insulation Resistance (500 VDC)
..............................1,000 megohms
Power Rating @ 70°C
(Voltage limited by Power Dissipation or 350 VAC, Whichever is Less)
Linear.................................... .75 watt
Audio..................................... .50 watt
Switch
Initial Electrical Characteristics
Power Rating...................10mA @ 15V
Contacts (SPST) ....Normally Closed in CW, CCW or Center Position
Dielectric Withstanding Voltage
(sea level)...........1,000 VAC minimum
Contact Resistance....5 ohms maximum
Contact Bounce...5 milliseconds maximum
Environmental Characteristics
Operating Temperature Range...0°C to +125°C
Storage Temperature Range...-55°C to +125°C
Rotational Life.................50,000 cycles
Mechanical Characteristics
Stop Strength (1/4" and 6mm shaft Dimensions)..............................8 in-lb.
Mechanical Angle....................300° ±5°
Terminals...............PC pin or solder lug
Running Torque
Undetented..............0.3 to 0.75 oz.-in.
Detented.................0.75 to 2.25 oz.-in.
Detents...Center, CCW, 10, 20, 30, none
Shaft Variations................See Diagram

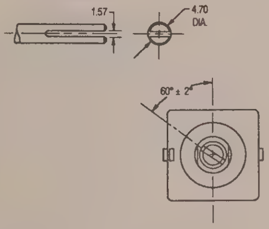
"J" STYLE
L DIM. = 28.58, 25.4, 22.23, 19.05



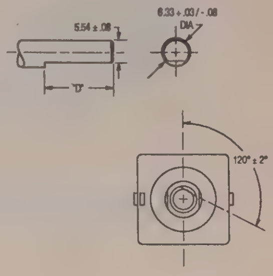
"R" STYLE
L DIM. = 28.58, 25.4, 24.03, 22.23, 19.05



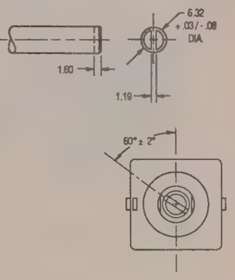
"Y" STYLE
L DIM. = 28.58/12.31, 25.4/12.21, 22.23/9.65, 19.05/9.65



"C" STYLE
L DIM. = 28.58, 25.4, 22.23, 19.05

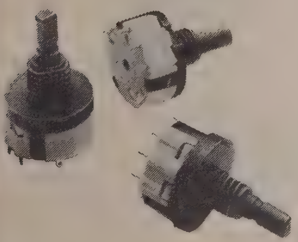


"B" STYLE
L DIM. = 28.58, 25.4, 24.03, 22.23, 19.05



Consult factory for other available options.
Specifications are subject to change without notice.

POT SWITCH



3900 Series

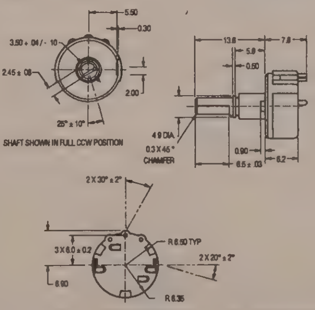
- **50,000 life cycle**
- **2% maximum CRV - potentiometer**
- **13 amp in rush**
- **3 amp steady state current rating - switch**
- **5 millisecond maximum contact bounce**

Electrical Characteristics
Potentiometer
Standard Resistance Range
Linear ....1K - 1 megohm
Audio ....1K - 1 megohm
Total Resistance Tolerance ....±20%
Independent Linearity...........................±5%
Absolute Minimum Resistance
..25 ohms maximum at CCW stop only

Effective Electrical Angle.........145° ± 5°
Contact Resistance Voltage
....2% maximum
Dielectric Withstanding Voltage
Sea Level................500 VAC minimum
Insulation Resistance
......................100 megohms minimum
Power Rating @ 70°C
(Derate to 0 at 125°C)
(Voltage limited by Power Dissipation or 350 VAC, Whichever is Less)
Linear.................................... 0.5 watt
Audio..................................... 0.25 watt
Contact Rotary
SPST...N.O.
Power Rating (Resistive Load)
..............................3 amps @ 12 volts
Contact Resistance
......................100 milliohms maximum
Contact Bounce.............5 milliseconds
Contact Push Momentary
SPST...N.O.
Power Rating (Resistive Load)
................10 milliamps @ 12 volts DC
Contact Resistance
...........................100 ohms maximum
Contact Bounce............5 milliseconds
Environmental Characteristics
Storage Temperature ....-40°C to +85°C
TCR (Over Storage Temperature Range)
....±1000ppm/°C
Vibration...15G
Total Resistance Shift...................±2%
Voltage Ratio Shift.........................±5%
Shock...30G
Total Resistance Shift...................±2%
Voltage Ratio Shift.......±5% maximum

Load Life (1,000 hrs)
..........................±10% TRS maximum
Rotational Life (No Load 50,000 cycles)
..........................±20% TRS maximum
Rotary Switch Life..........25,000 cycles
Push Momentary Life
..............................50,000 activations
Moisture Resistance ....±10% TRS
Mechanical Characteristics
Stop Strength..........................28 oz.-in.
Mechanical Angle ....270° ±10° or 230° ±10°
Torque
Running/Starting........0.2 to 2.5 oz.-in.
Rotary Switch............1.0 to 7.0 oz.-in.
Push Momentary
Weight ....4 grams
Terminals
Potentiometer........PC pins or J-Hooks
Switch ....PC pins or Solder Lug
Marking.........Manufacturer's trademark and date code

MODEL 39



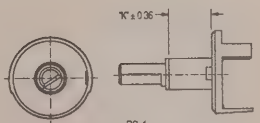


FIG 1

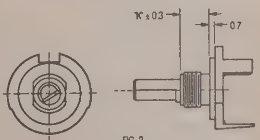


FIG 2

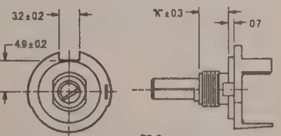


FIG 2

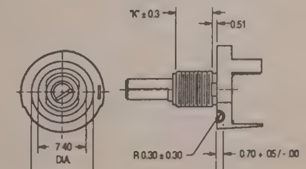


FIG 4

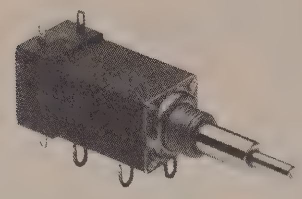
Consult factory for other available options.
Specifications are subject to change without notice.

BOURNS, INC., • 1400 NORTH 1000 WEST STREET, LOGAN, UTAH 84321
(801) 750-7200 • FAX: (801) 750-7253

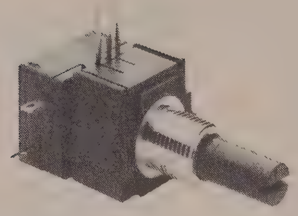
Pot Mount Rotary Switches

5/8" Square, Single-Turn, Rotary Switch Module

- Cermet or conductive plastic pot elements
- Designed for "on-off" function control
- Positive action "non-tease" detent
- Low actuation torque
- ±5%, ±10% and +/- 20% tolerances available
- Linear and audio tapers available
- PC pins, L-pattern and J-Hook terminal stages

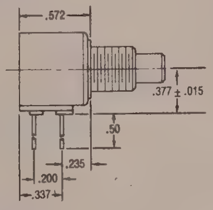


Model 85/86

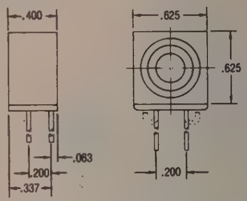


Models 97, 98, 99

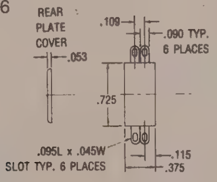
PRIMARY POTENTIOMETER MODULE
Model 85/86


.572
.377 ± .015
.50
.235
.200
.337

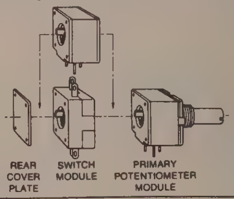
SECONDARY POTENTIOMETER MODULE
Model 85/86


.400
.625
.625
.063
.200
.337
.200

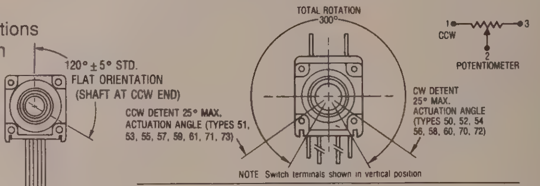
SWITCH MODULE
Model 85/86


REAR
PLATE
COVER
.053
.109
.090 TYP.
6 PLACES
.725
.095L x .045W
SLOT TYP. 6 PLACES
.115
.375

ASSEMBLY SEQUENCE
Model 85/86
Secondary Potentiometer Module

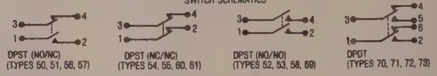

REAR
COVER
PLATE
SWITCH
MODULE
PRIMARY
POTENTIOMETER
MODULE

Models 97, 98, 99
Switch Module Variations
Shaft Flat Orientation


120° ± 5° STD.
FLAT ORIENTATION
(SHAFT AT CCW END)
TOTAL ROTATION
300°
CCW DETENT 25° MAX.
ACTUATION ANGLE (TYPES 51,
53, 55, 57, 59, 61, 71, 73)
CW DETENT
25° MAX.
ACTUATION ANGLE
(TYPES 50, 52, 54
56, 58, 60, 70, 72)
1
CCW
3
2
POTENTIOMETER

NOTE Switch terminals shown in vertical position

SWITCH SCHEMATICS


3
4
1
2
DPST (NO/NC)
(TYPES 50, 51, 56, 57)
3
4
1
2
DPST (NC/NC)
(TYPES 54, 55, 60, 61)
3
4
1
2
DPST (NO/NO)
(TYPES 52, 53, 58, 59)
3
4
5
6
1
2
DPDT
(TYPES 70, 71, 72, 73)

Switch contacts shown in detent position

Initial Electrical Characteristics[1]

Contacts:	
DPST	N.O/NO., N.C./N.C, or N.O./N.C
DPDT	2 N.O./N.C (break before make)
Power Rating (Resistive Load):	
DPST	2A @ 125 volts RMS-60 Hz or 2A @ 28 VDC, 1aA @ 250 volts RMS-60 Hz
DPDT	1A @ 125 volts RMS-60 Hz or 1A @ 28 VDC
Contact Resistance (.1VDC-10ma.)	10 milliohms nominal
Contact Bounce	5 milliseconds maximum
Dielectric Withstanding Voltage	MIL-STD-202, Method 301
Sea Level	1500 VAC minimum
Insulation Resistance	1000 megohms minimum

Environmental Characteristics[1]

Operating Temperature Range	0°C to +70°C
Exposure Temperature Range	-65° to +125°C
Vibration (Dual Section)	8G
Contact Resistance	10 milliohms maximum
Contact Bounce	0.1 millisecond maximum
Shock (Dual Section)	20G
Contact Resistance	10 milliohms maximum
Contact Bounce	0.1 millisecond maximum
Rotational Life	25,000 cycles
Switch Actuating Torque (50% Duty cycle @ Rated Power Load)	2-7 oz-in.
Contact Resistance	100 milliohms maximum
Moisture Resistance	MIL-STD-202, Method 106, Condition B
Contact Resistance (0.1VDC-10ma)	10 milliohms maximum
Insulation Resistance (After 24 Hours @ Room Temperature) (500 VDC)	100 megohms minimum
Housing Material	High temperature, flame retardant, thermosetting plastic

Mechanical Characteristics[1]

Actuating Torque (Each Section, Switch Module Only)	5-15 oz-in.
Running Torque (Out of Detent, 2-4 Module Assembly)	0.3-2 oz-in.
Detent	CW or CCW standard
Actuation Angle	25°
Contact Materials	Fine silver with gold overlay
Terminal Styles	Solder lug only
Standard Orientation	In-line with control terminals
Optional	Rotated 90° CCW from standard
Terminal Strength (Before and After Soldering Heat Exposure)	2 lbs. minimum

Specifications are subject to change without notice.

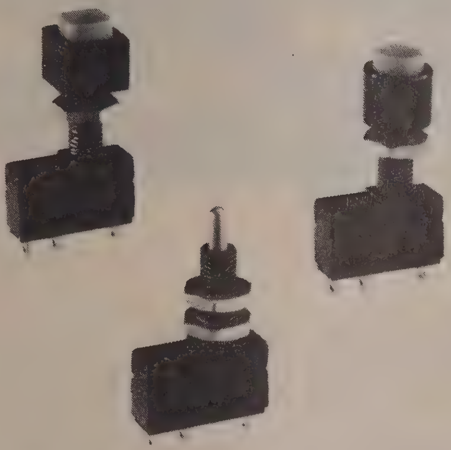
Burgess SAIA, INC.

Switch Division

1335 Barclay Boulevard
Buffalo Grove, IL 60089
Tel (1-708) 215-9600
Fax (1-708) 215-9606

BURGESS-SAIA PRODUCTS MEET **ISO 9001** STANDARDS

Panel Mounted Actuators – Can be fitted to all standard travel **V4N/V4NS** Series subminiature microswitches. Actuators supplied in kit form have a simple clip-on attachment. Complete assemblies, with actuators on a customer-specified V4N or V4NS switch, are also available. OEMs have a choice of either round or square push buttons and bezels. A variety of color buttons are available. Actuators with a long overtravel plunger are available. An actuator and switch assembly can be installed in equipment with single-hole panel mounting (6.35 mm diameter), or by insertion of the assembly in the switch mounting holes.



PANEL MOUNTED ACTUATORS FOR USE WITH V4N/V4NS SERIES

		Reference	Description
KIT	Push Buttons (button color must be specified)	**PBAS4**	Molded frame; actuator; square button and bezel; 1 locknut
		PBAR4	Molded frame; actuator; round button and bezel; 1 locknut
		PB5LK	Sealing kit (O ring and diaphragm)
	Long Overtravel Plunger	**QA4**	Molded frame; stainless steel plunger; overtravel actuator; 2 locknuts
COMPLETE ASSEMBLY	Push Button	**PBS** (add **PBS** to switch eg. V4NS **PBS**)	Switch with square button and bezel
		PBR (eg. V4NT7 **PBR**)	Switch with round button & bezel
	Long Overtravel Plunger	**Q** (add **Q** to switch eg. **Q**V4NST7)	Switch with long overtravel plunger

Low Differential Travel Subminiature Microswitch – V4D Series low differential travel subminiature microswitch features a maximum movement differential as low as 0.04 mm. Like the V4N/V4NS range, the V4D is available in a sealed version, V4DS, meeting IP 67 IEC requirements. The V4D/V4DS switches combine the versatility of the V4N/V4NS range with precise movements of standard size microswitches. There are seven options for terminals, including solder tag, PCB, faston and pre-wired versions to customer specification. All terminals are gold flashed. Clip-on terminal covers are an option. Silver-plated contacts are standard; gold plated contacts are optional for low-current applications. A variety of plain levers, cam follower and roller lever actuators are available. The electrical rating is 250V AC, 5A.

V4D LOW DIFFERENTIAL TRAVEL SWITCH

Reference	Actuator	Actuating Force (N)	Dimensions (mm)		Movement Differential (mm)
			Free Position Height	Lever Length	
V4DT7*	Plunger	1.2	8.7	–	0.04
V4DT7Y	Plain Lever	1.0	9.5	18.0	0.07
V4DT7Y2	Plain Lever	0.75	10.1	25.0	0.09
V4DT7Y3	Plain Lever	0.6	10.8	32.0	0.12
V4DT7YC	Cam Follower Lever	1.0	12.2	18.5	0.07
V4DT7YR1	Roller Lever	1.2	14.85	16.0	0.06

* T7, solder tag terminals; T8, PCB; T6 and T9, faston.

Extremely Long Overtravel Microswitches – V4L/V4LS Series subminiature microswitches provide an extremely long minimum overtravel of 2.2 mm in the small V4 switch dimensions of 20 X 6 X 10 mm. V4L/V4LS switches are available with various types of terminals and mounting arrangements. Contacts are either welded silver, or gold alloy coated silver palladium crossbar. An IP 40 enclosure provides protection for the V4L. The sealed V4LS version has an IP 67 enclosure for protection against water according to IEC standards. Minimum mechanical life of the switches is 10 million cycles. Rating is up to 5A/250 VAC.

EXTREMELY LONG OVERTRAVEL SWITCHES

Reference	Lever	Free Position Height (mm)	Operating Position	Movement Differential	Overtravel (mm)
V4LT7	NONE	12.3	11.2 ± 0.3	0.5	2.2
V4LTS7*	PLAIN	12.3	11.2 ± 0.3	0.5	2.2
V4LT7F	NONE	12.3	11.2 ± 0.3	0.5	2.2
V4LST7F*	PLAIN	12.3	11.2 ± 0.3	0.5	2.2
V4LSF*	PLAIN	12.3	11.2 ± 0.3	0.5	2.2

* S Designation: IP67, equivalent to NEMA 6.

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Switch Division

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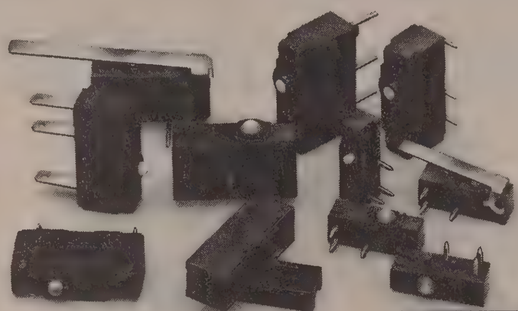
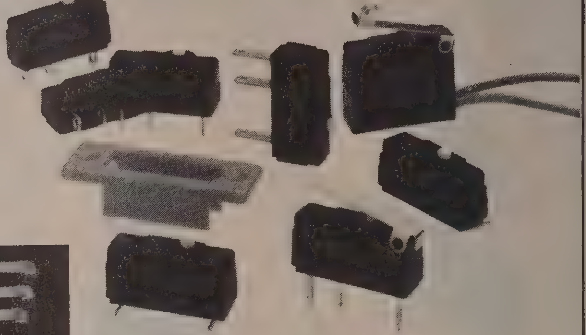
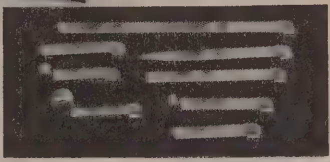


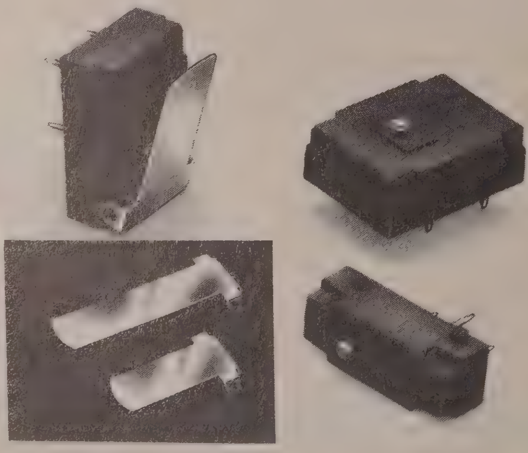


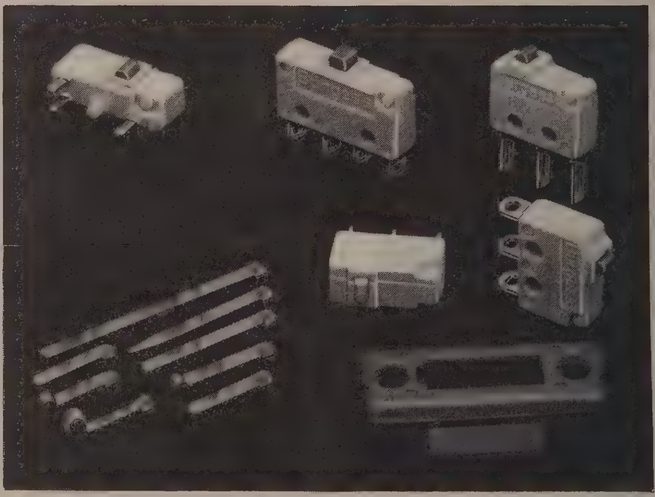


The products shown here are a brief selection of our wide range of quality switches.

Sub-Miniature and Ultra Miniature
Features: 10 million cycle life, 9 terminal options, gold cross-point, gold plate, or silver contacts, full over-travel, fully sealed & process compatible models with or without leads, mounting holes or pegs, standard/low force models, wide variety of clip-on levers, snap-on terminal covers, high temp. versions.

Reference	Sealing	Dimensions			Actuating Force		Max. Rating 125/250 VAC	Terminals
		L	W	H	N	OZ		
F1N	NO	15	5	6	2.0	7.0	5 Amp	Side PCB
F1NS	YES	15	5	6	2.0	7.0	5 Amp	Side PCB
V4N	NO	20	6	18	1.4/0.5 5/2	5.0/1.8 5/2	2 Amp 5 Amp	Sldr. PCB, QC,SM
V4NS	YES	20	6	18	2.5	9.0	5 Amp	Sldr., PCB QC,SM,Lds.
XC	NO	20	6	18	3.0/0.4	11/1.4	10/1 Amp	Sldr.,PCB,QC





Ultra-Miniature, Low Profile –
Mechanical life in excess of 10 million cycles, gold or silver contacts, full over travel, double pole versions, 3 terminal options, broad range of clip-on levers, selection of operating forces.

Burgess-SAIA products are approved by all major national testing authorities worldwide including UL, VDE, and CEE 24. Burgess-SAIA products meet ISO 9001 standards.

Reference	Dimensions			Actuating Force		Max. Rating 125/250 VAC	Terminals
	L	W	H	N	OZ		
F5T8	13	5	12	1.2	4.3	5 Amp	PCB
F4T7	13	5	18	1.2	4.3	5 Amp	Sldr./QC/PCB
LPHSP	20	7	9	1.8	6.5	3 Amp	PCB
LPSP	20	7	9	1.4	5.0	2 Amp	PCB
LP1SP	20	7	9	0.75	2.7	1.5 Amp	PCB
LPDP	20	14	9	2.8	10.0	2 Amp	PCB
LP1DP	20	14	9	1.5	5.4	1.5 Amp	PCB
FK4T7	18	5	15	1.5	5.4	5 Amp	Sldr./QC/PCB

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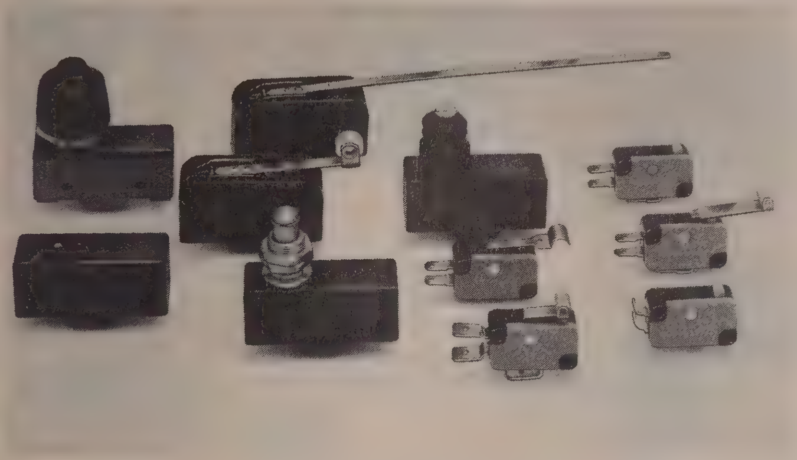
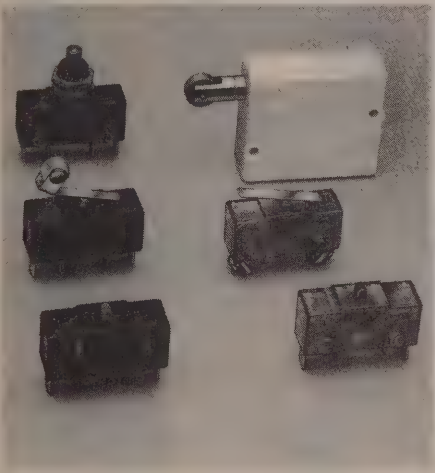
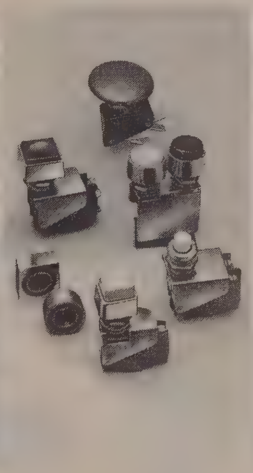


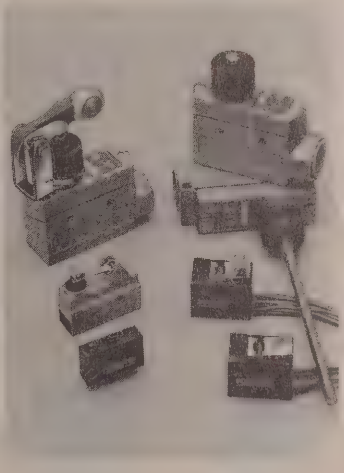
CR – CT Basics – Single-pole, changeover, snap-action with moulded cases and lids, sensitive beryllium copper trident spring mechanisms, flat base with 3 solder tag terminals version, stepped base fitted with 6-32 UNC screw and cup washer , 15A 125/250 VAC rating, broad selection of actuators, sealed models.

XG Miniatures – Single-pole, double or single throw, nine force/current variations 320 cN/45cN - 23A ½ hp/10A 1/6 hp, up to 100 million cycles mechanical life. Silver, gold, or silver-cadmium-oxide contacts, high temperature versions up to 150° C. Wide selection of terminals including PCB mount, large variety of integral lever actuators. Rast 5 connector for European domestic appliance requirements available.
International approvals - UL/CSA, BEAB, VDE, SEMKO, SEV, DEMCO, NEMCO, KEMA, UTE.

XP, XT, XS Multi-pole Security Switches – Intended for use in locations within equipment where doors and covers are opened and personnel are to be protected. XP Single Pole, XT Double Pole and XS Triple Pole versions are available.
Electrical breaking capacity ranges from logic level to 16A 125/250 VAC for electrical mains or power contact. Contact gaps in excess of 3mm for use in main isolation, contact gaps creepage and air gaps up to 8mm for UL / CSA, VDE, BEAB, SEV SEMKO, NEMKO, DEMKO, SETI, KEMA, IMQ, BEAB, and CEBEC approvals. Normally open, normally closed and changeover version, –20° C. to +85° C. and +140° C. on some models.
Contact material can be from silver nickel, silver palladium, pure silver, gold-plated and other materials on request.
Accessories include a multiplug terminal housing connection and a service key for the XT Series. A Rast 5 connector for European domestic appliance requirements is available.







K5 Series – Moulded-case with single-hole, two circuit, double-break mechanisms, plain plunger, wedge-shaped, internally-pivoted cam follower, plain spring plunger, plain and roller lever versions available –10° to +85° C., mechanism enclosed to IP40, mechanical life 1 to 10 million cycles, 25A 125/250 VAC rating.

KB5 Series – Positive action, forced break, normally closed single throw switches for guard interlock duty, 3mm minimum contact separation to meet international specifications, 100,000 cycles UL approvals, interchangeable mounting with similar range snap switches, mechanical life exceeds 10 million cycles, 25A 125/250 VAC rating.

Joysticks – 40 standard options with latching, momentary, lift-to or normal operation, V3 or V4 switching, 2 or 4 gate or 360° stirring action, panel sealing to IB65, accurate down to –50° C., designed for general industrial applications.

EUROPA – Proximity Sensors – Over 500 models, sensing ranges from under 1mm up to 20mm, AC, DC and NAMUR, N/O, N/C and universal outputs, housed in rugged nickel plated brass in compact or standard lengths, models to meet CENELEC EN, plug and socket types for easy installation.
Push-Buttons – Up to 25A 125/250 VAC, reliability over a long life with positive, nonfatiguing operation, single and double pole versions with momentary or alternate actions, a two button version, an emergency stop button unit, and a wide variety of bezels including a sealed bezel.
Protected Switches – A versatile selection of switches for difficult environments, from 15A 250 VAC metal housed with conduit entry and industrial actuators down to 10A 250 VAC compact, and 5A 250 VAC miniature single and double pole pre-wired sealed and pressure tested. Mechanical life up to 10 million cycles, NEMA Type 6, IP 67 enclosures.

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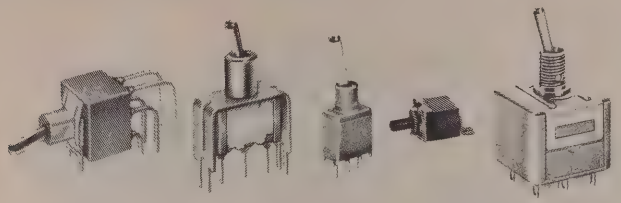
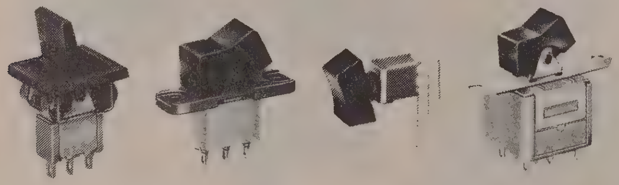


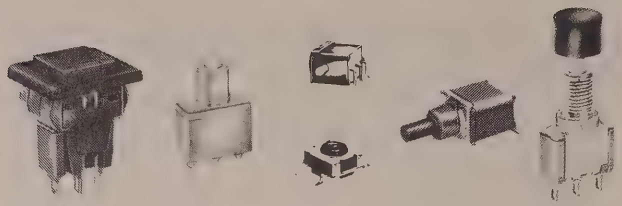
Toggle Switches

A full range of miniature, tiny and ultraminiature models for panel and P.C. mounting, including sealed/process compatible and surface mount. SP thru 4P models with many styles and options available.



Rocker and Lever Handle Switches

A full range of miniature and tiny models for panel and P.C. mounting, including anti-static and sealed/process compatible designs. SP thru 4P models and many options available.



Pushbutton Switches

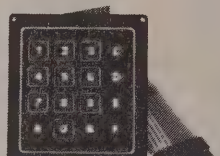
A complete line of miniature, tiny, subminiature and microminiature switches with momentary, snap-acting and alternate action functions—SP thru 4P. Surface mount and sealed/process compatible models available.

Slide Switches

A full range of miniature, tiny and ultraminiature models for panel and PC mount, including sealed/process compatible.

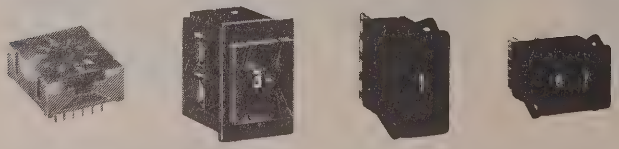
Rotary Switches

A full range of miniature instrument grade rotary switches in one and two pole models with 30 degree indexing (12 positions max) or 36 degree indexing (10 positions max).



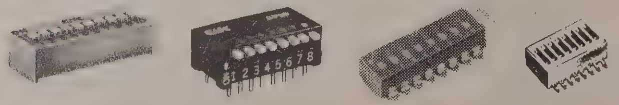
Membrane Switches

Custom assemblies and keypads available in embossed detented or flat non-tactile models.



Coded Switches

A full range of miniature and sub-miniature thumbwheel and pushbutton switches with snap-in front or rear panel and PC mounting.



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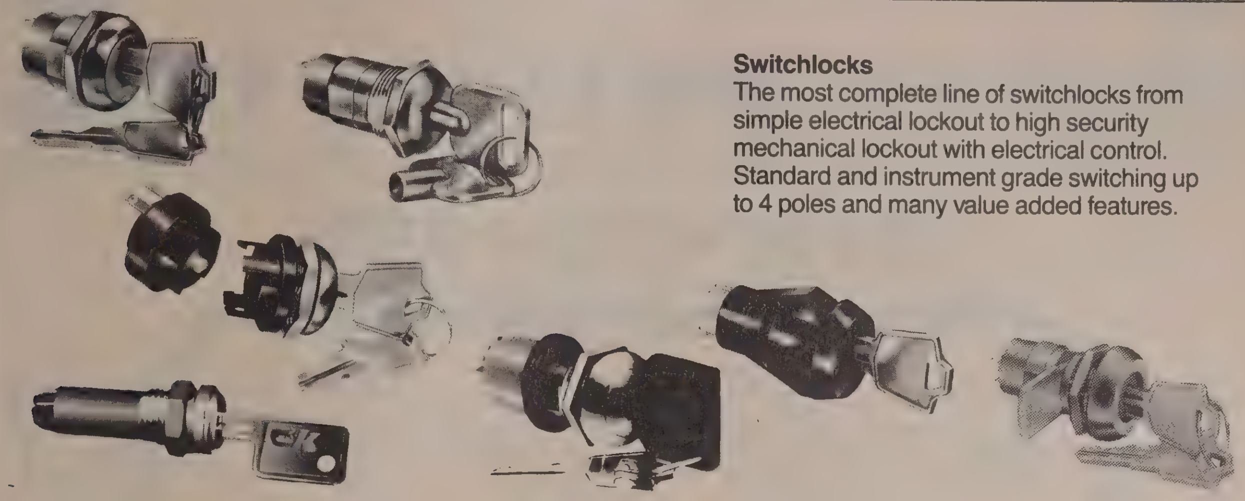

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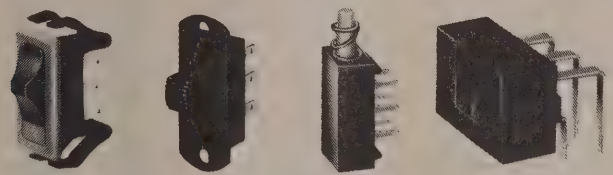
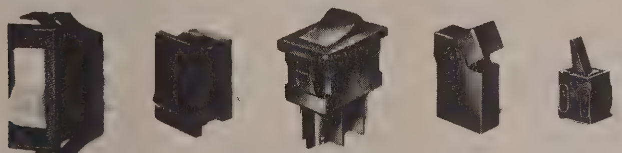


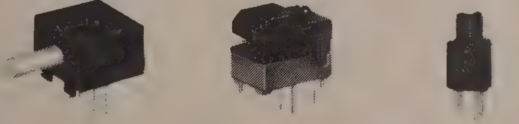
Slide Switches

Power and Line Voltage Select Slide Switches. Miniature and Snap-In Slide Switches.



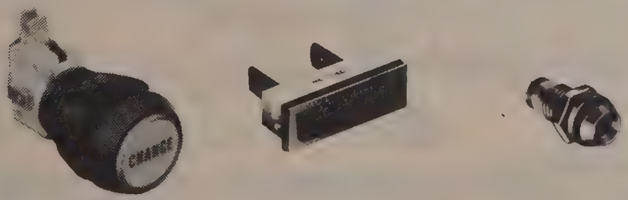
Rocker and Lever Handle Switches

A full range of miniature power rocker and lever handle switches.



Pushbutton Switches

Pushbutton and mechanical pushbutton models and options for panel and P.C. mounting.



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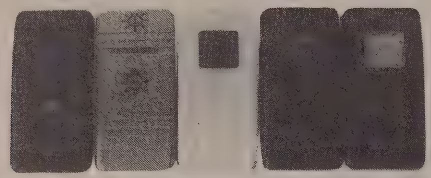
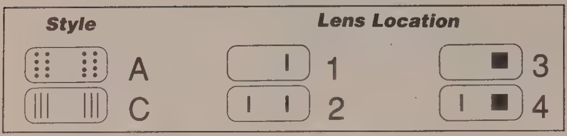
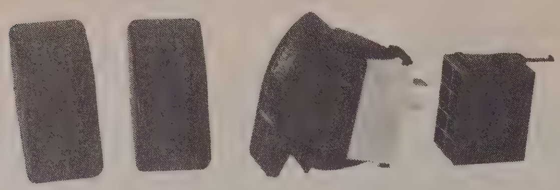


Actuators





Base and actuator snap together!

Sealed version with front panel components certified to IP66 and IP68*, signifying complete protection against dust and prolonged submersion under pressure and UL1500, signifying ignition protection for marine products. Mounts in standard industry panel cutout. Features removable actuators in multiple designs with optional "soft-touch" surfaces, illumination with various lens designs, international symbols. Optional lock-on terminal connector, actuator removal tool and mounting hole blank plug.
* Contact factory for panel opening dimensions.

To order Connector Housing, specify **VCH:**
NOTE: Customer to supply connector terminals. Connector housing accepts certain Amp, Packard or other industry standard .250" Q.C. terminals. Please consult factory.
To order Hole Plug, specify **VHP.**

Other circuits, lenses and imprinting available, please consult factory.

This information listed above is for standard Carlingswitch products. Consult Carlingswitch for additional product information.

Call for our complete catalog:
1-800-243-8556

UNLIGHTED

Type Base	*Switch Action*	*Bezel Color*	*Terminals*
V15AS00B	SP-ST ON-OFF	Back	.250 tabs
VA5AS00B	DP-ST ON-OFF	Black	.250 tabs
V45AS00B	SP-DT ON-ON	Black	.250 tabs
VD5AS00B	DP-DT ON-ON	Black	.250 tabs
V65AS00B	SP-DT ON-OFF-ON	Black	.250 tabs
VJ5AS00B	DP-DT ON-OFF-ON	Black	.250 tabs

Add one actuator below

Type Actuator	*Black Actuator Surface*	*Corresponding Picture*
VVAZC00	Hard Surface	See A
VVCZ00	Hard Surface	See C
VVAZB00	Soft Surface	See A
VVCZB00	Soft Surface	See C

ONE LAMP

Type Base	*Switch Action*	*Bezel Color/ Lamp Color*	*Terminals*
V1DABC0B	SP-DT ON-ON	Black/Red 12V LED	.250 tabs
VADABC0B	DP-ST ON-OFF	Black/Red 12V LED	.250 tabs

Add one actuator below

Type Actuator	*Black Actuator Surface Lens Callout*	*Corresponding Picture*
VVA1C00	Hard Surface/One Lens Clear	See A/1
VVA4C00	Hard Surface/One Lens Clear	See A/3
VVC1C00	Hard Surface/One Lens Clear	See C/1
VVA1B00	Soft Surface/One Lens Clear	See A/1

TWO LAMPS

Type Base	*Switch Action*	*Bezel Color/ Lamp Color*	*Terminals*
V45AD11B	SP-DT ON-ON	Black/125V Neon	.250 tabs
VD5AD11B	DP-ST ON-ON	Black/125V Neon	.250 tabs
V6DADCCB	SP-DT ON-OFF-ON	Blk/Red 12V LED	.250 tabs
VJDADCCB	DT-DT ON-OFF-ON	Blk/Red 12V LED	.250 tabs

Add one actuator below

Type Actuator	*Black Actuator Surface Lens Callout*	*Corresponding Picture*
VVA2C00	Hard Surface/Two Lenses Clear	See A/2
VVA5C00	Hard Surface/Two Lenses Clear	See A/4
VVC2C00	Hard Surface/Two lenses Clear	See C/2

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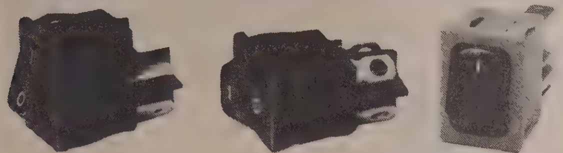
CARLINGSWITCH

SWITCHES

New! MAXI-Series Rocker Switches



The MAXI-Series miniature rocker switches are available in both single and double configurations. The 632 MAXI-Series is illuminated. These new switches provide 100 amp inrush capability, fit into industry standard cut-out dimensions and include a quick-make contact mechanism. Other features include a small, shallower base, a contemporary actuator design and availability with a single pole circuit and an independent lamp.

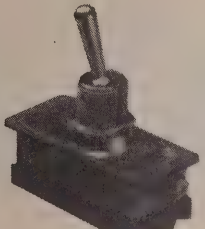
12A 125 VAC ½HP
8A 250 VAC ½HP UL/CSA 10 (4) 250 TBS TUV

Type	*Switch Action*	*Bezel/Rocker Color*	*Terminals*
622132-B-B-NN	SP-ST ON-OFF	Black/Black	.187 tabs
622232-B-B-NN	SP-ST ON-OFF	Black/Black	.187 tabs
		Bezel/Lens Color	
632142-2B-JN	SP-ST ON-OFF	Black/Red 125V Neon	.187 tabs
632232-2B-KN	DP-ST ON-OFF	Black/Red 250V Neon	.187 tabs

Imprinting is available, please consult factory.

General Purpose AC-DC Toggle Switches

2B-Series



EK/DK-Series

110-Series

Quick make and break AC-DC rated. UL recognized and CSA certified $\frac{15}{32}$" bushing, $\frac{11}{16}$" toggle.

6 AMPS 125 V
3 AMPS 250 V

Type	*Switch Action*	*Terminals*
110-73	S.P.S.T. ON-NONE-OFF	Solder
110-S-73	S.P.S.T. ON-NONE-OFF	Screw
111-16-73	S.P.S.T. ON-NONE-OFF	Wire
2BB62-73	S.P.D.T. ON-NONE-ON	Solder
2BK62-73	D.P.S.T. ON-NONE-OFF	Solder
2BK65-73	D.P.S.T. ON-NONE-OFF	Wire
2BL62-73	D.P.D.T. ON-NONE-ON	Solder

HEAVY DUTY TOGGLE SWITCHES

16 AMPS, 125V; 8 AMPS 250 V; 1 HP125-250 V

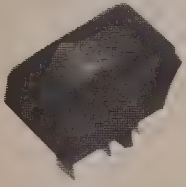
DK284-73	D.P.S.T.	Screw

20 AMPS 125 V–10 Amps 250V–1½H.P.-125-250V

EK204-73	D.P.S.T.	Screw

Curvette® Snap-in Switches

R-Series



LR-Series

Visi-Rocker R-Series

Slow make & break action, .250 quick connect terminals. 16 amps 125 VAC-10Amps 250 VAC, 10(4) amps-250VAC, UL recognized, CSA and VDE certified. Rated life 50 M cycles @ rated load. Also features our unique Visi-Rocker, Two color molded curved rocker for low cost "ON" indication.

Type	*Switch Action*	*Rocker Color*
RA911-RB-B-0-N	S.P.S.T. ON-NONE-OFF	Black
RA911-VB-B-0-V	S.P.S.T. ON-NONE-OFF	Visi-Rocker
RA911-VB-B-!-V	S.P.S.T. ON-NONE-OFF	Visi-Rocker W/ON-OFF Legend
RB211-RB-B-0-N	S.P.D.T. ON-NONE-ON	Black
RC211-RB-B-0-N	S.P.D.T. ON-OFF-ON	Black
LRA211-RS-B/120N	S.P.S.T. ON-NONE-OFF Lighted	Strawberry

SC High Inrush Curvette Snap-in Switches

LRGSC-Series

RSC-Series

RGSC-Series

Designed ti handle current surges over 100 amps. UL recognized and CSA certified for 20 amps 125 VAC -15 amps 250 VAC, 16(6) amps 250 VAC, VDE certified.

Type	*Switch Action*	*Rocker Color*
RSCA711-RB-B-0-N	S.P.S.T. ON-NONE-OFF	Black
RGSCC711-RB-B-0-N	D.P.S.T. ON-NONE-OFF	Black
LRGSCK221-RS-B/120N	S.P.S.T. ON-NONE-OFF Lighted	Strawberry

ON/OFF imprinting is available, consult factory.

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CARLINGSWITCH SWITCHES

Miniature Curvette Snap-In Switches

621 Series

The 621-Series switches are double insulated and availble for either snap-in or PC back panel mounting. They are rated @ 4 amps 250 VAC-8 amps 125 VAC, 6(4) amps 250 VAC. Worldwide certifications. Also features the Visi-Rocker two-color molded rocker for low cost "ON" indication.

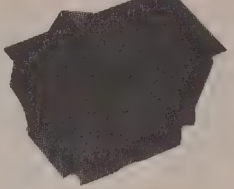
Type	Switch Action	Terminals	Rocker Color
62111926-0-0N	S.P.D.T. ON-NONE-ON	Solder	Black
62112926-0-0-N	D.P.D.T ON-NONE-ON	Solder	Black
62116319-0-0-N* 11 amps 125 VAC	S.P.S.T. ON-NONE-OFF	.187 Tabs	Black
62115929-0-0-V**	D.P.D.T. ON-NONE-ON	.187 Tabs	Visi-Rocker
62116919-0-9V**	S.P.S.T. ON-NONE-OFF	.187 Tabs	Visi-Rocker w/I-O legend

* UL recognized and CSA certified for 11 amp 125 VAC ratings.

** Curvette Visi-Rocker has a second color molded in for attractive low cost "ON" indication. ON/OFF imprinting is available, consult factory.

Heavy Duty Rocker Switches

LTIL-Series



TIG-Series

These full-size rocker switches are designed for AC and low voltage DC applications. They include a slow-make, slow-break contact mechanism, nylon snap-in brackets. They are rated at 15 amps 125 VAC, 10 amps 250 VAC, ¾ H.P. UL recognized and CSA certified. Suitable for 20 amp 28 VDC.

Type	Switch Action	Terminals	Rocker Color
TIGA51-6S-BL-NBL	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black
TIGK54-6S-BL-NBL	D.P.S.T ON-NONE-OFF	Screw	Black
LTILA51-6S-BL-RC-NBL (125 VAC lamp)	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black w/red light

DRIP DRY ROCKER SWITCHES

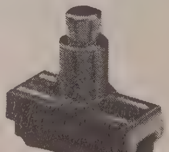
We have modified the Tippette Switches above to provide front panel dust and moisture protection with built in seal feature.

Type	Switch Action	Terminals	Rocker Color
TIGA51-6S-BL-WBL	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black
TIGK54-6S-BL-WBL	D.P.S.T ON-NONE-OFF	Screw	Black
LTILA51-6S-BL-RC-WBL (12 V lamp)	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black

ON/OFF imprinting is available, consult factory.

General Purpose Pushbutton Switches

P27-Series



170-Series

110-SP Series

Multi-purpose, single or double pole switches. Available in a variety of circuits and actuator styles. UL Recognized and CSA certified for AC/DC with ratings up to 10A 250 VAC, 20A 125 VAC.

6 AMP 125 VAC-3 AMP 250 VAC
UL RECOGNIZED AND CSA CERTIFIED

Type	Switch Action	Terminals	Caps
P26A-1D-RND MTL	S.P.N.O.	Solder	Metal
P26L-1D-RND MTL	S.P.N.C.	Solder	Metal
P27A-BL	S.P.N.O.	Solder	Black
P27A-RD	S.P.N.O.	Solder	Red
P27L-BL	S.P.N.C.	Solder	Black
P27L-RD	S.P.N.C.	Solder	Red

5 AMP 125 VAC-10 AMP 250 VAC

170	S.P.N.C.	Screw	Metal
172	S.P.N.O.	Screw	Metal

QUICK MAKE/QUICK BREAK MAINTAINED AC/DC
6 AMP125 V-3 AMP 250 V
UL RECOGNIZED AND CSA CERTIFIED

170	S.P.N.C.	Screw	Metal
172	S.P.N.O.	Screw	Metal

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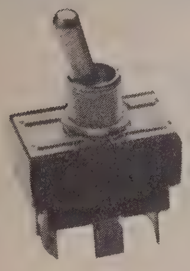
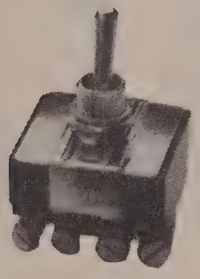
Heavy Duty AC Rated Toggle Switches

F-Series



G-Series

H-Series



I-Series

General purpose switches rated @ 15 amps 125 VAC and 10 amps @ 250 VAC, UL recognized and CSA certified in single, double, three and four pole configurations. All are rated ¾ H.P. 125-250 VAC- $\frac{15}{32}$" bushing-$1\frac{1}{16}$" toggle. Suitable for 20 amp 28VDC

Type	Switch Action	Terminals
2FA53-73	S.P.S.T. ON-NONE-OFF	Solder
2FA53-73-TABS	S.P.S.T.ON-NONE-OFF	.250 tabs
2FA54-73	S.P.S.T. ON-NONE-OFF	Screw
2FB53-73	S.P.D.T. ON-NONE-ON	Solder
2FB53-73-TABS	S.P.D.T. ON-NONE-ON	.250 tabs
2FB54-73	S.P.D.T. ON-NONE-ON	Screw
2FC53-73	S.P.D.T. ON-OFF-ON	Solder
2FC53-73-TABS	S.P.D.T. ON-OFF-ON	.250 tabs
2FC54-73	S.P.D.T. ON-OFF-ON	Screw
6FC54-73	S.P.D.T. (ON)- OFF- (ON)	Screw
2GK50-73	D.P.S.T. ON-NONE-OFF	Solder
2GK51-73	D.P.S.T. ON-NONE-OFF	.250 tabs
2GK54-73	D.P.S.T. ON-NONE-OFF	Screw
2GL50-73	D.P.D.T. ON-NONE-ON	Solder
2GL51-73	D.P.D.T. ON-NONE-ON	.250 tabs
2GL54-73	D.P.D.T. ON-NONE-OFF	Screw
2GM50-73	D.P.D.T. ON-OFF-ON	Solder
2GM51-73	D.P.D.T. ON-OFF-ON	.250 tabs
2GM54-73	D.P.D.T. ON-OFF-ON	Screw
HK250-73	3.P.S.T. ON-NONE-OFF	Solder
HK251-73	3.P.S.T. ON-NONE-OFF	.250 tabs
HK254-73	3.P.S.T. ON-NONE-OFF	Screw
HL250-73	3.P.D.T. ON-NONE-ON	Solder
HL251-73	3.P.D.T. ON-NONE-ON	.250 tabs
HL254-73	3.P.D.T. ON-NONE-OFF	Screw
HM250-73	3.P.D.T. ON-OFF-ON	Solder
HM251-73	3.P.D.T. ON-OFF-ON	.250 tabs
HM254-73	3.P.D.T. ON-OFF-ON	Screw
IK250-73	4.P.S.T. ON-NONE-OFF	Solder
IK251-73	4.P.S.T. ON-NONE-OFF	.250 tabs
IK254-73	4.P.S.T. ON-NONE-OFF	Screw
IL250-73	4.P.S.T. ON-NONE-ON	Solder
IL251-73	4.P.D.T. ON-NONE-ON	.250 tabs
IL254-73	4.P.D.T. ON-NONE-ON	Screw
IM250-73	4.P.D.T. ON-OFF-ON	Solder
IM251-73	4.P.D.T. ON-OFF-ON	.250 tabs
IM254-73	4.P.D.T. ON-OFF-ON	Screw

Nylon Insulated Toggle Switches

D-Series

D-Series switches have self-cleaning wiping action contacts suitable for both power and low-level switching, nylon flat or bat lever actuators and bushing/frame super structure for double insulated requirements-UL recognized, CSA certified. Series rated @ 10amp 125 VAC 5 amp 250 VAC ½ H.P. 125-250 VAC 10 amp 28 VDC.

PADDLE TOGGLE ACTUATOR

Type	Switch Action	Terminals
DA100-PB-B	S.P.S.T. ON-NONE-OFF	Solder/.250 tabs
DA105-PB-B	S.P.S.T. ON-NONE-OFF	Wire
DB100-PB-B	S.P.D.T. ON-NONE-OFF	Solder/.250 tabs
DC100-PB-B	S.P.D.T. ON-OFF-ON	Solder/.250 tabs

BAT TOGGLE ACTUATOR

Type	Switch Action	Terminals
DA100-BB-B	S.P.S.T. ON-NONE-OFF	Solder/.250 tabs
DA105-BB-B	S.P.S.T. ON-NONE-OFF	Wire
DB100-BB-B	S.P.D.T. ON-NONE-OFF	Solder/.250 tabs
DC100-BB-B	S.P.D.T. ON-OFF-ON	Solder/.250 tabs

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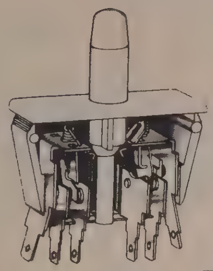
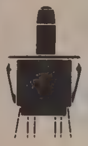
Panel Mount Pushbutton
E series - Double Pole



Series E75	**16 amps**
Series E77	**10 amps/ 0.1 amps**
Series E78	**0.1 amps**
Series E79	**10 amps**

Switch body 1.57″ x 1.05″ x .680″



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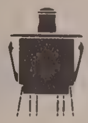

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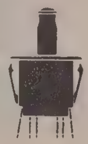

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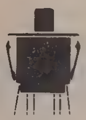

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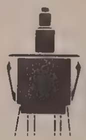
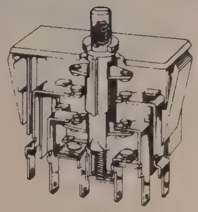


-50A

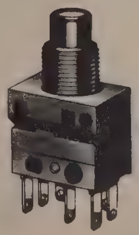
Line Interrupt
F80 series



Series F81	**10 amps**
Series F82	**16 amps**
Series F83	**0.1 amps**
Series F84	**Combination of current ratings**

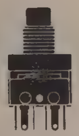
Switch body 1.57″ x 1.16″ x .685″

Lighted Pushbutton Switches
P1 series



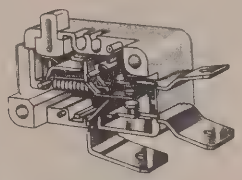
Series P162	**10.1 amps**
Series P163	**0.1 amps**

Switch body .844″ x .688″ x .578″

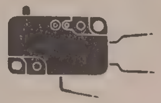


-C3RA Red button–LED, SPDT
-C3BU Black button–No light, SPDT
-D3RA Red button–LED, DPDT
-D3BU Black button–No light, DPDT

International Miniature
D3 series - Heavy Duty

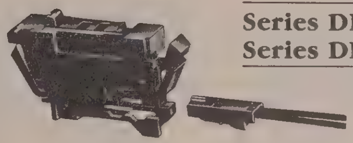


Series D36	**4 amps**
Series D37	**10 amps**
Series D38	**16 amps**



Switch body 1.094″ x .625″ x .406″

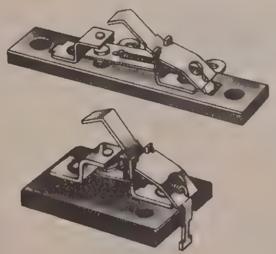
Terminator
DN series



Series DN3	**0.1 amps**
Series DN6	**3 amps**

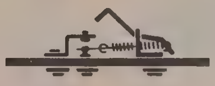
Switch body
1.337″ x .854″ x .406″

Open Switches
S series

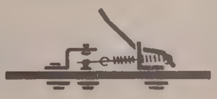


Series S23	**5 amps**
Series S25	**10 amps**
Series S30	**10 amps**
Series S31	**0.1 amps**

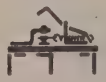
Switch body
S23, S25 2.125″ x .438″ x .094″
S30 1.062″ x .750″ x .093″
S31 1.031″ x .250″ x .062″



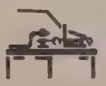
-00T



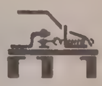
-60T



-00W

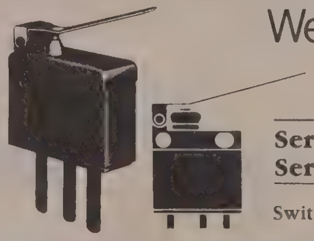


-20W



-20P

Weatherproof
E72 series



Series E72	**10.1 amps**
Series E73	**0.1 amps**

Switch body .915″ x .880″ x .385″

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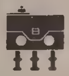
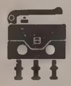
Ultra - Subminiature
DH series*

Series DH1C	**50-500 mA**
Series DH2C	**5-50 mA**

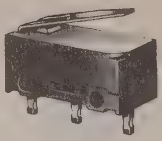


DH1C-B1AA
DH2C-B1AA
Switch body
.322″ x .244″
x .106″

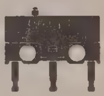


DH1C-B1PA
DH2C-B1PA
Switch body
.322″ x .244″
x .106″

Sub - Subminiature
DG series*

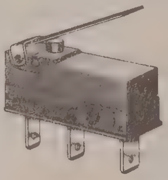


Series DG1	**3 amps** **2 amps**
Series DG2	**50 mA**

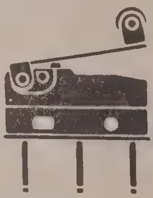


DG series
Switch body
.504″ x .255″ x .228″

Subminiature International
DB series* - Automated



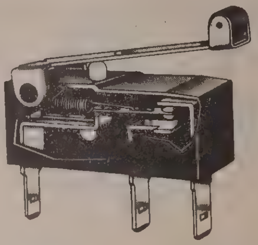
Series DB1	**5 amps**
Series DB2	**10 amps**
Series DB3	**0.1 amps**



DB series
Switch body
.783″ x .380″
x .256″

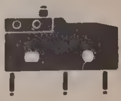
* Silhouettes shown actual size

Subminiature
DA3 series - Automated

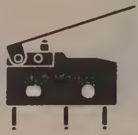


Series DA3	**0.1 amps**

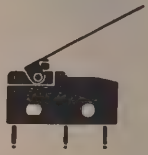
Switch body
.781″ x .375″ x .250″



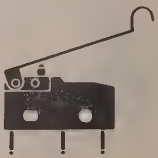
-F1AA



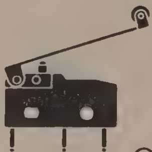
-F1LB



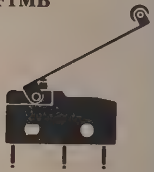
-F1MB



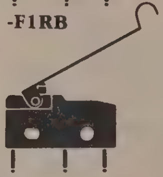
-F1SB



-F1RB



-F1TB



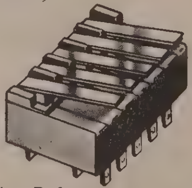
-F1UB

Subminiature Modules
HM series

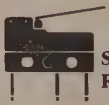
Two Pole
(2 PDT)

Series E61	**5 amps**
Series E62	**10.1 amps**
Series E63	**0.1 amps**

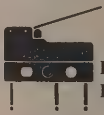
Switch body
2 PDT = .781″ x .483″ x .470″
3 PDT = .781″ x .483″ x .672″
4 PDT = .781″ x .483″ x .875″
5 PDT = .781″ x .483″ x 1.086″



Five Pole
(5 PDT)



Standard Ratio

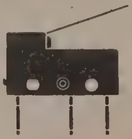


High Ratio

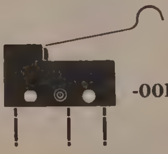
Subminiature
E series

Series E61	**5 amps**
Series E62	**10.1 amps**
Series E63	**0.1 amps**

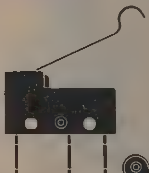
Switch body
.781″ x .375″ x .250″



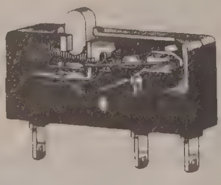
-50H

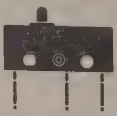


-00R

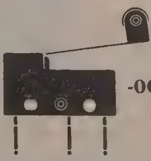


-50R

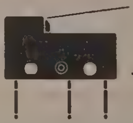




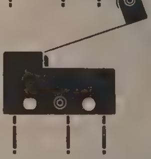
-00A



-00K



-00H



-50K

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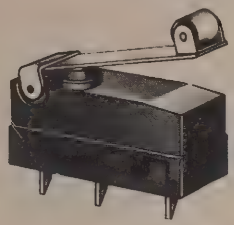
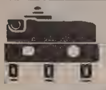
International Subminiature Waterproof

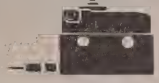
DC series



Series DC1	5 amps
Series DC2	10.1 amps
Series DC3	0.1 amps
Series DC4	3 amps



Solder Terminals
Switch body
.783″ x .397″
x .256″

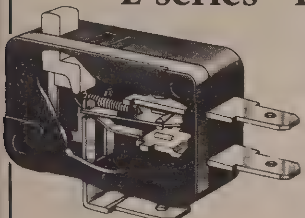


Wire Terminals
Switch body
.783″ x .602″
x .256″

Miniature

E series - Light Force (X Suffix)

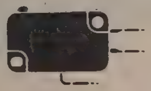
Standard Force



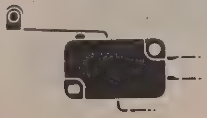
Series E21	0.1 amps
Series E22	3 amps
Series E23	5 amps
Series E31	1 amp
Series E33	10 amps
Series E34	15 amps
Series E35	20.1 amps*
Series E36	25 amps*

* Light Force only

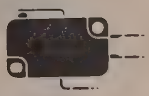
Switch body
1.093" x .625" x .406"



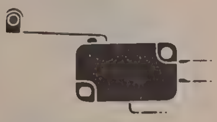
-00A
-00AX



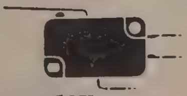
-50K
-50KX



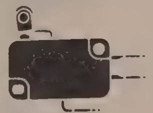
-00H
-00HX



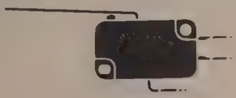
-50KL
-75KX



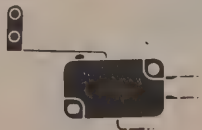
-50H
-50HX



-00K



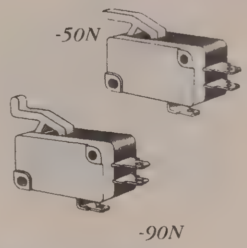
-75HX



-50P

Plastic Lever Actuator

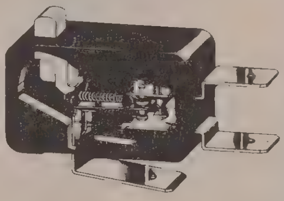
for miniature E series Light Force and Standard Force



Series/prefix numbers, electrical ratings and switch body dimensions are the same as the E series models shown above.

Miniature International

D4 series Light Force (L-Suffix) Standard Force



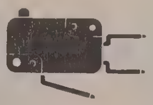
Series D41	0.1 amps
Series D42	3 amps
Series D43	5 amps
Series D44	10 amps
Series D45	15 amps *
Series D48	21 amps *

US part number suffix (straight terminals)

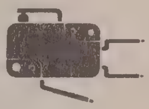
(International suffix) (dogleg terminals)

Switch body
1.095" x .625" x .406"
27.81 mm x 15.88 mm
x 10.31 mm

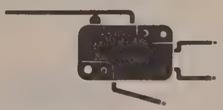
* International versions of D45 require larger terminals. Consult factory.



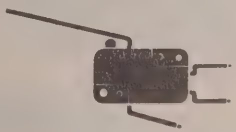
L-R1AA C-R1AA
(9-Q3AA) (3-Q3AA)



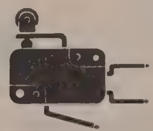
L-R1LA C-R1LA
(9-Q3LA) (3-Q3LA)



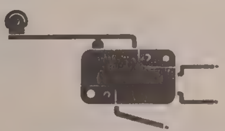
L-R1YD C-R1LD
(9-Q3YD) (3-Q3LD)



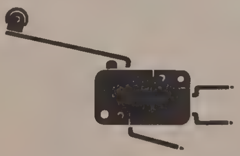
L-RIXD C-RIXD
(9-Q3XD) (3-Q3XD)



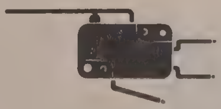
L-R1RA C-R1RA
(9-Q3RA) (3-Q3RA)



L-R1RC C-RIRC
(9-Q3RC) (3-Q3RC)



L-R1TC C-R1TC
(9-Q3TC) (3-Q3TC)



L-R1YL C-RIYL
(9-Q3YL) (3-Q3YL)

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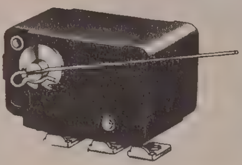
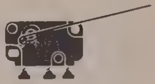
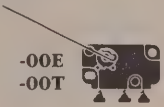
Low Torque
E/F Series

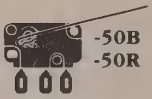


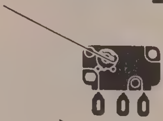
Series E51/F51	6 amps
Series E53/F53	0.1 amps

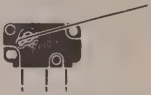
Switch body
1.218″ x .687″ x .580″


-00B
-00R


-00E
-00T


-50B
-50R


-50E
-50T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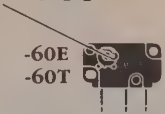
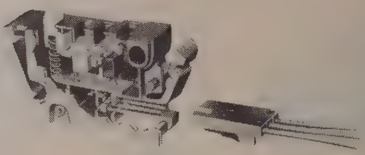
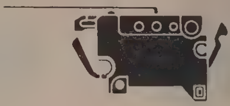

-60E
-60T

Logic Switch
DN Opto Series

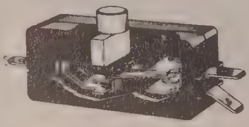


Linear
button/actuator
type optoelectronic
switch.



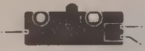
Switch body
1.337″ x .914″ x .406″

General Purpose
E series - Single Pole



Series G13	0.1 amps
Series E13	15 amps
Series E14	25 amps
Series E30	30.1 amps

Switch body
1.823″ x .640″ x .644″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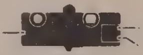
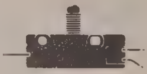

-00R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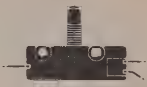
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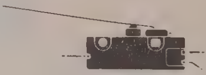
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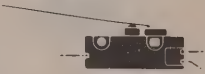
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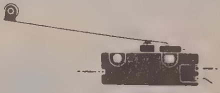
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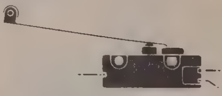
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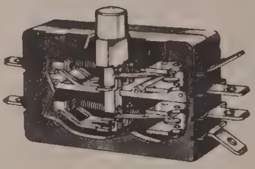
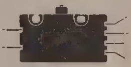
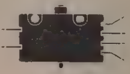
General Purpose
E series - Double Pole

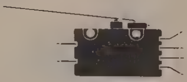


Series E19	15 amps
Series E19A	15 amps/ 0.1 amps
Series E20	20 amps
Series G20	0.1 amps

Switch body
1.813″ x 1.125″ x .640″


-00A


-00R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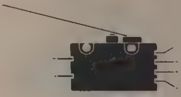
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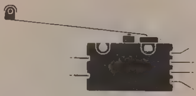
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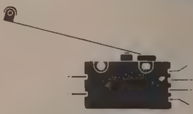
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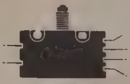
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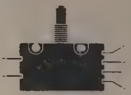
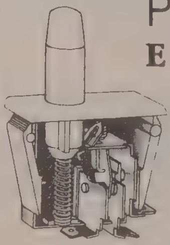
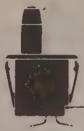

-00M

Panel Mount Pushbutton
E series - Single Pole



Series E65	16 amps
Series E68	0.1 amps
Series E69	10 amps

Switch body 1.25″ x 1.05″ x .680″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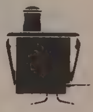
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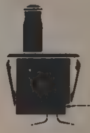
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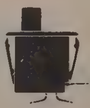
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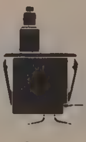
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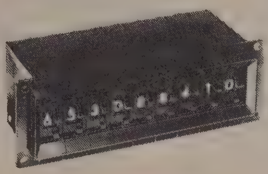
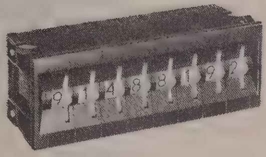


SERIES T10 THUMBWHEEL

Industrial Size Back Mount

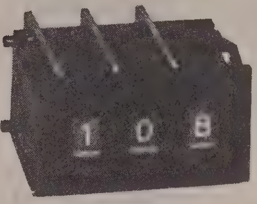
- 8, 10, 12 and 16 dial positions
- Variety of output codes
- Wide window version
- Stops to limit rotation
- Dimensions: 1.36″ (34.55mm)H x .500″ (12.7mm)W



SERIES T75 THUMBWHEEL

Standard Size Front Mount Snap-In

- 8, 10, 12 and 16 dial positions
- Variety of output codes
- Lighted version
- Stops to limit rotation
- Dimensions: 1.30″ (33mm)H x .394″ (10mm)W



SERIES T55 PUSHWHEEL

Sub-Subminiature Size Front Mount Snap-In

- 8, 10, or 16 dial positions
- Variety of output codes
- Lighted version
- Stackable units without mounting hardware
- Dimensions: .591″ (15mm)H x .300″ (7.62mm)W

SERIES T59 PUSHWHEEL

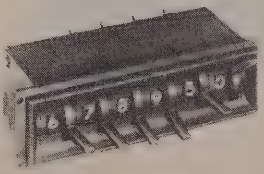
Sub-Subminiature Size "Dustproof" Front Mount Snap-In

- 8 or 10 dial positions
- BCD or octal codes
- PC pin outputs
- Stackable units without mounting hardware
- Dimensions: .709″ (18mm)H x .236″ (6mm)W

SERIES T20 THUMBWHEEL

Miniature Size Back Mount

- 8, 10, 12 or 16 dial positions
- Variety of output codes
- Lighted version
- Stops to limit rotation
- Dimensions: .960″ (24.4mm)H x .500″ (12.7mm)W



SERIES L20 LEVERWHEEL

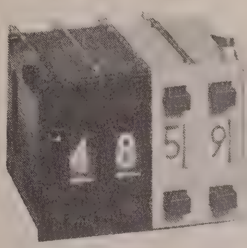
Miniature Size Back Mount

- 8, 10, 12 or 16 dial positions
- Variety of output codes
- Quick re-set lever action
- Stops to limit rotation
- Dimensions: .960″ (24.4mm)H x .500″ (12.7mm)W

SERIES T50 THUMBWHEEL

Subminiature Size Back Mount

- 8, 10 or 16 dial positions
- Variety of output codes
- Most popular series
- Stops to limit rotation
- Dimensions: .709″ (18mm)H x .315″ (8mm)W



SERIES T56 PUSHWHEEL

Sub-Subminiature Size Front Mount Snap-In

- 8, 10 or 16 dial positions
- Variety of output codes
- Lighted version
- Stackable units without mounting hardware
- Dimensions: .945″ (24mm)H x .300″ (7.62mm)W

Other Series available upon request.

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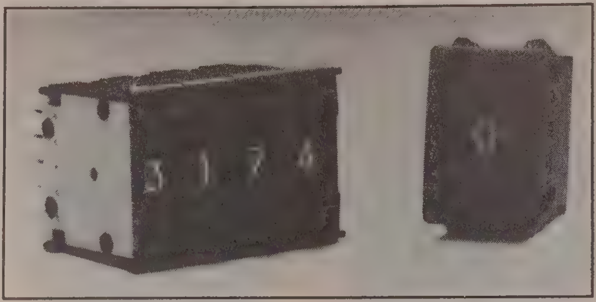
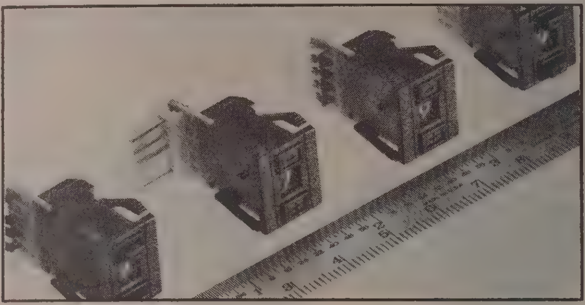


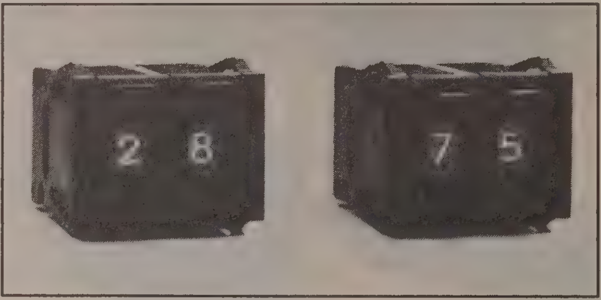
SERIES PB PUSHWHEEL
Sub-Subminiature Size
Front Mount Snap-In

- •Minimum mounting depth, low mounting height (.614", 15,6 mm)
- •Connection through integrated solder pins, automatic soldering possible
- •Stackable unit without mounting hardware
- •Printed circuit board mounting
- •Dimensions: .709" (18 mm)H x .236" (6 mm)W



SERIES PH PUSHWHEEL
Sub-Subminiature Size
Front Mount Snap-In

- •Recessed buttons available
- •End caps built-in
- •Multiple termination options
- •Full rotation 0-7, & 0-15 switch positions
- •Dimensions: .591" (15 mm)H x .500" (12,7 mm)W



Series PA Front Mount Snap-In with Standard and Recessed Buttons

SERIES PA PUSHWHEEL
Sub-Subminiature Size
Front Mount Snap-In

- •Flexibility of output codes
- •Electrostatic discharge protection optional
- •Stackable unit without mounting hardware
- •Recessed buttons available
- •Full rotation 0-15 switch positions
- •Multiple termination options
- •Dimensions: .591" (15 mm)H x .300" (7,62 mm)W

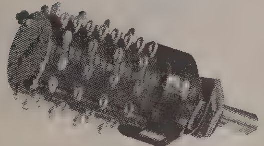
SERIES PF PUSHWHEEL
Sub-Subminiature Size
Back Mount Snap-In

- • Recessed buttons available
- •Variety of output codes
- •Stackable units without mounting hardware
- •Full rotation 0-15 switch positions
- •Multiple termination options
- •Dimensions: .551" (14 mm)H x .300" (7,62 mm)W

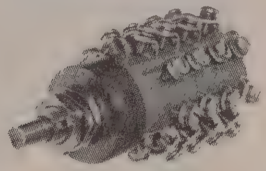
COLE INSTRUMENT: YOUR SOURCE.

1150 Series
.320 dia. with
.125 dia. shaft

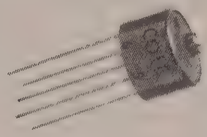
3600 MIL-S-3786/4 with
solder termination



3600 MIL-S-3786/4 with
screw type termination

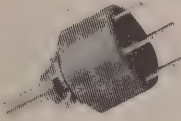


1250 Series: the smallest
in Cole's family

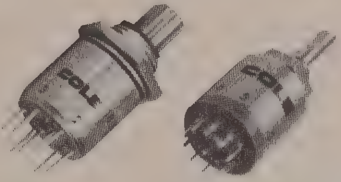


3900 MIL-S-3786/39
with PC terminals

1800 Encoded

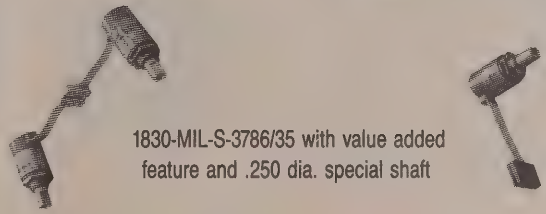


1800 MIL-S-3786/20 with
.125 and .250 dia. shafts



3900 MIL-S-3786/13,/39,/41 keylock
with PC and solder terminations

3900 MIL-S-3786/39
Special with add-a-pot
features



1830-MIL-S-3786/35 with value added
feature and .250 dia. special shaft

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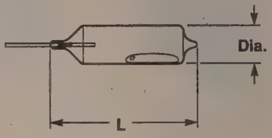
NEW **Non-Mercury Tilt Switches - CW1300 Series**

Glass Switches

Part. No.	Dimensions L	D	Max. Operate Angle	AC Ratings (Amps) 30V	115V	230V	DC Ratings 30V	120V	250V	Mount Clip#
CA20-0	0.5	.16	10°	.25	.1	.05	0.1	.07	.03	1A
CA22-0	0.9	.18	1°	.3	.1	.05	0.1	.07	.03	1A
CB17-0	1.4	.32	10°	6	3	2	3	2	1	3BH
CB51-0	1.0	.32	2°	3	1	0.5	1.5	0.7	.3	3BH
CH03-0	1.4	.35	1.4°	1	0.2	0.1	.2	.15	.05	3BH
*CH04-0	1.6	.35	2°	1	0.2	0.1	0.2	.15	.05	3BH
CK30-0	2.2	.45	28°-32°	20	10	5	12	8	3	7KF
CL52-0	2.6	.60	3°	20	10	5	12	8	3	9L

*SPDT



Metal Switches

(For information on Non-Mercury Version, Contact Factory)

Part No.	A x	B x	C	Fig.	Max. Operate Angle	AC Ratings 30V	115V	230V	DC Ratings 30V	120V	250V	Mount Clip#
CM100-0	.38	.32	.82	1	10°	2	1	0.75	0.7	0.5	0.2	3BH
CM200-0	.66	.32	1.1	1	10°	4	2	1.5	1.7	1.0	0.4	3BH
CM225-0	.66	.32	1.1	1	20°-30°	4	2	1.5	1.7	1	0.4	3BH
CM1000-0	1.25	.44	1.5	2	10°	20	10	5	8	5	3	T59
*CM1050-0	1.25	.44	1.8	3	10°	20	10	5	8	5	3	T59
CM1300-0	.40	.19	.88	1	10°	1	0.5	0.3	0.5	0.2	0.1	1A
CM1320-0	.40	.19	1.0	1	10°	0.5	0.25	0.2	0.5	0.2	0.1	1A
**CM1800-1	.28	.18	.40		**	0.2	0.1	0.08	0.1	.07	.03	1A

*SPDT
**No angle specified - motion and vibration sensor

Fig. 1

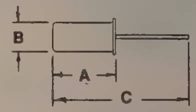


Fig. 2

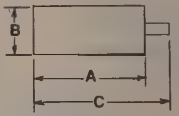
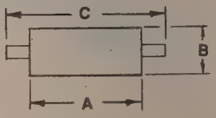


Fig. 3

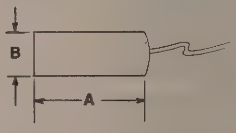


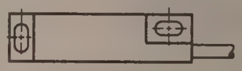
Encapsulated Switches

(For information on Non-Mercury Version, Contact Factory)

Part No.	Max. Operate Angle	A x	B	AC Ratings 30V	115V	230V	DC Rating 30V	120V	250V
CM100-70	10°	1.3	0.5	2	1	.75	0.7	0.5	0.2
CM200-70	10°	1.3	0.5	4	2	1.5	1.7	1.0	0.4
CM1000-70	10°	1.8	0.55	20	10	5	8	5	3
CM1320-70	10°	0.9	0.3	0.5	0.25	0.2	0.5	0.2	0.1
CM1320-90	10°	1.9	0.48	0.5	0.25	0.2	0.5	0.2	0.1

Epoxy Sealed Housing





CM1320-90

Tip-Over Switches - Omnidirectional

Part No.	Operate Angle	Dimensions A x	B x	C	Fig.	AC Ratings 30V	115V	230V	DC Rating 30V	120V	250V
CM1370-1 NO	50°-70°	.40	.23	1.0	1	.5	.25	.200	0.5	0.2	0.1
CM1445-0 NO	35°-55°	.38	.37	.81	1	2	1	0.75	0.7	0.5	0.2
CM1490-0 NC	30°-60°	.38	.37	.81	1	2	1	0.75	0.7	0.5	0.2
CM1535-0 NC	25°-45°	.49	.77	.74	2	30	12.5	7	15	8	5
**CM1535-75 NC	25°-45°					30	12.5	7	15	8	5
CM1725-0 NC	15°-35°	.42	.60	.66	2	2	1.5	0.8	1.0	0.6	0.2
***CM4150-1	4° (Typ)	.42	.93	.65	2	1	1	0.5	1.0	0.6	0.2

** (2) 1/4" QC terms and insulated mounting stand-off. UL approved.
*** (1) Four N.O. contacts that close depending on direction of tilt.

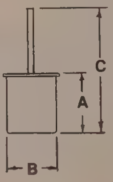


Fig. 1

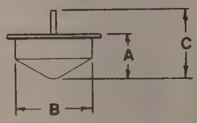


Fig. 2

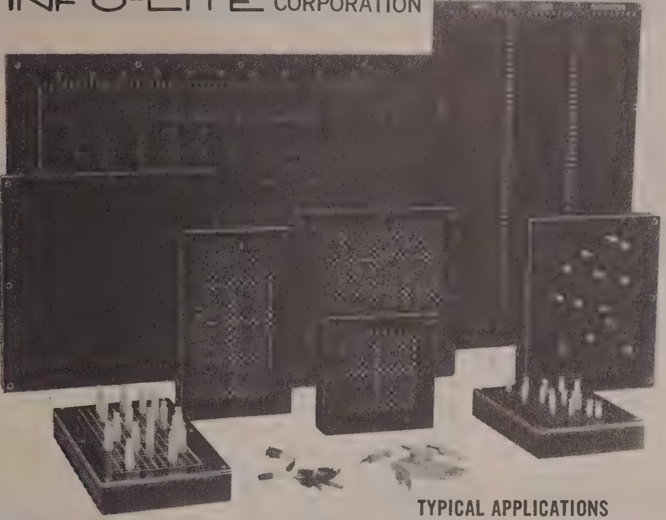
Also Available As Encapsulated Switch.

CROSSPOINT

THE PROGRAMMING PRODUCTS DIVISION OF
INFO-LITE CORPORATION

PROGRAMMING PRODUCTS

MATRIX PINBOARDS



INFO-LITE has developed a most convenient, compact and economical system for reliable programming and switching • The Matrix Program Board allows a wide variety of switching/programming functions to be performed by simply inserting programming pins (shorting or diode type) into a 2 to 10 deck contact matrix • No accessories such as "read" "write" equipment are required • Matrix Board features have led them to be favored over such devices as patchboards, card readers, toggle and thumbwheel switches, mag/punched tape and electronic memories • The two basic uses for Matrix Program Boards are: (1) Cordless patching (input-output switching), using shorting pins; (2) Programmable diode matrices (logic memories), using diode pins • Units with up to 100 x 100 crosspoints can be supplied to meet your requirements, whether for prototype or production quantities.

See Data Sheet MB3 for detailed specifications.

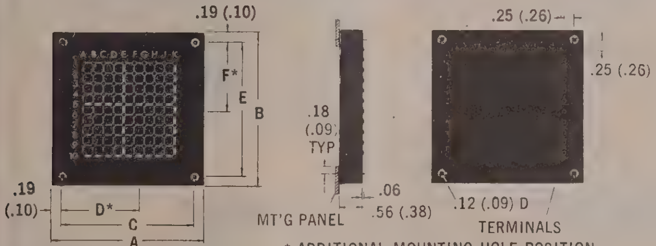
FEATURES

- Reliable closed entry contact
- Rugged programming pins that will not bind
- Rapid and convenient method of programming/switching
- Permits insertion of components into network without soldering
- Replaces costly complex switching hardware
- Attractive and compact package
- Low capacitance for high frequency applications
- Ease of visual program checking

TYPICAL APPLICATIONS

Numeric Controlled Equipment
Logic Memories
Power Distributors
Circuit/Component Test Programmers
Lighting Systems
Code Generators
Programmable Diode Matrices
Communications Distributors
Status Indicators
Data Logging
Vending Machine Control
Thermo-Couple Selectors
Batching Programmers
Function Generators
Sequence Programmers
Pulse Code Programmers

STANDARD SPECIFICATIONS & STOCK MATRICES FOR 1000 & 2000 SERIES



* ADDITIONAL MOUNTING HOLE POSITION

Matrix Size	Dash #	2000 Series — .250" Grid						1000 Series — .130" Grid					
		A	B	C	D	E	F	A	B	C	D	E	F
10 x 10	—1	3.69	3.69	3.25	—	3.25	—	2.02	2.02	1.82	—	1.82	—
10 x 15	—2	3.69	4.94	3.25	—	4.50	—	2.02	2.67	1.82	—	2.47	—
10 x 20	—3	3.69	6.19	3.25	—	5.75	2.75	2.02	3.32	1.82	—	3.12	—
10 x 25	—4	3.69	7.44	3.25	—	7.00	3.50	2.02	3.97	1.82	—	3.77	1.82
10 x 50	—5	3.69	13.69	3.25	—	13.25	4.50	2.02	7.22	1.82	—	7.02	3.51
20 x 20	—8	6.19	6.19	5.75	2.75	5.75	2.75	3.32	3.32	3.12	—	3.12	—
25 x 25	—9	7.44	7.44	7.00	3.50	7.00	3.50	3.97	3.97	3.77	1.82	3.77	1.82
50 x 50	—10	14.44	14.19	14.0	7.00	13.75	7.00	7.48	7.35	7.28	7.15	3.64	3.51

STANDARD SPECIFICATIONS

1 — Contact Type: Closed Entry
2 — Contact Material: Be-Cu, Alloy 25
3 — Contact Finish: a - .0002" Ag over Cu Flash
b - .00002" Min. Au over Ni Flash
4 — Contact Support Material: Silicone Rubber
5 — Contact Resistance: .040 Ohm, typ.
6 — Contact Capacitance: 1 uuf [2 uuf]/in. at 1 MHz, typ.
7 — Bussing: 1st (top) Deck Vertical; 2nd Deck Horizontal
8 — Breakdown Voltage: 1000 VRMS
9 — Current Rating: 5 [2] Amps standard; 10 [4] Amps available
10 — Terminals: Combination Taper Pin Socket/Solder Cup [Solder Cup]
11 — Panel Material: Black XX Grade Phenolic
12 — Panel Marking: Alpha-Numeric/Grid, White Epoxy Ink Screened

NOTE: Values in brackets [ ] are for 1000 Series if two values are given.

SPECIFYING PART NUMBERS

X000-X - X X

.130" GRID 1
.250" GRID 2
MATRIX SIZE (SEE TABLE)
S SILVER CONTACT FINISH
G GOLD CONTACT FINISH
A SCREENED FRONT PANEL
B BLANK FRONT PANEL

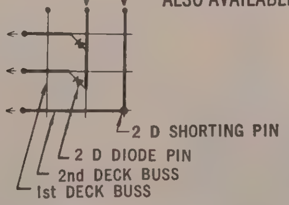
EXAMPLE: A 20 x 20, .250" grid matrix with silver contacts and blank front panel would have Part Number 2000-8-BS. U.S. Patent No. 3,631-374

Programming Pins Diode Pins 1000 Series (.13" Grid)	Specifications Diode	 Anode To†
1020S-CS0001/-CS0002	1N4151	Tip/Sleeve
1020G-CS0003/-CS0004	1N4151	Tip/Sleeve
2000 Series (.25" Grid)	†On Std.Matrices Tip makes W/2nd Deck.	
2020S-CS0006/CS0007	1N270	Tip/Sleeve
2020S-CS0010/CS0011	1N4151	Tip/Sleeve
2020G-CS0012/CS0025	1N4151	Sleeve/Tip
2020S-CS0014/CS0024	1N4004	Sleeve/Tip
Shorting Pins 1010G & 2010GA		

† Sold in multiples of 25 pieces.

SCHEMATIC

2 DECK MATRIX (3, 4, 6 & 8 DECK ALSO AVAILABLE)



PROGRAMMING PINS

2 D SHORTING PIN

.13 GRID: #1010G
.25 GRID: #2010GA*

*2010GA has straight shank with undercut on grip end (without plastic cap).

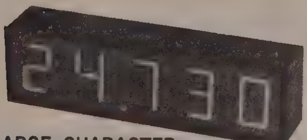
2 D DIODE PIN

X020X-CSXXXX

.13" GRID 1
.25" GRID 2
SILVER S
GOLD G
DEFINES DIODE & ORIENTATION. SEE TABLE ON LEFT

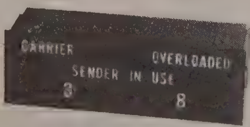
Diode orientation shown: Anode to Sleeve (1st Deck)

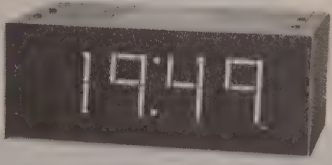
OTHER INFO-LITE PRODUCTS



LARGE CHARACTER DIGITAL DISPLAYS

MULTI-MESSAGE LIGHTED INDICATORS





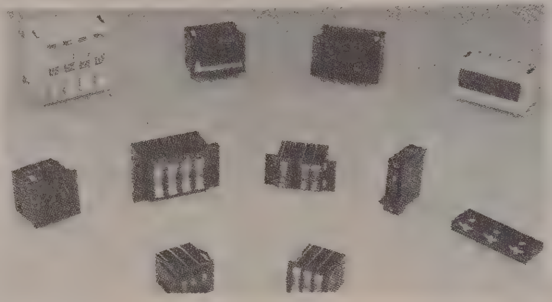
DIGITAL INSTRUMENTS & SYSTEMS

SEE OUR PAGES IN EEM SECTION 2450

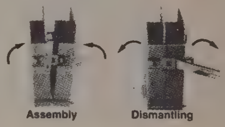
CROSSPOINT • Div. of INFO-LITE, CORP • 422 Cliff St., Fairview, NJ 07022 • (201) 941-4455 • FAX (201) 941-4919 • "LINKS BETWEEN MAN AND MACHINE"

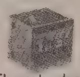
Crouzet® Digital Switches

Thumbwheel, Rocker, Push Button, L.E.D. Readouts

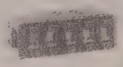


Crouzet Digital Switches, including thumbwheel, rocker, pushbutton models, and LED readouts are highly regarded in our customer community for aesthetics and ease of assembly (no hardware required). A variety of colors, options and accessories has made this line popular with the medical equipment and instrumentation industries. For more complete information, please request our Digital Switch catalog.



	P/N	Height	Width	Voltage (V)	Current (mA)
 Thumbwheel	84210	1.30 in.	.31 in.	.1 to 50 V	.1 to 100 mA

	P/N	Height	Width	Voltage (V)	Current (mA)
Rocker	84211	1.30 in.	.39 in.	.1 to 50 V	.1 to 100 mA
	84212	2.28 in.	.49 in.		
	84213(x)	1.30 in.	.39 in.		
	84214	.95 in.	.30 in.		
	84218(x)	.94 in.	.30 in.		

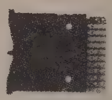
	P/N	Height	Width	Voltage (V)	Current (mA)
 Pushbutton	84230	.94 in.	.30 in.	1 to 50 V	1 to 50 mA
	84231	.59 in.	.30 in.		

	P/N	Height	Width	Voltage (V)	Decoder	
					C-MOS	TTL
LED Readout	84215	1.30 in.	.63 in.	5/12/ 15/24V	Yes	Yes
	84216	1.30 in.	.31 in.	5V	No	Yes
	84217	1.30 in.	.39 in.	5/12/ 15/24V	Yes	No

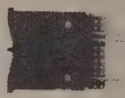
(x) = rear mount

Terminals

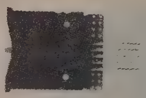
S
Direct
Soldering



X3
Pins for
P.C. board
soldering

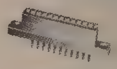


X2
Pins for
Wire Wrapping



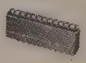
Accessories and Optional Features

W2
Solder
Terminals



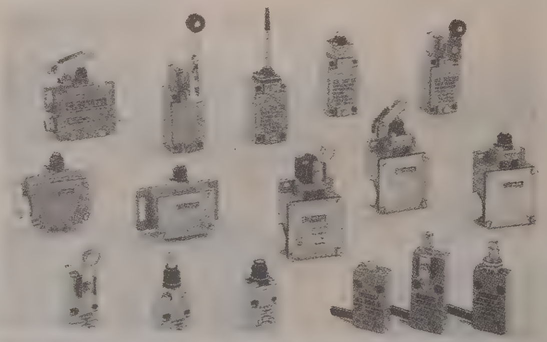
X2
Wire-Wrap
Terminals

X3
P.C. Board
Terminals



Connectors shown available for 84210, 84211, 84212, and 84213. Spacers, end caps, and various wheel and case colors available for most parts.

Limit Switches



Crouzet manufactures a wide range of limit switches. Most notable is our Sealed Miniature Limit Switch line, which includes the following features:

- wide variety of actuators
- completely sealed
- oil tight
- immersion proof (3 ft.)
- rugged metal housing

In addition, these miniature limit switches come complete with 6 ft. pre-wired cable and are rated at 6 amp 250 VAC. Most versions are available from stock.

Crouzet® ***Motors-Switches-Timers-Counters-Pneumatic Controls***

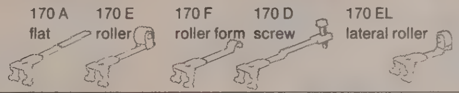
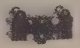
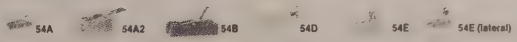
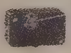
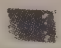
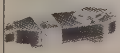
Crouzet Corporation 3237 Commander Dr., Carrollton, TX 75006-2506 • Tel: 214-250-1647 • 1-800-677-5311 • Fax: 214-250-3865

Crouzet® Snap Action Switches

Miniature and Sub-Miniature

Snap-Action Switches

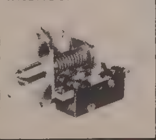
Crouzet's line of snap-action switches includes standard miniature and sub-miniature switches, double-break, waterproof, splashproof, and other "specialty" switches. Most switch types are available from stock in substantial quantities. For complete information, please request our Snap-Action Switch catalog.

Presentation	Type	Rating	Movement Differential in. (mm.)	Operating Force oz. (gms.)	Actuators
1.09×.40×.62 (27.8×10.2×15.8)	83161.___	1 to 15.1A 250 VAC	.01 (.35)	.9 to 10 (25.2 to 300)	161V 161A 161A 161E 161E 161L
.78×.25×.38 (19.8×6.4×9.6)	83170.___	.1 to 10A 250VAC	.006 (.15)	1.8 to 5.3 (50 to 150)	 170 A flat 170 E roller 170 F roller form 170 D screw 170 EL lateral roller
 1.17×.65×.71 (29.6×16.4×18)	83 101.0 83 103.0 83 106.0 83 109.0 83 112.0	10 A 250 V AC (5A-UL rating)	.019±.008 (0.5±0.2)	14.4 (400)	A B B8 D F Lever P1 G Q V V2 V3 V4
1.09×.39×.62) (27.8×10×15.8)	83 153.7 83 160.___	6 to 15 A 250 V AC	.011 to .027 (0.3 to 0.7)	3.5 to 17.9 (100 to 500)	153A 153B 153E 153
.80×.25×.39 (20.4×6.4×10)	83 132.0 83 133.0 83 134.0	5 A 250 V AC	.013±.004 (.35±0.1)	5.6 (160)	 54A 54A2 54B 54D 54E 54E (lateral)
 1.09×.39×.72 (27.8×10×18.3)	83 137.0	5 A 250 V AC	10°±4°	.17 (12)	
 .94×.34×1.26 (24×8.8×32)	83 139.0	5 A 250 V AC	.013±.004 (.35±.1)	8.99 (250)	
 1.97×1.54×.45 (50×39×11.4)	83 123.0 83 731.3 83 732.3 83 733.3	5 A 250 V AC	.004 to .008 (.1 to .2)	19.06 to 53.9 (530 to 1500)	

Special Application Switches

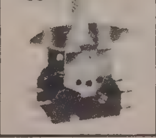
A variety of "specialty" switches are available for applications requiring quality and precision, including the Interlock, Push-button, Toggle and Keylock models shown.

Interlock

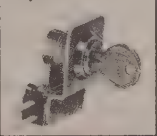


Push-button

Toggle



Keylock



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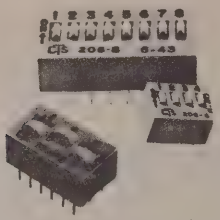
CTS® CORPORATION DIP SWITCHES

ELECTROCOMPONENTS, ELKHART, IN.

CTS SERIES 206

CTS DIP PROGRAMMABLE SWITCHES



FEATURES

- Contact wiping on make and break
- Suitable for flow soldering on PC board or mounting with standard DIP sockets
- Long term contact corrosion resistance provided by gold plated contact arms
- All U.L. 94V-O plastic used
- Integral terminal and contact locked into plastic base rails
- Crisp, positive slide actuators
- Available with flush (low profile) actuators—SPST styles

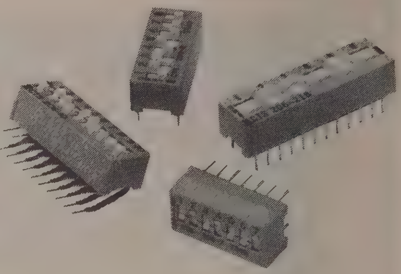
Description
From 2 thru 10 and 12 SPST; 1 thru 6 SPDT; 1 thru 6 DPST; 1, 2, or 3 DPDT and 1, 2 or 3 4PST slide switches per switch package on .100" DIP centers

Initial Contact Resistance
50 milliohms

Maximum Contact Resistance
100 milliohms after 10,000 cycles switching 800 mA @ 24 VDC

Maximum Non-Switching Rating
Maximum Rise of 30° C @ 5A

Insulation Resistance
Across open switch and between adjacent closed switches: 1×10^9 ohms



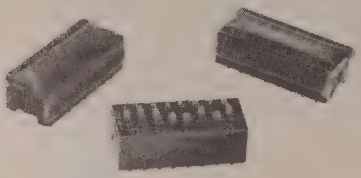
RA's available for all 206 series versions.

Dielectric Breakdown
Between adjacent switches minimum: 500 VDC

Switch Capacitance
Between adjacent switches maximum: 5.0 pF

CTS SERIES 208

CTS DIP PROGRAMMABLE SWITCHES



FEATURES

- Contact wiping on make and break
- Suitable for flow soldering on PC board or mounting with standard DIP sockets
- Economical version with non gold contacts
- All U.L. 94 V-O plastics used
- Integral terminal and contact locked into plastic base rails
- Crisp, positive slide actuators

Description
From 2 thru 10 and 12 SPST switch package on .100″ × .300″ DIP centers-SPST Styles

Initial Contact Resistance
100 milliohms

Maximum Contact Resistance
500 milliohms after 2000 cycles switching 50 mA @ 15 VDC

Maximum Non-Switching Rating
100 mA or 50 VDC

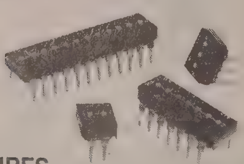
Insulation Resistance
Across open switch and between adjacent closed switches: 1×10^9 ohms

Dielectric Breakdown
Between adjacent switches minimum: 500 VDC

Switch Capacitance
Between adjacent switches maximum: 5.0 pF

CTS SERIES 209 AUTO-DIP™ SWITCH

AUTOMATICALLY INSERTABLE, WAVE SOLDERABLE, BOARD WASHABLE DIP SWITCH



FEATURES

Optimized Contact System

- Redundant, wiping contacts
- Contactor does not deflect during actuation

Optimized Mechanical Features

- Fully sealed to withstand insertion shock, wave solder temperatures, board washing
- Positive detent separate from contactor
- Closed windows prevent particle contamination
- .027" actuator travel
- Molded .300″ integrated circuit package outline

Premium Materials

- Gold contacts, solder coated terminals
- Beryllium copper contactor
- 260°C housing heat deflection temperature assures contact and seal integrity after wave soldering
- All plastics rated U.L. 94 V-O

ELECTRICAL AND MECHANICAL SPECIFICATIONS

Contact Resistance
25 milliohms maximum initial
50 milliohms maximum at end of life

Actuation Life
2000 cycles switching
100 mA @ 20 VDC or .1 mA @ 5 VDC

Nonswitching Rating
100 mA or 50 VDC

Insulation Resistance
$1 \times 10^9 \Omega$ minimum between insulation terminals

Dielectric Strength
500 VAC minimum

Switch Capacitance
5 pF maximum between adjacent closed switches

Temperature Range
-20 to 85° C operation – 40 to 85° C storage

Allowable Wave Solder Time
Up to 4 seconds with 260°C solder

Shock
Per MIL-STD-202F, method 213B, condition A 50 G's with no contact inconsistencies greater than 1 microsecond

Vibration
Per MIL-STD-202F, method 204D, condition B (.06" or 15 G's between 10Hz to 2 KHz) with no contact inconsistencies greater than 1 microsecond

CTS CORPORATION, ELECTROCOMPONENTS • 1142 Beardsley Avenue, Elkhart, Indiana 46514 • 219-295-3575 • FAX: 219-295-3580

CTS® CORPORATION DIP SWITCHES

ELECTROCOMPONENTS, ELKHART, IN.

CTS SERIES 194

CTS DIP SWITCHES

FEATURES

- Electrical switching occurs at 50% of actuator rotation angle
- Contact wiping on make and break
- Enclosed actuators shield contacts from foreign particles throughout life of switch
- The gold plated, over-center design provides positive detent action
- Reliable tape top seal optional/ bottom epoxy seal standard
- Insert molded base halves of thermoset material ensure mechanical integrity of contacts and terminals through soldering operations
- All U.L. 94 V-O plastics used

Description

Side actuated 2 thru 10 and 12 section SPST switching functions per package on .100″ × .300″ DIP centers

Initial Contact Resistance

50 milliohms maximum

Insulation Resistance

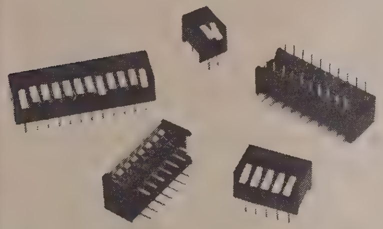
Across open switch and between adjacent closed switches: 1 × 10^9 ohms minimum

Maximum Contact Resistance

100 milliohms after 7000 cycles switching 50 mA @ 24 VDC

CTS SERIES 195

CTS DIP SWITCHES



FEATURES

- Electrical switching occurs at 50% of actuator rotation angle
- Contact wiping on make and break
- Enclosed actuators shield contacts from foreign particles throughout life of switch
- Economical version with non gold contacts over-center design provides positive detent action
- Reliable tape top seal optional/ bottom epoxy seal standard
- Insert molded base halves of thermoset material ensure mechanical integrity of contacts and terminals through soldering operations
- All U.L. 94 V-O plastics used

Description

Side actuated 2 thru 10 and 12 section SPST switching functions per package on .100″ × .300″ DIP centers

Initial Contact Resistance

100 milliohms maximum

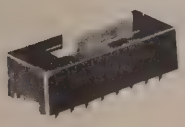
Insulation Resistance

Across open switch and between adjacent closed switches: 1 × 10^9 ohms minimum

Maximum Contact Resistance

500 milliohms after 2000 cycles switching 50 mA @ 24 VDC

CTS SERIES 197



FEATURES

- Integral terminal and contact locked into thermoset base rails
- Contact wiping on make and break
- Break before make contacts
- Useful in "service/operate" applications, low level signal routing, digital circuit programming, etc.
- Long term contact corrosion provided by gold plated/inlaid contacts
- All U.L. 94 V-O plastics used

Description

4PDT slide actuated switch package on .100″ × .300″ DIP centers

Initial Contact Resistance

50 milliohms maximum

Maximum Contact Resistance

100 milliohms after 2000 cycles switching 50 mA @ 24 VDC

Insulation Resistance

Across open switch and between adjacent closed switches: 1 × 10^9 ohms minimum

Dielectric Breakdown

Between adjacent switches minimum: 500 VDC

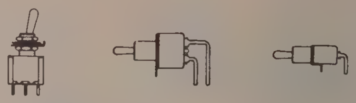
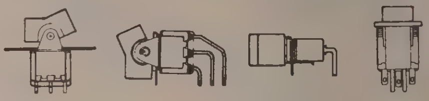
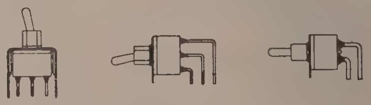
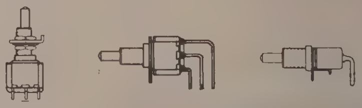
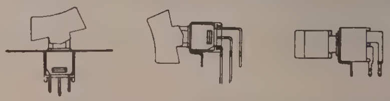
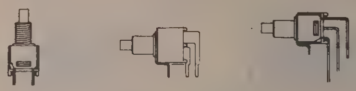
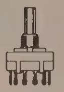
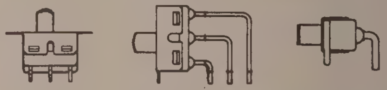
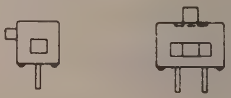
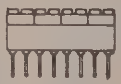
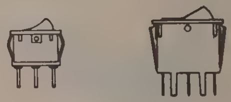
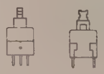
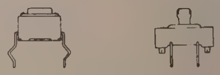
Switch Capacitance

Between adjacent switches maximum: 5.0 pF

YOUR SOURCE FOR SWITCHES

A Full Range of Standard, Minature, and Sub-Minature Models

WE HAVE THEM ALL-IT'S THE CUI STACK DIFFERENCE

Miniature Toggle and PC Mount Toggle	Contact Rating: 5A with resistive load @ 120VAC or 28VDC. Electrical Life: 50,000 Make-and Break cycles at full load. Contact Resistance: 10mΩ max. initial @ 2-4VDC, 100mA for both coin silver and gold plated contacts.	
Miniature Rocker and Paddle & PC Mounted Rocker and Paddle	Contact Rating: 5A with resistive load @ 120VAC or 28VDC. Electrical Life: 50,000 Make-and Break cycles at full load. Contact Resistance: 10mΩ max. initial @ 2-4VDC, 100mA for both coin silver and gold plated contacts.	
Sealed Toggle Switches	Contact Rating: 0.4VA max. @ 20VAC or 20VDC max. Electrical Life: 40,000 Make-and Break cycles at full load. Contact Resistance: Below 10mΩ typical initial @ 2-4VDC, 100mA for both coin silver and gold plated contacts.	
Snap-Acting Pushbutton Switches	Contact Rating: Q power model—1A with resistive load @ 120VAC or 28VDC. R DRY CKT models 0.4 max. @ 20VDC max. Electrical Life: 50,000 Make-and Break cycles at full load. Contact Resistance: 10mμ max. initial @ 2-4VDC.	
Sub-Miniature Rocker Switches	Contact Rating: 3A with resistive load @ 120VAC or 28VDC. Electrical Life: 30,000 Make-and Break cycles at full load. Contact Resistance: 20mΩ max. initial @ 2-4VDC, 100mA for both coin silver and gold plated contacts.	
Sub-Miniature Pushbutton Switches	Contact Rating: 1A with resistive load @ 120VAC or 28VDC. Electrical Life: 60,000 Make-and Break cycles at full load. Contact Resistance: 20mΩ max. initial @ 2-4VDC, 100mA for both coin silver and gold plated contacts.	
Rotary Switches	Contact Rating: 350mA @ 110 Volts (AC or DC), 150mA @ 250V (AC or DC). Electrical Life: 15,000 cycles at full load up to 30,000 detent operations. Contact Resistance: 20mΩ max. initial. Current Carrying Capacity: 5A continuous.	
Slide Switches	Contact Rating: 6A with resistive load @ 120VAC or 28VDC. 2A with resistive load @ 250VAC. Electrical Life: 30,000 cycles at full load. Contact Resistance: 10mΩ max. initial.	
Miniature Slide Switches for PC Board	Contact Rating: Silver contacts 2A 250V, gold contacts: 100mA 30V-with resistive load. Mechanical Life: Silver 20,000 operations, gold/brass 20,000 operations.	
DIP	2 to 12 poles available. Electrical Life: 5,000 Make-and-Break cycles per Pole. Dielectric: 500VDC min. between adjacent terminals	
Power Rocker Switches	Contact Rating: 10A @ 250VAC, 16A @ 125VAC Electrical Life: 20,000 Make-and-Break cycles at full load. Contact Resistance: 50mΩ.	
Push Button Key Switches	Contact Rating: 25mA max. @ 50VAC or 50VDC max. Mechanical Life: 100,000 cycles. Contact Resistance: 20mΩ typical initial @ 2-4VDC, 100mA	
Tact Switches	Contact Rating: 0.5A @ 12VDC. Mechanical Endurance: 100,000 cycles @ 10 cycles per minute. Contact Resistance: 100mΩ @ 1A, 2-4VDC	

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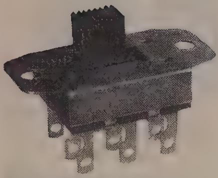
Custom designs. Custom performance. Countless combinations. From America's largest slide switch manufacturer.

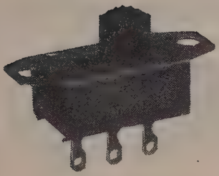
Switches

DISCOVER CW



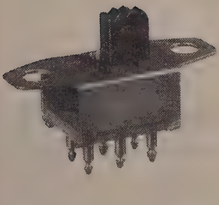
STANDARD SLIDE SWITCHES (Catalog S2120-II)

- DPDT body size .880" x .550" x .310"
- One thru four poles
- Two thru four positions
- For switching up to 13A - 125V AC
- Top, side, front, or rocker actuation
- Panel or PC board mount
- U.L. recognized, C.S.A. listed
- Solder, solderless PC board or wire wrap termination



MINIATURE SLIDE SWITCHES (Catalog S2120-III)

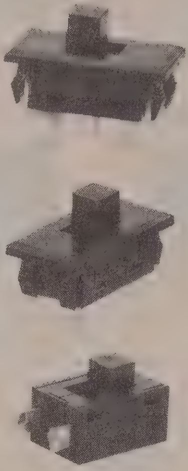
- DPDT body size .628" x .400" x .285"
- One thru four poles
- Two thru five positions
- For switching up to 8.5A - 125V AC
- Top, side, end, or toggle actuation
- Panel, PC board, or bushing mount
- U.L. recognized, C.S.A. listed
- Solder, solderless, or wire wrap termination



MICROMINIATURE SLIDE SWITCHES (Catalog S2120-IV)

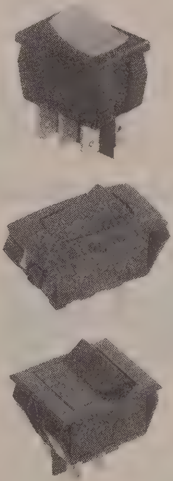
- SPDT body size .380" x .220" x .200"
- DPDT body size .380" x .312" x .228"
- One and two pole
- Two and three positions
- For switching up to .5A AC/DC - 125V
- Top or side actuation
- U.L. recognized, C.S.A. listed
- Solder or PC board termination

See volume C, page **C•1304** for our Connector products



MICROMINIATURE SWITCHES FULLY ENCLOSED (Catalog S2120-V)

- SPST body size .505" x .305" x .255"
- Single pole
- Two position
- For switching up to .5A AC/DC - 125V
- Mounting options - PC board or panel
- Solderless, solder, or PC termination
- Contacts protected



PLASTIC ENCLOSED POWER SWITCHES (Catalog S2121)

- Body size: .745" x .500" x .460" or
  1.120" x .547" x .632" or
  1.060" x .866" x . 582"
- One or two poles
- Two or three positions
- For switching up to 16A - 250V; 3/4 HP 250V; 10A 14V (T)
- Rocker, slide, paddle actuation
- U.L., C.S.A., VDE recognized/listed
- Solderless or solder termination
- Mount in .756 " x .508" or 1.125" x .550" or 1.071" x .872" panel cutout

Standard & Custom Switches Available

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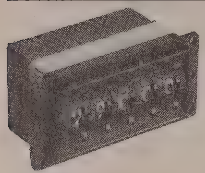
PRESENTING THE LONGEST-RUNNING SERIES IN THE BUSINESS

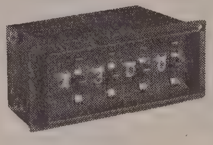
Innovative, Quality-Engineered Thumbwheel Switches Available Off-The-Shelf At Unbeatable Prices.



29000 SERIES
ECONOMY MINISWITCH

An economical miniswitch for high package density. Extra large in-line character readout. Width, .350" (8.9) and cutout height 1.020" (25.9)

- 10, 12 or 16 Dial Positions
- Many Output Codes and Configurations
- Message Units for Longer Legends
- Optional Dial Stops to Limit Rotation
- Rear-Mounted



43000/44000/45000 SERIES
MINISWITCH

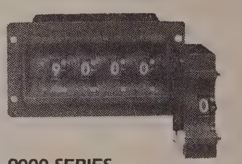
These low cost switches feature optional LED lighting and snap-together assembly. Field installable stops to limit dial rotation. Printed circuit boards with solder or pin terminations.

- Available in Most Popular Codes
- 10 Dial Positions
- .200" High, Up-Front Dial Characters
- 43000 — 500"(12.7)W x .980"(24.89)H
- 44000 — .315"(8.0)W x 1.220"(31.0)H
- 45000 — .315"(8.0)W x .961"(24.4)H

300/13000 SERIES
GENERAL PURPOSE DIGISWITCH

One of the most widely used thumbwheel switches, with more available options, output codes and special termination features than any other switch.

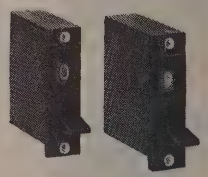
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Easy to Replace MIL-Spec Lighting
- Message Units for Longer Legends
- 13000 is Front-Mounted Version
- 300 — .500"(12.7)W x 1.380"(35.05)H
- 13000 — .500"(12.7)W x 2.00"(50.8)H



9000 SERIES
DIGISWITCH

The 9000 offers more available options, output codes and special termination features than any other fully-sealed MIL-spec switch. Rear-mounted, qualified to MIL-S-22710/12.

- 8, 10, 12, or 16 Dial Positions
- RFI Shielding Available
- Optional Replaceable MIL-Spec Lighting
- Dial Stops to Limit Dial Rotation
- Dimensions — .600"(15.24)W x 1.375"(34.93)H



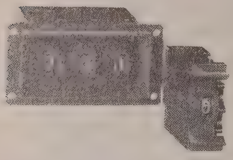
24000/28000 SERIES
LEVER SWITCH

24000: Bi-directional front panel sealed switch built to perform in any hostile environment qualified to MIL-S-22710/24.

- Optional, Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 24000 — .480"(12.19)W x 1.175"(29.84)H

28000: Minilever commercial switch that can be actuated in either direction.

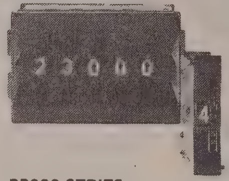
- "Upper" or "Lower" Window Location
- 90° Full Lever Travel
- 10 and 12 Dial Positions
- 28000 — .500"(12.7)W x .980"(24.89)H



200/700/8000 SERIES
MINISWITCH

Small switches for hostile environments, virtually impervious to sand, dust, oils, high humidity, salt spray and explosive atmospheres. Series 200 has potted wire leads, 700 — P.C.B. both qualified to MIL-S-22710/15 and /20

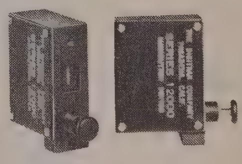
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Optional, replaceable MIL-Spec Lighting
- 8000: Commercial Version
- Dimensions 500"(12.7)W x .980"(24.89)H



23000 SERIES
"SNAP-IN" SLIMSWITCH

For applications where maximum panel density, good reliability and error-proof positive setting action are required. Switch width only .315" with cutout height of 1.221."

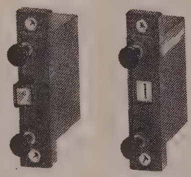
- 10 Dial Positions
- Snap-in, Front Mount—No Tools Required
- Large (.170" High) In-Line Characters



12000/53000 SERIES
MINIBUTTON

Reliable, contamination-proof switches for applications requiring panel sealing per MIL-S-22710. No supplemental panel cover or boot is required for sealing.

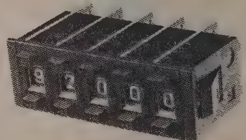
- Individually Mounted Switches
- Glass Window that Seals Switch Interior
- Metal Case — Facilitates R.F.I. Shielding
- Optional Replaceable MIL-Spec Lighting
- 12000 Series: Qualified to MIL-S-22710/17
- 12000 — .500"(12.7)W x .83"(21.08)H
- 53000 — .350"(8.89)W x 1.020"(25.91)H



63000/64000 SERIES
BI-DIRECTIONAL MINIBUTTON

Two-button bi-directional switches designed to meet all performance requirements of MIL-S-22710. Rear-mounted, panel sealed.

- 63000 — 8, 10, 12 Dial Positions
- 64000 — 16 Dial Positions
- Metal Case — No RFI Shielding Required
- Optional Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 63000 — .410"(10.41)W x 1.230"(31.25)H
- 64000 — .460"(11.68)W x 1.312"(33.53)H



92000/93000/62000 SERIES
DOUBLE PUSHBUTTON

These commercial switches are designed for applications where speed and ease of settings are important.

- Snap-together Assembly
- L.E.D. Lighting Available (92000)
- Low Cost, High Quality, High Reliability
- 10 and 16 Dial Positions Available
- Dial Stops to Limit Dial Rotation
- 92000 — .300"(7.62)W x .551"(14.2)H
- 93000 — .300"(7.62)W x .886"(22.5)H
- 62000 — .315"(8.00)W x .945"(24)H

NOTE: Numerals in brackets indicate millimeter equivalents.

More military and commercial thumbwheels and greater code selection than anybody else. And it's all under one roof to maintain the very highest standards of product quality and delivery.

Let Digitran integrate your digital switches into your subassembly. Contact Digitran's Subsystems Engineering and Manufacturing Services Center at (714) 391-4321. Also see our keyboards (5150) and monitors (2450).

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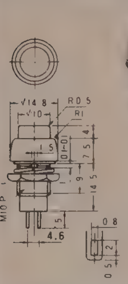
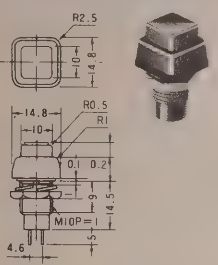
PUSH ROCKER • TOGGLE SLIDE SWITCHES (Operating Life 100,000 Cycles)

P-SERIES

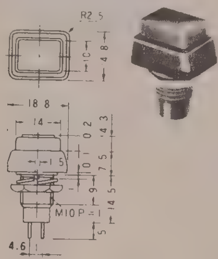
DS-450 (ALTERNATE)
DS-463 (MOMENTARY)



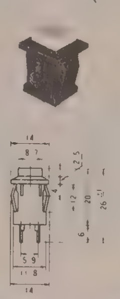
DS-453 (ALTERNATE)
DS-466 (MOMENTARY)



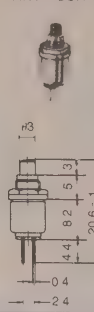
DS-458 (ALTERNATE)
DS-471 (MOMENTARY)



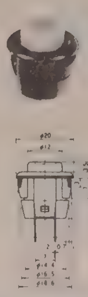
DS-430 PUSH-(ON)
DS-431 PUSH-(OFF)



MS-402
TINY PUSH-ON

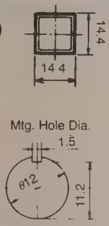


DS-412



ILLUMINATED SWITCHES. Long Life (Electrical 50,000 Operations, Mechanical 100,000 Operations.)

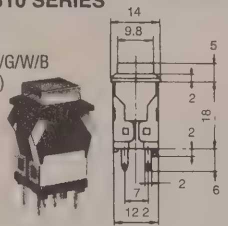
DS-700 (ALTERNATE
DS-710 (MOMENTARY)



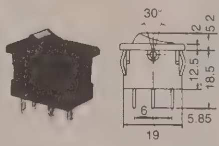
LED
FILAMENT LAMP

MS-800, 810 SERIES

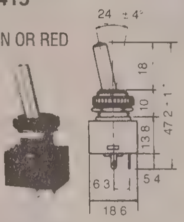
LED; R/Y/G
F. LAMP; R/Y/G/W/B
(6V, 12V, 28V)



DS-850
SNAP-IN ROCKER
W/LED
FRAM: BLK, WHT or GRAY

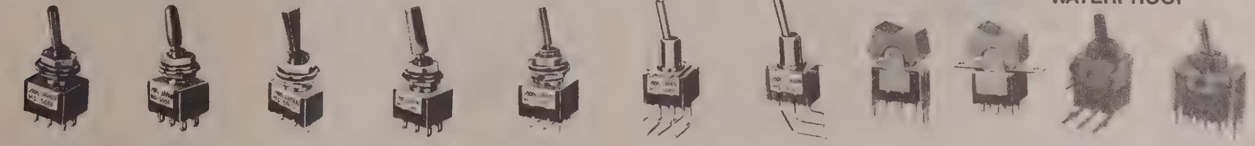


DS-415
LED
GREEN OR RED
2P



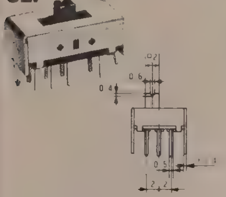
MS-500 SERIES—TOGGLE

6P DPDT BODY 10mm
3P SPDT KNOB 5mm
WATERPROOF

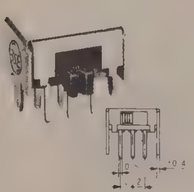


SLIDE SWITCHES

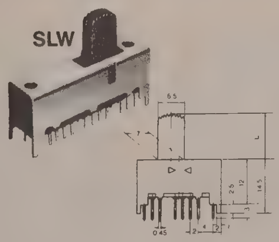
SLV



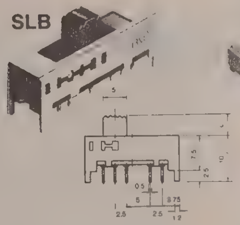
SLH



SLW

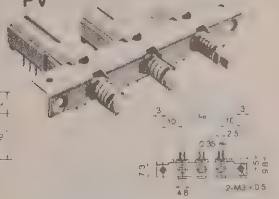


SLB



PUSH SWITCHES

PV



Part No.	DS-700 (alt) DS-710 (mom)	MS-200	MS-800 (alt/mom) MS-810 (alt/mom)	DS-850	DS-415 DS-417	DS-412	MS-402	DS-430 DS-431	P-Series DS-450	MS 500 TOGGLE	Slide Switches
Model Type	Illuminated Push Button Switches LED (Red, Green, Yellow) Filmt Lamp (6V, 12V, 28V) R/G/Y/W/B Available also W/O Lamp or LED			Rocker LED Color: Red, Yellow Green	Toggle LED/red, green	Push-button Round	Push-button	Push-button	Push-button	—	Available in vary size, pole position
Rating	1A 250V AC 3A 125V AC	0.4VA (20mV-28V) 0.1mA-0.1A	0.1A 30V DC	3A 250VAC 5A 125VAC	3A 125VAC	1A 125VAC 0.5A 250V	0.5A 125V AC	1A 125VAC 0.5A 250V	3A 125VAC 1A 250VAC	6A 125V AC	DC30V 0.03A DD12V 30.1A
Circuit	SPDT DPDT	A3PSPDT on-off B3PSPDT on-(on) C3PSPDT on-off-on D3PSPDT on-off-(on) E3PSPDT (on)-off-(on) F6PDPDT on-on G6PDPDT on-(on) H6PDPDT on-off-on I6PDPDT on-off-(on) J6PDPDT (on)-off-(on)	A DPST off-on B DPST off-(on) C DPST on-off D DPST on-(off) E SPDT on-on F F SPDT on-(on)	2P SPST	2P (SPST) on-off 3P (SPDT) on-on	2P (SPST) DS-412 Push-(on) Color: R/W	2P (SPST)	2P (SPST) DS-430 Push-(on) DS-431 Push-(off) Color: R/B/W	2P (SPST) DS-450-462 on-off DS-463-475 Push-(0n) R/W/B/Slvr	3P (SPDT) 6P (DPDT)	many type of Slide Switches are available PLS Call
Switching Function	on-on ALTN on-(on) MOM			on-off			Push-(on) Momentary			on-on on-(on) on-off-on on-off-(on) (on)-off-(on)	
Contact Resistance	2.5VDC 1A 10mΩ max.	1mA, 0.1µW 50mΩ max.	2.5VDC 10mA 50mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 10Ω max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 10mΩ max.	2.5VDC 1A 20mΩ max.	200mΩ max.	DC5V. 1A 20mΩ max.
Insulation Resistance	DC.500V 100mΩ min.	DC.500V 1000mΩ min.	DC.500V 500mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.	DC.500V 100mΩ min.
Voltage Breakdown	AC 1500V 1 minute	AC 500V 50/60Hz 1 min.	AC 500V 1 minute	AC .1000V 1 minute	AC .1000V 1 minute	AC 1500V 1 minute	AC 1000V 1 minute	AC 1500V 1 minute	AC 1500V 1 minute	AC 1000V min.	AC 500V 1 minute
Mounting Hole Dia. mm	12		12.6 square	13`x 9	12	17.8 dia.	5.2 dia.	12.4 x 11.2	All Model 10.2 dia.	6.2	vary size

DSC offers a complete line of switches including Slide, Multi-Push, Subminiature, Lever, Rocker, Toggle and Illuminated Types. For Complete information on our Wide Range of Products Please Contact:
For more information please call: 212-691-9050

SEE DSA CONNECTORS IN EEM VOLUME C PAGE 1309

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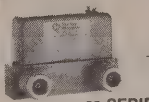
CORPORATION

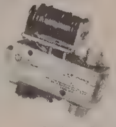
RF SWITCHES

60 SERIES

260 SERIES


63 SERIES

66 SERIES

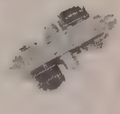

77 SERIES

54 SERIES

164 SERIES

78 SERIES

116 SERIES


167 SERIES

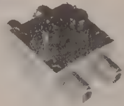
169 SERIES

DOW-KEY SERIES NO.	CONTACT ARRANGEMENT	CONNECTOR OPTIONS	IMPEDANCE (OHMS)	FREQUENCY (MAX)	INSERTION LOSS (dB TYP OPERATING)	ISOLATION (dB TYP OPERATING)	POWER RATING (CW) AT 100 MHz	POWER RATING (CW) AT MAX FREQ.
60	SPDT	BNC N UHF C	50	2000 MHz	0.1	50	1000W	200W
260 260 B	DPDT BYPASS	BNC N UHF	50	2000 MHz	0.1	50	1000W	200W
63 64	SPDT TRANSFER	N	50	3000 MHz	0.1	50 30	150W	25W
66	SPDT	F	75	1000 MHz	0.1	70	100W	20W
77	SPDT	F BNC	75 50	1000 MHz	0.1	40	100W	20W
54/55/56/62	SPDT	BNC TNC	50	2000 MHz	0.1	70	100W	50W
46 164	DPDT SPDT	BNC	50	1000 MHz	0.1	50	125W	50W
78	MULTI-THROW MANUAL	BNC UHF	50	1000 MHz	0.1	50	1000W	200W
116	SP4T	BNC	50	2000 MHz	0.1	50	200W	50W
167	TRANSFER	N UHF	50	1000 MHz	0.1	40	1000W	100W
169	SPDT	BNC	50	1000 MHz	0.1	50	100W	20W

HIGH POWER SWITCHES

310 SERIES

312 SERIES


313 SERIES

DOW-KEY SERIES NO.	CONTACT ARRANGEMENT	CONNECTOR OPTIONS	IMPEDANCE (OHMS)	FREQUENCY (MAX)	INSERTION LOSS (dB TYP OPERATING)	ISOLATION (dB TYP OPERATING)	POWER RATING (CW) AT 100 MHz	POWER RATING (CW) AT MAX FREQ.
310	SPDT	SC N HN	50	1000 MHz	0.1	30	2000W	500W
312	BYPASS	SC N HN	50	1000 MHz	0.1	30	2000W	500W
313	TRANSFER	SC N HN	50	1000 MHz	0.1	30	2000W	500W

MICROWAVE SWITCHES

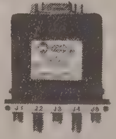
401 SERIES

403 SERIES

411 SERIES

402 SERIES

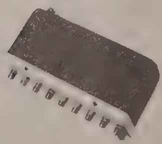
412 SERIES


421 SERIES

461 SERIES

DOW-KEY SERIES NO.	CONTACT ARRANGEMENT	CONNECTOR OPTIONS	IMPEDANCE (OHMS)	FREQUENCY (MAX)	INSERTION LOSS (dB TYP OPERATING)	ISOLATION (dB TYP OPERATING)	POWER RATING (CW) AT 100 MHz	POWER RATING (CW) AT MAX FREQ.
401 AVAILABLE IN 5 MS AND HI-REL/SPACE	SPDT	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
403	SPDT	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
411	TRANSFER	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
402	SPDT	BNC N TNC	50	12.4 GHz	.1 TO .5	70	1000W	100W
412	TRANSFER	BNC N TNC	50	12.4 GHz	.1 TO .5	70	1000W	100W
421	FIVE PORT TERMINATED	SMA	50	18.0 GHz	.1 TO .5	90	100W	10W
431 TO 481	SP3T TO SP8T	SMA	50	18.0 GHz	.2 TO .5	70	90W	30W

IN-LINE SERIES OF MULTITHROW SWITCHES


IN LINE MULTITHROW SERIES

DOW-KEY SERIES NO.	CONTACT ARRANGEMENT	CONNECTOR OPTIONS	IMPEDANCE (OHMS)	FREQUENCY (MAX)	INSERTION LOSS (dB TYP OPERATING)	ISOLATION (dB TYP OPERATING)	POWER RATING (CW) AT 100 MHz	POWER RATING (CW) AT MAX FREQ.
443	SP4T	SMA	50	18.0 GHz	0.4	60	100W	10W
473	SP7T	SMA	50	18.0 GHz	0.7	60	100W	10W
483	SP8T	SMA	50	18.0 GHz	0.8	60	100W	10W
493	SP9T	SMA	50	18.0 GHz	1.0	60	100W	10W
4A3	SP10T	SMA	50	18.0 GHz	1.0	60	100W	10W
4C3	SP12T	SMA	50	18.0 GHz	1.0	60	100W	10W

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Sensors. Hall effect. VR. Inertia.

Hall effect Magnetel© sensors for speed and position sensing. Wide operating temperatures (-40 to $+150^{C}$); wide air gap. Drop in, Bolt 'n Go. True zero speed. Power-up recognition. High data resolution. For cam and crankshaft; speed and position sensing; timing; throttle position sensing. Also general industrial controls and equipment.

Variable Reluctance Sensors. Typically used in applications where supply voltage is not available. Wide air gap; high signal output; wide temperature range (-40 to $+150^{C}$).

Inertia Sensors. Hermetically sealed. For low G-force (under 2 G's); tight tolerancing. Low contact resistance.

See postion sensing switches at right.

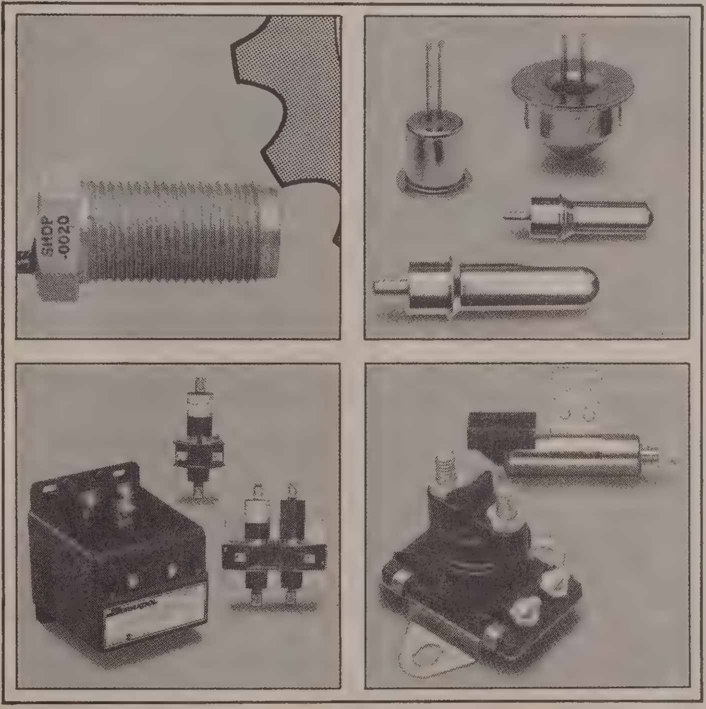
Custom Relays

Electro-mechanical. Hermetically sealed. Reliable. Ideal for hostile environments.

A first choice when continued, frequent switching would degrade mechanical device or when unusual environmental conditions or unpredictable transients are expected, or if replacement would be difficult or costly.

Applications include: resistive heating; injection molding equipment; industrial processing; oven/furnace controls; food processing; lighting and traffic controls; test/laboratory; high-voltage; capacitor discharge; motors and pumps.

Available with the following options: 1) General Purpose (UL defined) — 10-150 amps, for inductive, resistive, tungsten, and motor loads; 2) Special Purpose — 30, 35, 50 and 60 amps, for resistive or motor loads; 3) High Voltage — 10 amps, 2500 to 3500VAC; 4)Time Delay — 6-20 amps, 0.5-10 second delay.



Switches

Position-sensing. Tip 'n tilt. Tip-over. Motion. Liquid level. Specials.

Tip 'n Tilt. Electro-mechanical switches "make" when electrode is tilted below horizontal.

Tip-Over, Motion Switches: Specified by angle of liquid level. For sump pumps, waste and sewage treatment, fluid processing control panel indicators.

All switches are hermetically sealed and feature self-renewing contacts, long-life, low contact resistance, metal construction, NOT glass — virtually indestructible.

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MINIGLOSSARY
POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

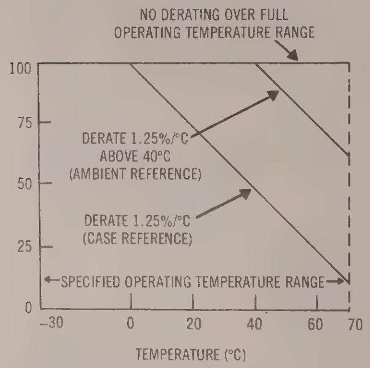

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

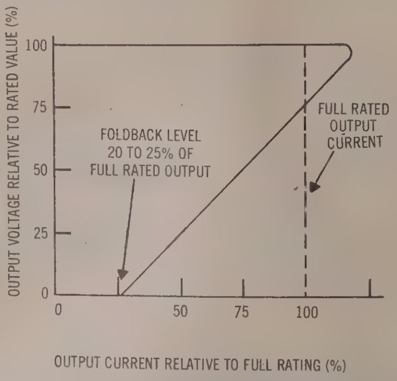

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

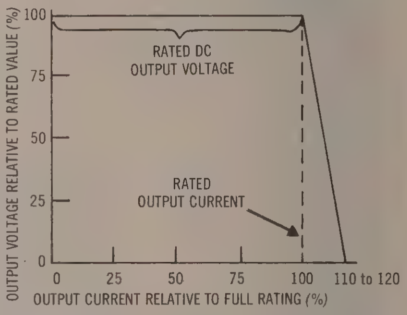

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(–) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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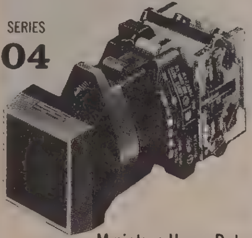
THE WORLD'S FINEST SWITCHES

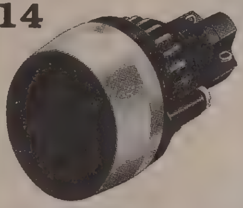
OIL, WATERTIGHT

SERIES
04



Miniature Heavy Duty
- Meet IP 65 and NEMA 4 & 13
- 7/8" Round Mounting Hole
- 12 Int'l. Approvals

SERIES
14

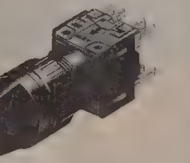


Rugged, Short Back of Panel Depth
- Meet IP 65 and NEMA 4 & 13
- 7/8" Round Mounting Hole
- 9 Int'l. Approvals

SERIES
51

Highly Stylized
- Meet IP 65 and NEMA 4 & 13
- 7 Int'l. Approvals

SERIES
52



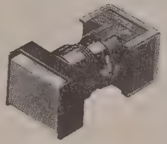
Subminiature Lighted Rotary
- Same as Series 51

SERIES
96

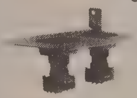
Washable Sealed Switch
- Meet IP 67 & Exceeds NEMA 4 & 13
- PCB Mountable

NEW MODULAR SYSTEM

SERIES
61



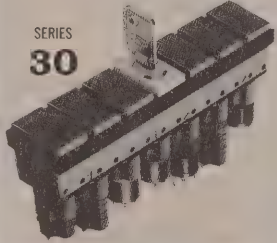
Short Back of Panel Depth
- Meet IP 65 and NEMA 4 & 13
- 5/8" Round Mounting Hole
- 4 Int'l. Approvals



With Flush Mount Panel Adapter

INTERLOCKS

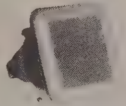
SERIES
30



Mechanical Interlocks, 2-20 Stations
- Many Interlock Systems Available
- 6 Int'l. Approvals

PCB MOUNTABLE

SERIES
92

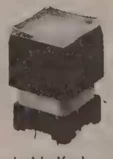


Membrane cap sealed to IP 67
- 5/8" Round Mounting Hole

SERIES
97

LED Miniatures

SERIES
99



Washable Keyboard Pushbutton
- Incandescent or LED

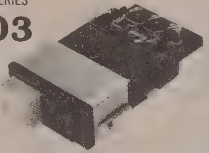
Series 96 • See Oil/Watertight

POWER SWITCHES

SERIES
02

Rugged Design for Power Applications
- Rectangular Mounting Hole
- 11 Int'l. Approvals

SERIES
03



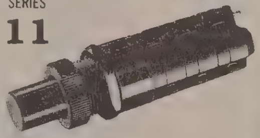
Switches and indicators
- 2 Lamps, Large Screen
- 11 Int'l. Approvals

SERIES
22

Front of Panel Mount
- Meet IP 65 and NEMA 4 & 13
- Rectangular Mounting Hole
- 8 Int'l. Approvals

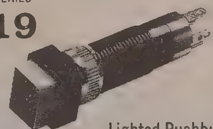
MINIATURES

SERIES
11



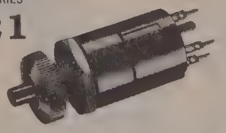
Lighted Rear Mount Pushbutton
- 9 Int'l. Approvals

SERIES
19



Lighted Pushbutton
- 3/8" Round Mounting Hole
- Round or Square Bezel

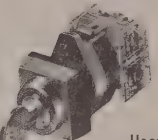
SERIES
21



Unlighted Rear Mount Pushbutton

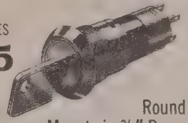
KEYLOCKS

SERIES
04



Heavy Duty
- Sames as Series 04 Oil/Watertight
- 2 & 3 Position

SERIES
15



Round Front
- Mounts in 3/4" Round Hole
- 5 Int'l. Approvals

SERIES
31/51

Miniature Keylock
- Round, Square or Rectangular Bezel
- Mounts in 5/8" Round Hole

KEYLOCKS ALSO AVAILABLE IN SERIES 02, 03, 22, 32, 61, 99

GENERAL PURPOSE

SERIES
01

Lighted Pushbutton • Round, Square & Rectangular Bezel
- 12 Int'l. Approvals

SERIES
31

Short Back of Panel Depth
- Available with Buzzers, Flashers, Fuse Switch and Readouts

SERIES
41

Two Lamp Lighted Pushbutton & Indicator
- Rectangular Mounting Hole
- 10 Int'l. Approvals

YOU CAN FEEL THE DIFFERENCE!

eao

EAO SWITCH CORPORATION
P.O. BOX 552
MILFORD, CT [illegible]
TELEX: [illegible]
FAX: [illegible]
TELEPHONE: (203) 877-4577

electro-mech
LIGHTED PUSH-BUTTON SWITCHES

DISPLAY ASSEMBLIES/ INTERLOCK SWITCH ASSEMBLIES/INDICATORS

ELECTRO-MECH provides a perfect blend of quality standard products with in-depth experience in answering unique requirements. Proven engineering designs are illustrated by the excellent performance characteristics of each ELECTRO-MECH lighted push-button switch, indicator, and display assembly. Low-bounce, long-life contacts, new innovations in legends, displays, field-service, packaging— all standard features. Whatever your applications, ELECTRO-MECH is prepared to answer your specific needs. Choose from any of the most popular models.

Technical specifications apply to all ELECTRO-MECH Switch models unless otherwise specified:

- **Ratings: 30 volts DC or 115 Volts AC; 2 amps resistive, 1 amp inductive**
- **Weight: 0.8 oz. (approx.)**
- **Operating Pressure: 2 lbs. + 1 lb.**
- **Plunger Travel: 3/16" (approx.)**
- **Actuations: 100,000**
- **Accommodates all "switchlines" standard lenses. Uses one T1-3/4, AN3140-327, 328, 330 bulb or neon lamp, 3 actuation modes standard**
- **Lenses: Available in ½" to 1" round and spare, plus various rectangular sizes.**

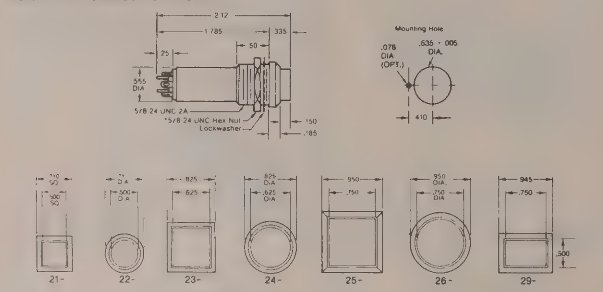
SERIES 8128
ELECTRO-MECH INTRODUCES ITS MINIATURE SPST LIGHTED SWITCH!

The 8128 is a SPST illuminated, momentary switch that mounts to the front panel and takes up only ¾" behind the panel. Lens L11 accommodates a T-1 sub-midget flange base lamp or LED.

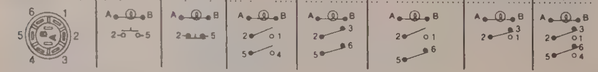
SPECIFICATIONS:

- **Ratings: 30 VDC or 115 VAC; 1a resistive, 0.25a inductive.**
- **Weight: 1 gram (approx.)**
- **Operating Pressure: 24 ounces ± 8 ounces**
- **Plunger Travel: 0.075 (approx.)**
- **Actuations: 100,000 minimum**
- **Pushbutton Lens: Switch accommodates a 0.245 round lens (part number L11).**
- **Lamps: Lens accommodates a T-1 sub-midget flange base lamp or LED. The lamp is replaceable from the front of the panel.**

MOUNTING SPECIFICATIONS



SWITCH FUNCTIONS	SPST N.O.	SPST N.C.	DPST N.O.	DPST N.C.	DPST 1N.O , 1N.C.	SPDT	DPDT
MOMENTARY	2*-128	2*-129	2*-130	2*-131	2*-132	2*-149	2*-150
PUSH ON PUSH-OFF	2*-228	2*-229	2*-230	2*-231	2*-232	2*-249	2*-250
PUSH-ON REMAIN-IN PUSH-OF	2*-828	2*-829	2*-830	2*-831	2*-832	2*-849	2*-850
N.O. POS	2-5		1-2 4-5		1-2	1-2	1-2, 4-5
N.C. POS		2-5		2-3, 5-6	5-6	2-3	2-3, 5-6
COMMON POS			2, 5	2, 5		2	2, 5



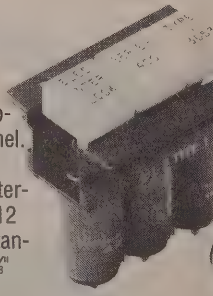
*—indicate style of switch (21- through 26 and 29)

SERIES 20
A NEW CONCEPT OF FAST EASY SWITCH INSTALLATION AND DISPLAY DESIGN VERSATILITY

FEATURES:

- **Momentary or alternate action**
- **All bezel sizes mount in a ⅝" dia. round hole**
- **High density mounting ability–less than 3/4" centers**
- **Low profile appearance in one unitized housing**

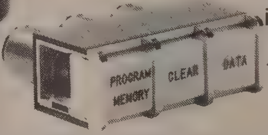
SERIES 400
MULTI-STATION SUB-PANEL ASSEMBLIES



Multi-station switch assemblies designed for sub-panel mounting by means of a flanged "U" channel. All standard ELECTRO-MECH switches can be incorporated with several types of mechanical interlocking/lockout actions between stations. Up to 12 stations in one or two row configurations. The standard center distance between switches is ⅝", ¾", ⅞" and 1".

SERIES 500
INTERLOCKING SWITCH ASSEMBLIES

Added beauty and long-lasting appearance with handsome chrome barriers between each switch or indicator. Independent or interlocking action. Ten types of tracking action and switching sequences. Up to 12 switches in single or dual row, ⅞" or 1" centers.

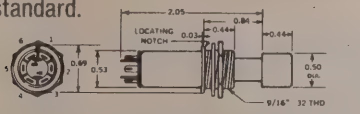


electro-mech
LIGHTED PUSH-BUTTON SWITCHES

COMMUNICATIONS/INDUSTRIAL CONTROLS/DISPLAYS
COMPUTER PERIPHERALS/INSTRUMENTATION

SERIES 2100

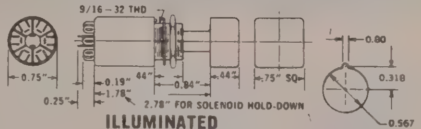
This version of our standard illuminated Pushbutton Switch features silver slide bar action. Add BR after part number for mounting on ⅝″ centers. Utilizes AN3140-T 1¾″or Neon bulb. All other specifications same as standard.


2.05
0.84
LOCATING NOTCH
0.03
0.44
0.44
0.69
0.53
0.50 DIA.
9/16″ 32 THD
1
2
3
4
5
6

	1 PST		2 PST		1 N.O.		
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.C.	1 PDT	2 PDT
Momentary	2128	2129	2130	2131	2132	2149	2150
Push-on / Push-off	2228	2229	2230	2231	2232	2249	2250

SERIES 2600

Standard models are available from 2PST to 6PDT in 116 different styles, including non-lighted units. Virtually any standard ELECTRO-MECH lens may be used with the 2600 Series.


9/16 – 32 THD
0.75″
0.25″
0.19″
1.78″
.44″
0.84″
.44″
.75″ SQ
2.78″ FOR SOLENOID HOLD-DOWN
0.80
0.318
0.567
MOUNTING HOLE

ILLUMINATED

	Mom.	Push On Push Off	Push On Remain In Push Off	Snap Feel Mom.
2 PDT	2650	2750	2850	2550
3 PDT	2651	2751	2851	2551
4 PDT	2652	2752	2852	2552
5 PDT	2653	2753	2853	2553
6 PDT	2654	2754	2854	2554

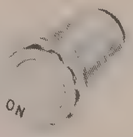
SERIES 3000

Illuminated Pushbutton switches with an integral hold-down coil which is activated with switch. Holds the push-button in the depressed position until coil is de-energized returning it to relaxed position. Available in all circuit configurations up to 6 PDT. Same specifications as standard model.

SERIES 4000 10 AMP

Low profile matches standard industry models. Momentary or Alternate Action design takes any standard lens size. 30 VDC or 115 VAC, 10 A Resistive, 5 A Inductive.

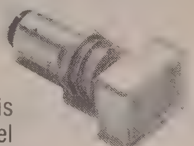
SERIES 5000



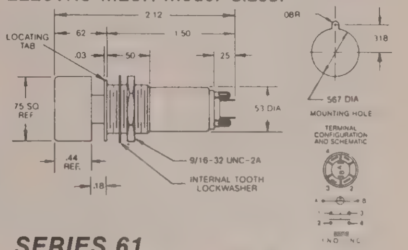
An exceptionally short momentary switch available in circuit configurations up to 2 PDT.

	1 PST		2 PST				
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.O. 1 N.C.	1 PDT	2 PDT
MOMENTARY	5128	5129	5130	5131	5132	5149	5150

SERIES 6100



High-density packaging requirements are answered with this shorter, front panel mount, providing the same quality design as standard ELECTRO-MECH model sizes.


2.12
.62
1.50
LOCATING TAB
.03
.50
.25
.75 SQ REF
.53 DIA
.44 REF.
.18
9/16-32 UNC-2A
INTERNAL TOOTH LOCKWASHER
.08R
.318
.567 DIA
MOUNTING HOLE
TERMINAL CONFIGURATION AND SCHEMATIC
1 NO
NC

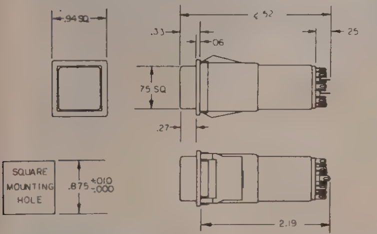
Designer Group Switches

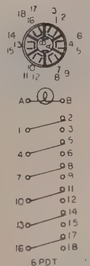
¾″ sq., ¾″ x 1½″, ¾″ x ⅞″, ½″ sq.

These ELECTRO-MECH Standards feature typical switch functions and mounting options for design flexibility. A choice of dual/quad display units are also available.

All Designer Group units feature:

- **1PST TO 6PDT**
- **Momentary: Alternate action; push-on remain-in; push-on, push-off and momentary snap-feel.**


.94 SQ
.33
.06
2.52
.25
.75 SQ
.27
SQUARE MOUNTING HOLE
.875 +.010 -.000
2.19

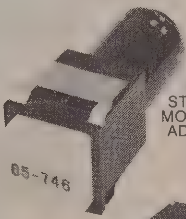

A
B
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

6 PDT SCHEMATIC

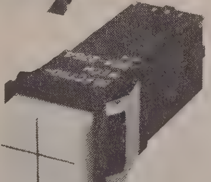
MODEL 65
NO BARRIER

MODEL 68
SINGLE BARRIER (L OR R)

MODEL 67
DOUBLE BARRIER



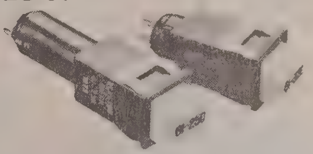
STYLE 65 MOUNTING ADAPTER



MODEL 600/800 DUAL/QUAD LITE SWITCH

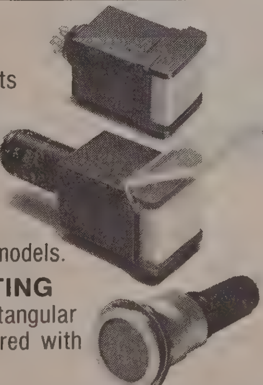
MODEL 73 ¾″ x 1½″ RECTANGULAR

SERIES 61



ELECTRO-MECH's Series 61 switches are provided in ½-inch square, snap-in or hardmount configurations. Each low-profile unit is available in any function from SPST to 2PDT, each controlled with an independent circuit. The all plastic, unitized housing, helps insulate switch from other surrounding components. The 61 Series is also available in a standard PC Board mounting configuration.

SERIES 60
MOMENTARY SWITCH



Rear mounted "U" bracket accepts switch installation from front of panel.

LG SERIES SAFETY LENS

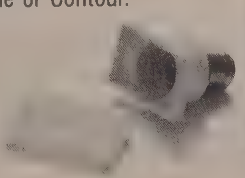
Available on all 67-single-station, double-barrier lighted push-button bezel switch models.

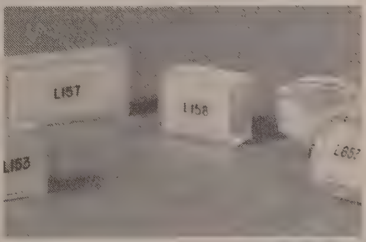
EL SERIES FLUSH MOUNTING

Available in round, square or rectangular styles. Specify switch model desired with "EL" suffix (i.e. 73 EL-2654).

SERIES 150
INTERCHANGABLE LENSES/FILTERS

Displays may be changed or buttons replaced. Non-wearing, clear-acrylic lens and filter buttons. Available in standard, Opaque or Contour.




L157
L158
L153
L657

ELECTRO-MECH COMPONENTS, INC. • 1826 N FLORADALE AVE. • SO. EL MONTE, CA 91733 • (818) 442-7180 • FAX: (818) 350-8070

ELECTROSWITCH
UNIT OF ELECTRO SWITCH CORP.

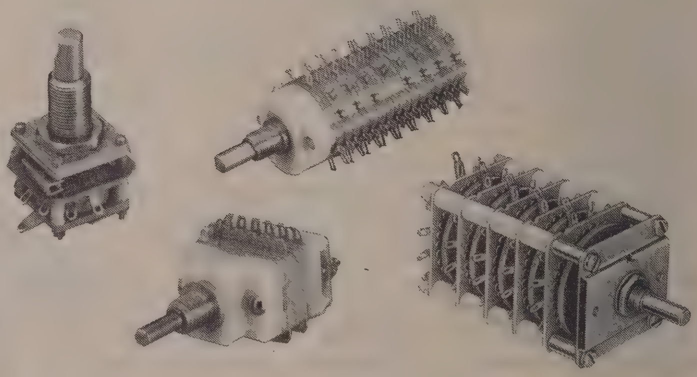
The W-I-D-E-S-T Selection of Electronic and Power ROTARY SWITCHES

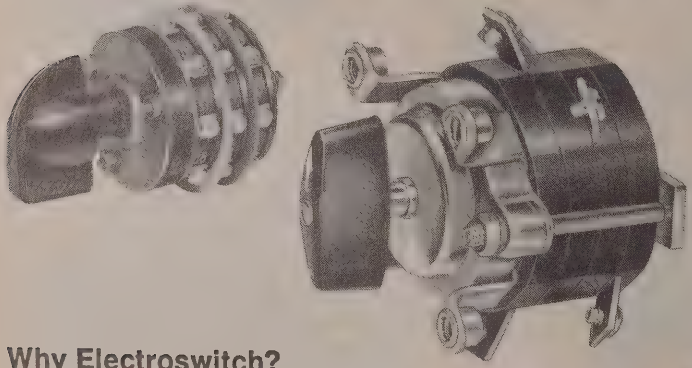
- Commercial
- Enhanced Commercial
- Military
- Electrical Utility

APPLICATIONS

Switch Ratings Range from under 1 amp to 200 amps

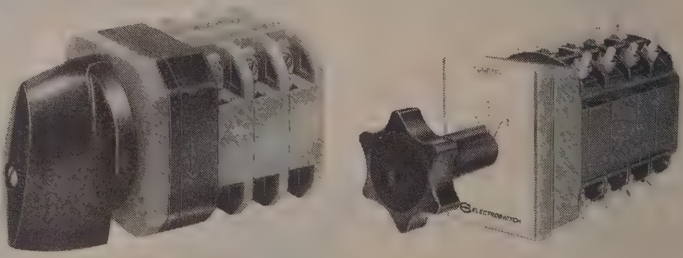
Whatever your needs...
Chances are there is a standard or custom Electroswitch product to meet your applications: from miniature electronic instrument and control switches ... to special mounts for PC boards ... to power detent-action types ... to snap-action units especially suited to DC applications ... to specialized control devices for the utility industry.





Options include:
tandem switches ... spring-return ... key-lock ... push-to-turn ... dual concentric shafts ... quick-connect terminals ... encoded contacts ... waterproof mountings ... and many, many more! **Plus Custom Designed switches** for unique needs.

Why Electroswitch?
We're now in our *fifth decade* of designing and manufacturing multipole rotary switches for demanding applications. This proven record of consistency and reliability should be a major factor in your selection of a rotary switch supplier.



Contact your nearest technical representative or the factory for detailed information and assistance in design and selection for your specific needs.

ELECTROSWITCH
UNIT OF ELECTRO SWITCH CORP.

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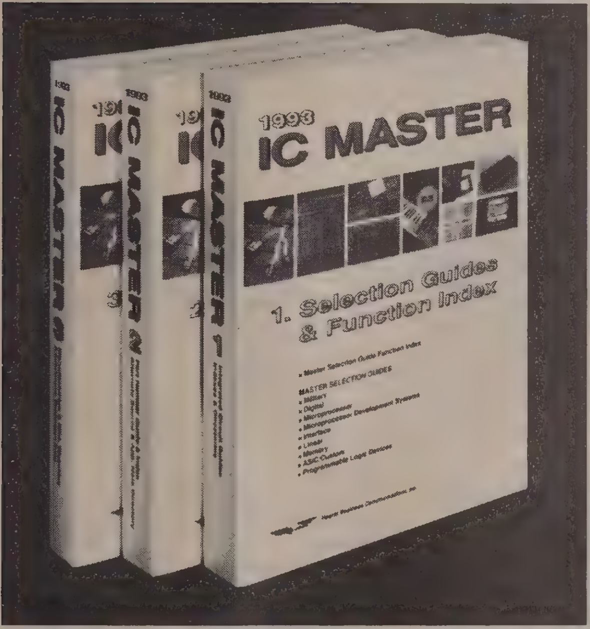
(617) 335-5200 • Fax: (617) 335-4253

SUPER
TIME
SAVER!



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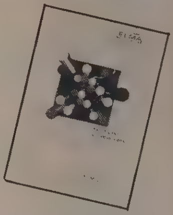
The Highest Quality Switches Available For Medium To Low Power Applications



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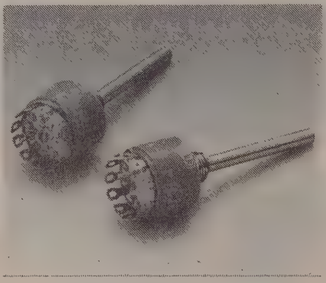
All ELMA products are available off-the-shelf and REASONABLY PRICED

ELMA — Experience and precision for every High Quality switch application

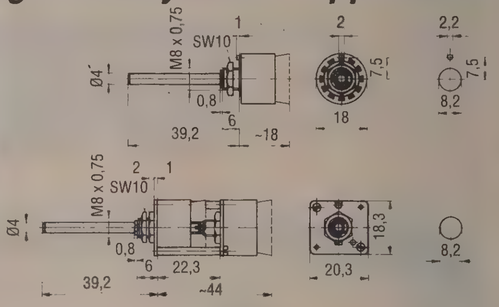
Type 01

Type 01 switches are used when high quality and low cost are primary considerations. The type 01 can be panel or PCB mounted.

Positions: 1-12
Poles: 1-8
Switch Mode: Shorting and non-shorting
Contacts: Silver or 120 micro inch gold
Mechanical Life: Greater than 600K detents
Temperature Range: -40 to +85 deg. C
Contact Resistance: < 10 milli Ohm
Indexing angle: 30, 36, and 60 deg.



TYPE 01

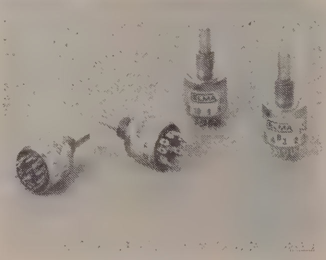

M8 x 0,75
SW10
1
2
2,2
Ø4
7,5
7,5
0,8
6
18
8,2
39,2
~18
M8 x 0,75
2
1
SW10
Ø4
18,3
0,8
6
22,3
20,3
8,2
39,2
~44

SW = Key spanner

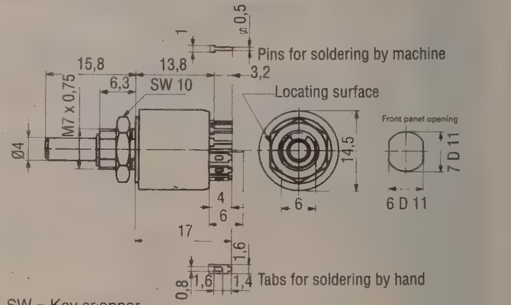
Type 02 MIL-S-3786/35

Type 02 switches are completely sealed and made to meet the rigorous requirements of MIL-S-3786/35. The type 02 can be panel or PCB mounted.

Positions: 1-12
Poles: 1-8
Switch Mode: Shorting and non-shorting
Contacts: 120 micro inch gold
Mechanical Life: Greater than 600K detents
Temperature Range: -40 to +85 deg. C
Contact Resistance: < 20 milli Ohm
Indexing angle: 30 deg.



TYPE 02

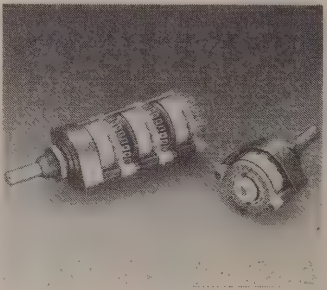

ø 0,5
1
Pins for soldering by machine
15,8
13,8
3,2
6,3
SW 10
Locating surface
M7 x 0,75
Front panel opening
Ø4
14,5
7 D 11
4
6
6
6 D 11
17
1,6
0,8
1,6
1,4
Tabs for soldering by hand

SW = Key spanner

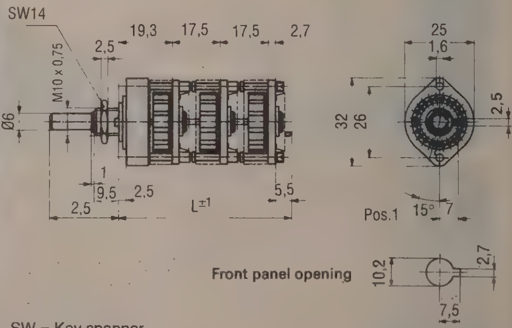
Type 04

The type 04 is often use in applications where many positions or poles are required in a small package. The type 04 can be panel or PCB mounted.

Positions: 1-24
Poles: 1-24 standard, higher upon request
Switch Mode: shorting and non-shorting
Contacts: Silver or 120 micro inch gold
Mechanical Life: Greater than 1.2M detents
Temperature Range: -40 to +85 deg. C
Contact Resistance: < 10 milli Ohm
Indexing angle: 15 and 30 deg.



TYPE 04

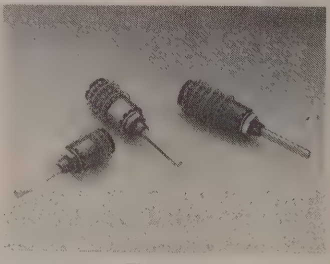

SW14
19,3
17,5
17,5
2,7
25
2,5
1,6
M10 x 0,75
Ø6
32
26
2,5
1
9,5
2,5
5,5
2,5
L±1
Pos.1
15°
7
Front panel opening
10,2
2,7
7,5

SW = Key spanner

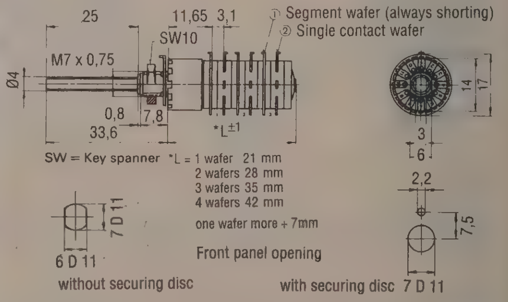
Type 06

The type 06 is perfect for applications which require a large number of poles packaged in a small switch. The type 06 is for panel mount use only.

Positions: 1-12
Poles: 1-16 standard, higher upon request
Switch Mode: Shorting and non-shorting
Contacts: Silver or 120 micro inch gold
Mechanical Life: Greater than 600K detents
Temperature Range: -40 to +85 deg. C
Contact Resistance: < 10 milli Ohm
Indexing angle: 30 deg.



TYPE 06


25
11,65
3,1
① Segment wafer (always shorting)
② Single contact wafer
SW10
M7 x 0,75
Ø4
14
17
0,8
7,8
33,6
*L±1
3
6
SW = Key spanner
*L = 1 wafer 21 mm
2 wafers 28 mm
3 wafers 35 mm
4 wafers 42 mm
one wafer more + 7mm
2,2
7 D 11
7,5
Front panel opening
6 D 11
without securing disc
with securing disc 7 D 11

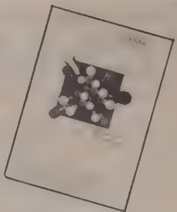
SW = Key spanner

See Section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.), see Section 1400 (Cabinet Enclosures), see Section 2460 (Lamps & Lights), see section 5150 (Keyboard & Keypads) for additional products.

ELMA

ELMA Electronic Inc.
A Member Of The Sulzer Group,
44350 Grimmer Blvd.
Fremont, CA 94538
(510) 656-3400, Fax: 510-656-3783

The Highest Quality Switches Available For Medium To Low Power Applications



For complete information write or call for our *free* catalog today!

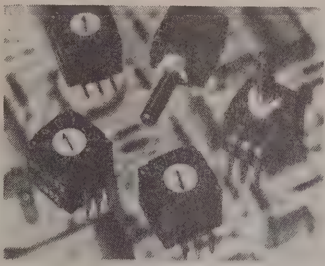
All ELMA products are available off-the-shelf and REASONABLY PRICED

ELMA — Experience and precision for every High Quality switch application

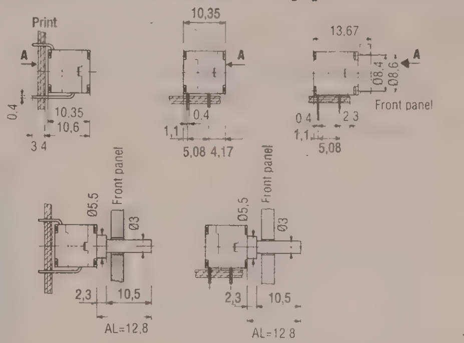
Type 07 Coded

The type 07 coded switches are the best made, highest quality, longest lasting coded switches in the world. . . and we can prove it. Please call for test results.

Positions: 1-16
Coding: BCD, BCD Compliment, HEX, HEX Compliment, Gray Code
Switch Mode: Shorting and non-shorting
Contacts: 80 micro inch gold
Mechanical Life: Greater than 320K detents for HEX
Temperature Range: -40 to +85 deg. C
Contact Resistance: < 10 milli Ohm
Indexing angle: 22.5 and 36 deg.



TYPE 07 ROTARY BCD

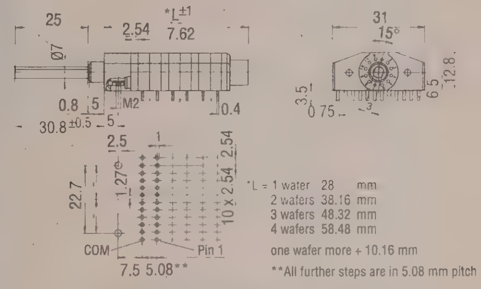

Print
10,35
13.67
A
A
A
0.4
10.35
10,6
3 4
0,4
1,1
5,08 4.17
Ø8.4
Ø8.6
Front panel
0.4
2 3
1,1
5,08
Front panel
Front panel
Ø5,5
Ø3
Ø5,5
Ø3
2,3
10,5
AL=12,8
2,3
10,5
AL=12 8

Type 08

The type 08 is perfect for PCB applications which require a large number of poles or a low overall height. It is intended for PCB use only.

Positions: 1-12
Poles: 1-100 and more... contact factory.
Switch Mode: Shorting and non-shorting
Contacts: Silver or 120 micro inch gold
Mechanical Life: Greater than 600K detents
Temperature Range: -40 to +85 deg. C
Contact Resistance: < 20 milli Ohm
Indexing angle: 30 deg.

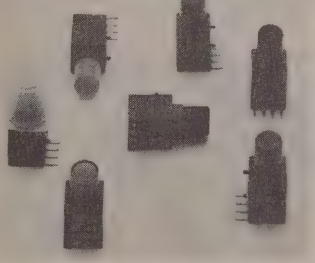
TYPE 08


25
*L±1
2.54
7.62
Ø7
Ø4
0.8
5
M2
0.4
30.8±0.5
5
31
15°
3.5
6.5
12.8
0 75
3
2.5
1
2.54
22.7
1.27
10 x 2.54
COM
Pin 1
7.5
5.08**
*L = 1 wafer 28 mm
2 wafers 38.16 mm
3 wafers 48.32 mm
4 wafers 58.48 mm
one wafer more + 10.16 mm
**All further steps are in 5.08 mm pitch

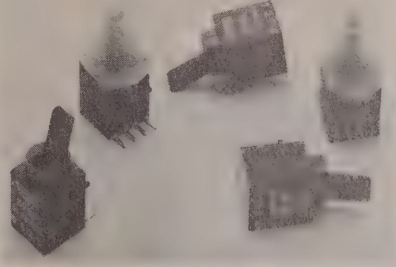
Type 09 Pushbutton and Toggle

The type 09 switches are excellent for front panel applications. They are completely sealed for cleaning after assembly.

Style: 2 or 3 position for toggle switches, push button or push button switch for push type
Poles: 2 poles for standard, 1 pole for lighted
Switch Mode: Shorting and non-shorting
Contacts: 80 micro inch gold
Mechanical Life: Greater than 100K activations
Temperature Range: -20 to +80 deg. C
Contact Resistance: < 50 milli Ohm



TYPE 09 PUSHBUTTON



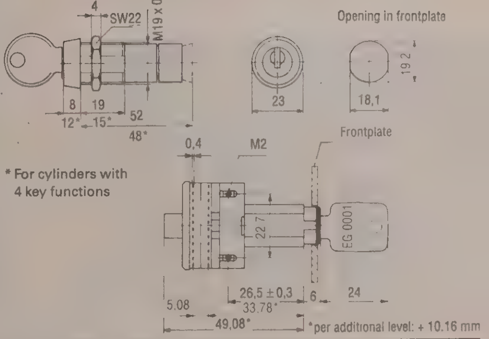
TYPE 09 TOGGLE

Type 01, 06 and 08 Keylock

Our keylock switches are ultra high security, precision made for the most demanding applications. These switches are suitable for both panel and PCB mounting.

Switch: Uses our type 01, 06 and 08 high quality switches shown above
Mechanism: Swiss made high precision 5 tumbler design
Arrangements: Customer can specify: which positions key can be removed in, spring return positions, different keys which can access different positions on the same lock (access hierarchy).

TYPE 01, 06 AND 08 KEYLOCK


4
SW22
M19 x 0,75
8
19
12*
15*
52
48*
23
Opening in frontplate
19 2
18,1
Frontplate
0,4
M2
* For cylinders with 4 key functions
22 7
EG 0001
5.08
26,5 ± 0,3
33,76*
6
24
49,08*
*per additional level: + 10.16 mm

See Section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.), see Section 1400 (Cabinet Enclosures), see Section 2460 (Lamps & Lights), see section 5150 (Keyboard & Keypads) for additional products.

ELMA

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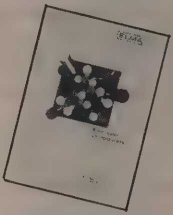


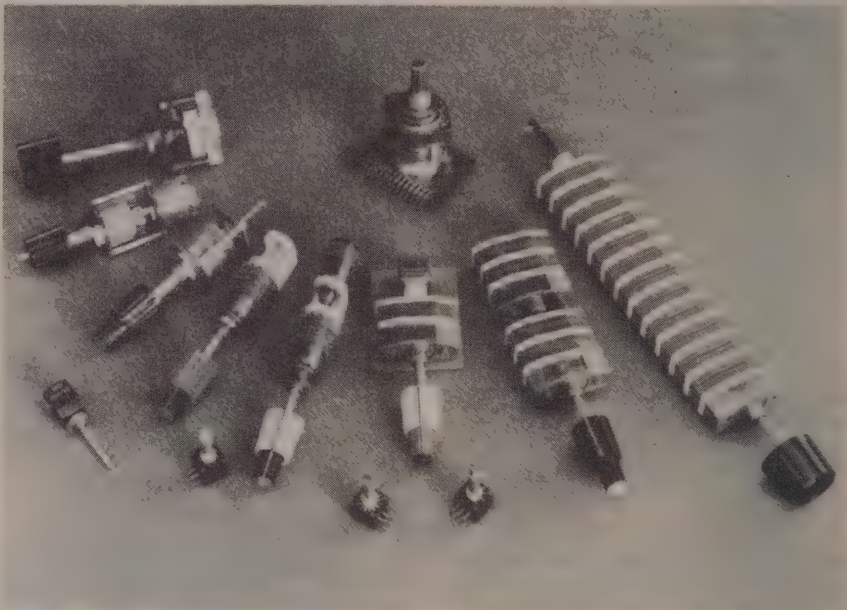
For complete information write or call for our *free* catalog today!

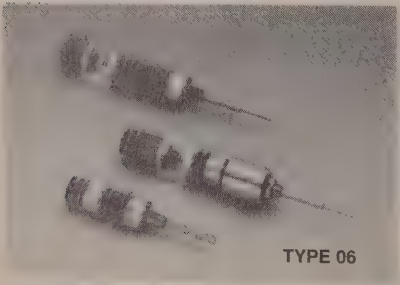
All ELMA products are available off-the-shelf and REASONABLY PRICED

ELMA Electronic has been designing and manufacturing state of the art switches for over 30 years. We have the experience and expertise to make the perfect switch for your special application. From high end audio to state of the art medical to switching networks for major phone companies, ELMA has the reliable solution. We will look at any application you have and work with you to find the best solution.

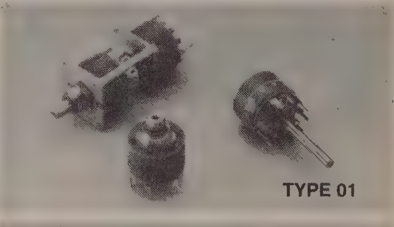
Our standard customs include the following:

1) Special length bushings
2) Special spindle lengths
3) Special spindle designs which may include: flats, roll pins, holes, drilled and tapped ends, slots, etc.
4) Hollow spindles for concentric shafts.
5) Dual concentric switch designs.
6) Custom spindle diameters.
7) Water proof switches sealed through the front panel with o-rings.
8) Dummy wafers
9) Custom mounting plates for mounting potentiometers or other third party devices.
10) Special wafer spacing and custom spacers or injected parts.
11) Spring loaded momentary contact positions.
12) Special materials.
13) Special push/rotary designs.
14) Large variety of options for keylock switches.
15) Custom wire harnesses to customer specifications.

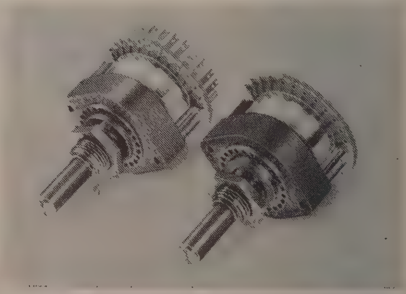


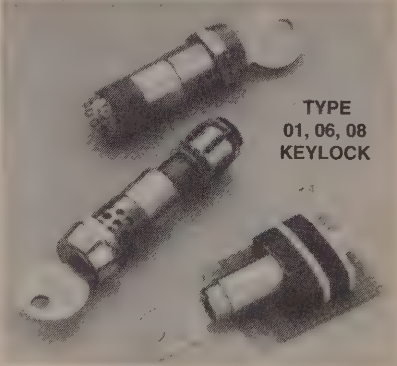


TYPE 06

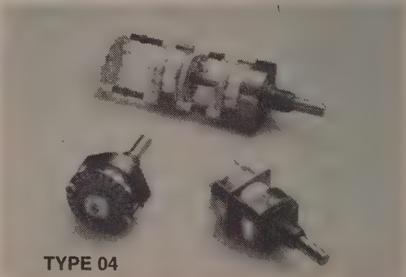


TYPE 01





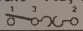
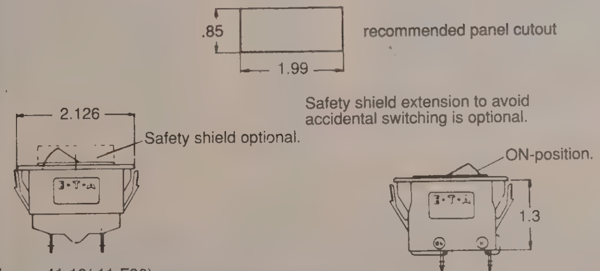
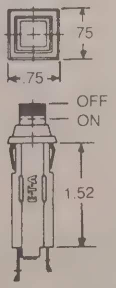
TYPE 01, 06, 08 KEYLOCK



TYPE 04

See Section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.), see Section 1400 (Cabinet Enclosures), see Section 2460 (Lamps & Lights), see section 5150 (Keyboard & Keypads) for additional products.

ON-OFF Switch Circuit Breakers

E-T-A® **setting the pace for circuit protection**	-F30/31 -G10	 3120-F621 fits panel cutout Heinemann TX2 and AIRPAX 203-11 2 pole.	
Series	**41-10-P10/41-11-P10**	**3120-F321**	**1110-F**
Description	Single pole, series trip Rocker, Toggle or Baton handles in many colors. (Illumination Optional)	Double pole, identical Snap-in mounting of single pole 41-10/41-11 series (Illumination Optional)	Single pole, series trip B/W button trip indicator Push ON/Push OFF Switching
Current ratings	0.1 thru 20A	0.1 thru 16A	0.10 thru 16A
Maximum voltage ratings	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc
Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A	10 times rated current normal use. UL up to 2000A	10 times rated current 0.1-2A. 300A for ratings 2.5-16A. UL tested to 2000A.	10 times rated current normal use. UL up to 1000A.
Current capacity of auxiliary contacts, NO, NC.	NA	5A resistive 3, .110" quick connect NO-NC-COM	NA
Life	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 10,000 mechanical
Terminals	.250 quick connect	.250 quick connect	.250 quick connect
Shunt circuit—A3, optional 	Optional; specify—A3	Optional	NA
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 up to 15A VDE
Design notes See technical data sheets for data	41-10 is unlighted 41-11 is illuminated	Options: • handle colors • handle marking • illumination • Amp ratings	Snap in mounting Fully trip free Color trip indicator band upon request
Technical Data Sheet	Catalog Sheet 40129 Catalog Sheet 40130	Catalog Sheet 40136	Catalog Sheet 40142
Physical Dimensions In Inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	 .85 1.99 recommended panel cutout Safety shield extension to avoid accidental switching is optional. 2.126 Safety shield optional. ON-position. 1.3 E-T-A (shown: 41-10/-11-F30)		

E-T-A® CIRCUIT BREAKERS

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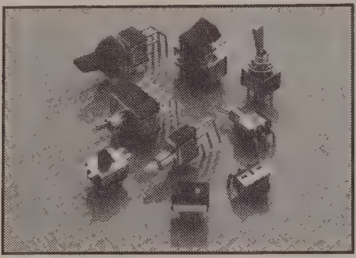
236 Hood Road, Markham, Ontario Canada L3R 3K8 • 416-475-5886 • FAX: 416-475-5889

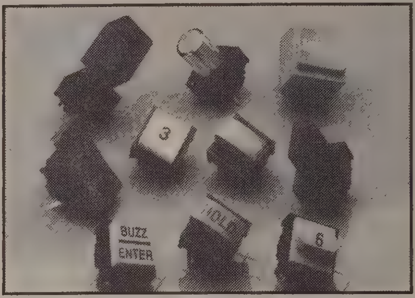
Your #1 Second Source

Miniature/Sub-miniature Toggle, Rocker, Paddle Switches



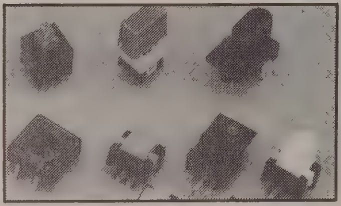
- 100/200 Series Toggle Switches
- 300/400 Series Rocker/Paddle Switches
- 700/800 Series Pushbutton Switches

320 Series Pushbutton Switches



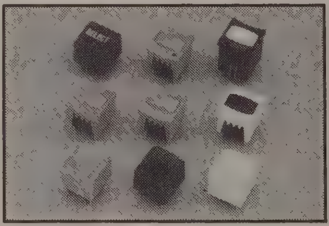
- Custom legends
- Variety of buttons
- SPST/SPDT
- Gold dome contacts
- LED styles available

TL Series Tact Switches



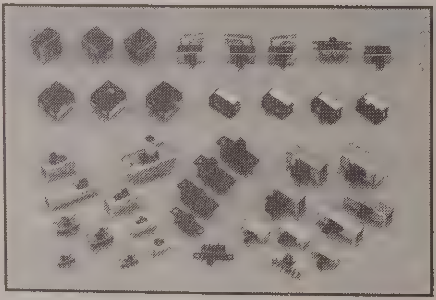
- SPST & DPDT types
- Alternate action and momentary styles
- Miniature and subminiature
- LED styles

420 Series Pushbutton Switches



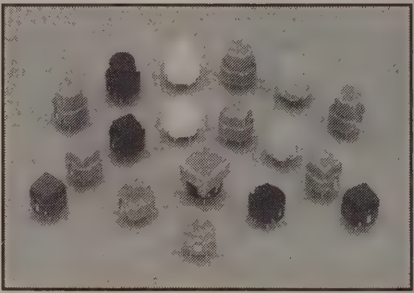
- Contact rating: 250 mA @ 120 V
- Alternate or momentary action
- Gold or silver contacts
- Multiple, round or square LEDs available
- Life:
  Momentary - 1,500,000 cycles
  Alternate - 500,000

EG Series Slide Switches



- Various current and voltage ratings
- Gold or silver contacts
- PC, solder lug or right angle mounting

520 Series Pushbutton Switches



- SPST
- Smooth tactile feel
- Momentary
- Life: > 500,000 cycles
- Low cost

E-SWITCH

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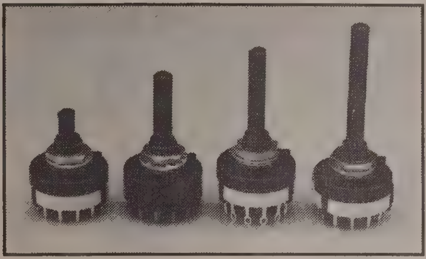
26 N. 5th Street, Minneapolis, MN 55403
612/375-9639 • FAX: 612/375-1905

Subsidiary of Stein Industries

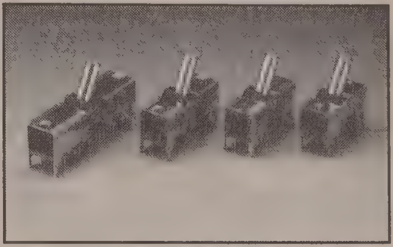
Your #1 Second Source

KC Series Single Deck Rotary Switches



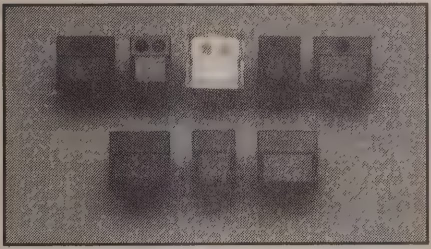
- Contact rating: 150 mA @ 150 V, 350 mA @ 100V
- Single, double, 3 pole and 4 pole versions, 2-12 positions

FC-001 Lever Switch



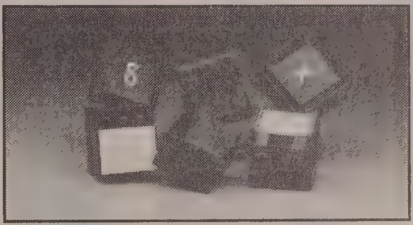
- 2, 4 or 6 pole
- Bifurcated double wiping contacts
- Momentary function
- Wave solderable and washable
- Anodized aluminum button

5500 Series Input Switches



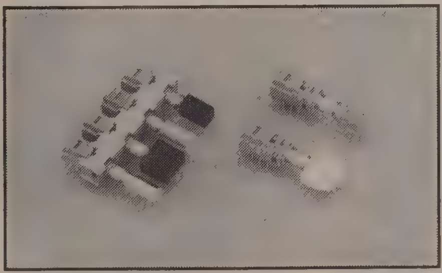
- Momentary function, SPDT
- Can accommodate 1 or 2 LEDs
- Gold Contacts
- Operating life> 500,00 cycles
- Contact rating 12 mA @ 24V
- Re-legendable caps

1100/1300 Series Mini-Tast Miniature Pushbutton Switches



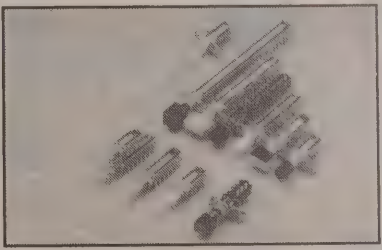
- Contact rating: 250 mA @ 60 VDC
- SPST, SPDT versions
- Self-cleaning, snap-action contacts
- Multiple LEDs
- Gold or silver contacts
- Life: >10,000 cycles

MTH Series Switches



- Available ganged or as individual modules
- 2, 4 or 6 pole configurations
- Six button styles in five colors
- Electrical life> 30,000 cycles

TA Pushbutton Switches



- Contact rating: 0.5 amp @ 100 VAC, 1 amp @ 25 VDC
- Available as single modules or ganged assemblies
- Momentary or alternate action
- Life: > 100,000 Actuations

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ONE COMPLETE SOURCE FOR

all types of switches, control devices...

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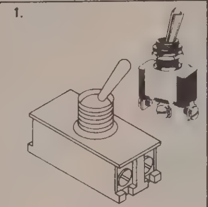
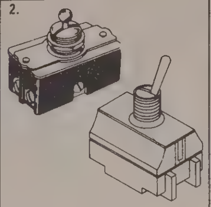
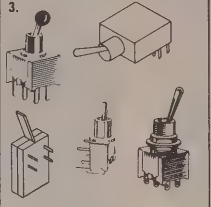
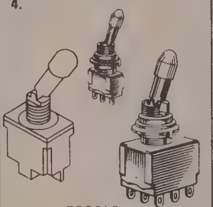
ESI SWITCHLOG NO.40EM

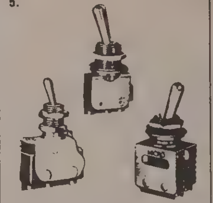
AEROSPACE – COMMERCIAL —

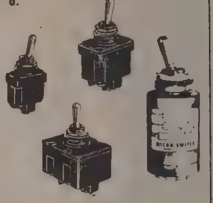
1.

TOGGLE
General Purpose

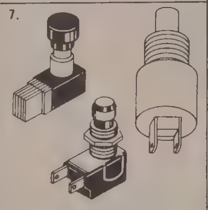
2.

TOGGLE
High Capacity

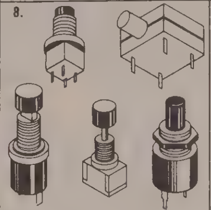
3.

TOGGLE
Miniature & Ultra Miniature

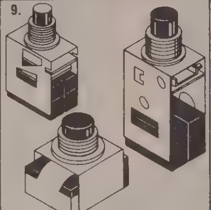
4.

TOGGLE
Locking Lever

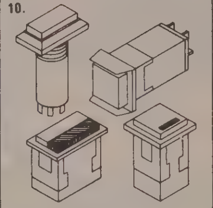
5.

TOGGLE
Precision

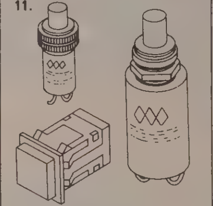
6.

TOGGLE
Environmentally Sealed

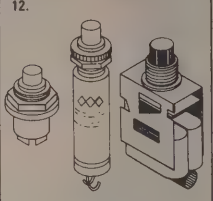
7.

PUSHBUTTON
General Purpose

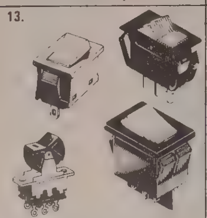
8.

PUSHBUTTON
Miniature & Ultra Miniature

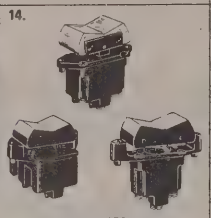
9.

PUSHBUTTON
Precision

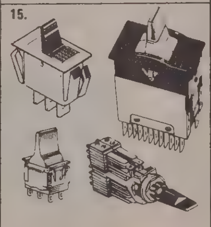
10.

PUSHBUTTON
Lighted

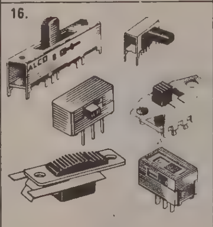
11.

PUSHBUTTON
Reed & Solid State

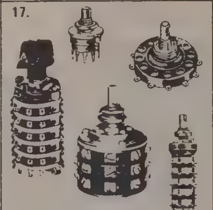
12.

PUSHBUTTON
Enviromentally Sealed

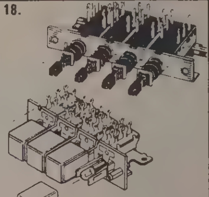
13.

ROCKER
Lighted & Unlighted

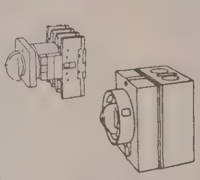
14.

ROCKER
Heavy Duty / Sealed

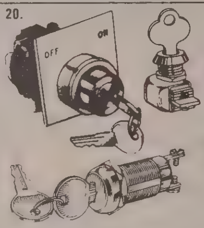
15.

PADDLE

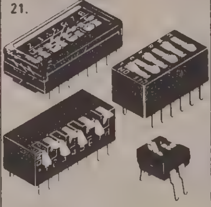
16.

SLIDE

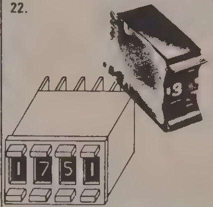
17.

ROTARY
Electronic Duty

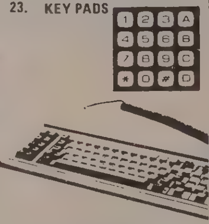
18.

MULTI-STATION
Push Button Switches
Make to Spec.

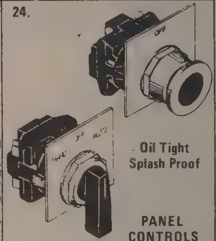
19

CAM-ROTARY
High Capacity HP Rated
Make to Spec.

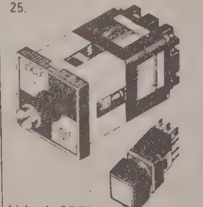
20.

KEY LOCK

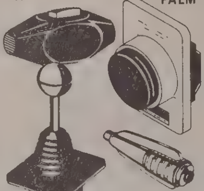
21.

DIP SWITCH

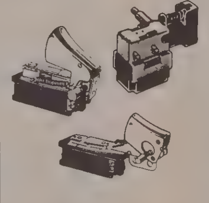
22.

PB/ROTARY THUMBWHEEL
Programmable Code Switch

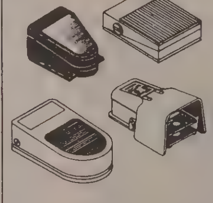
23. KEY PADS

KEYBOARDS

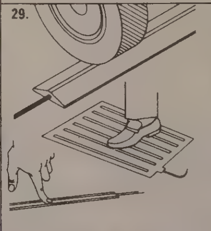
24.

Oil Tight
Splash Proof
PANEL CONTROLS

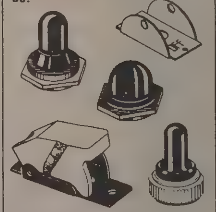
25.

Lighted - Oil Tight
PANEL CONTROLS

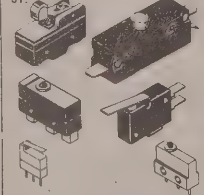
26. PALM

JOYSTICK
PENDANT

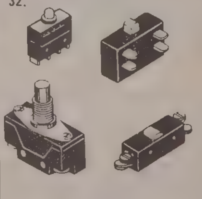
27.

TOOL HANDLE

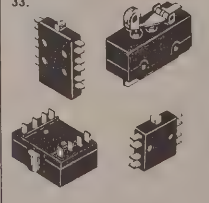
28.

FOOT SWITCH

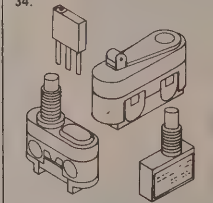
29.

TAPE/AIR SWITCHES

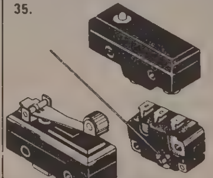
30.

SWITCH GUARDS & SEALS

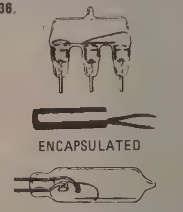
31.

MICRO
Single Break

32.

MICRO
Double Break

33.

MICRO
2 & 3 Poles

34.

MICRO
Sealed & Hi-Temperature

35.

MICRO Rotary
MICRO High DC Capacity
Magnetic Blow-Out Switches

36.

ENCAPSULATED
MERCURY SWITCHES

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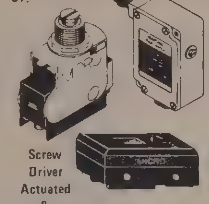
213–660–1310
800–421–8855
Fax: 213–660–5130

...motor controls & replacement parts

— ELECTRONIC – INDUSTRIAL – MILITARY

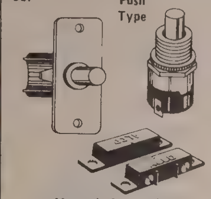
REQUEST FOR FREE CATALOG
ESI SWITCHLOG NO.40EM

37.



Screw Driver Actuated & PULSE SWITCHES

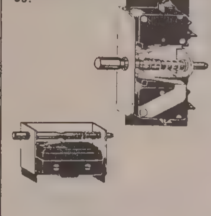
38.



Push Type

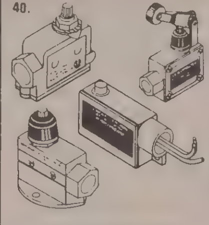
Magnetic Actuated DOOR SWITCHES

39.



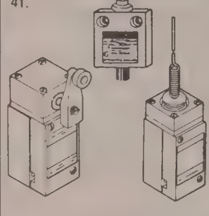
DOOR INTERLOCK

40.



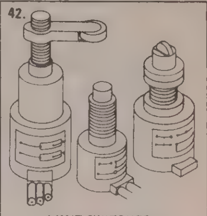
ENCLOSED SWITCHES

41.



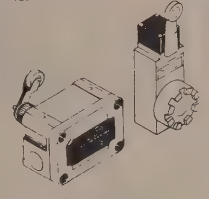
LIMIT SWITCHES

42.



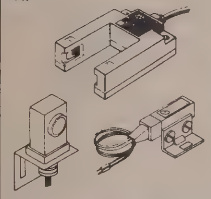
LIMIT SWITCHES
Sealed & Hi-Temperature

43.



LIMIT SWITCHES
Explosion Proof

44.



PHOTO–ELECTRIC CONTROLS
Fiber Optics-LED-Incandescent

45.

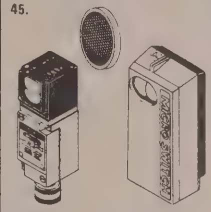
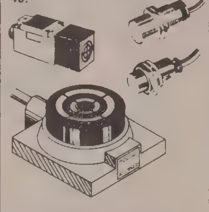


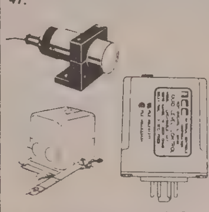
PHOTO-ELECTRIC CONTROLS
Self- Contained

46.



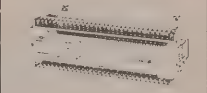
PROXIMITY CONTROLS

47.



LIQUID LEVEL CONTROLS

48.

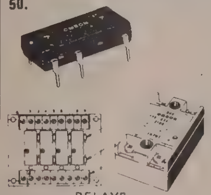


PC
Programmable Controllers

49.

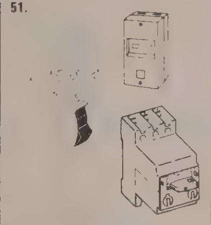
RELAYS
Electro-Mechanical

50.



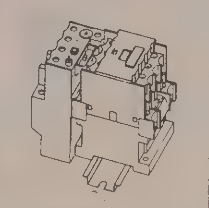
RELAYS
I/O Modules/Board
Reeds & Solid State

51.



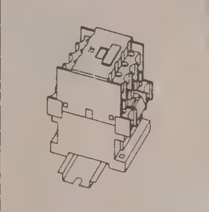
MANUAL MOTOR STARTERS

52.



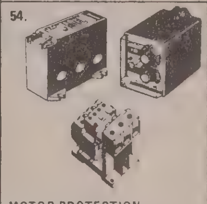
MAGNETIC MOTOR STARTERS

53.



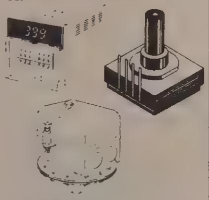
MAGNETIC CONTACTORS

54.



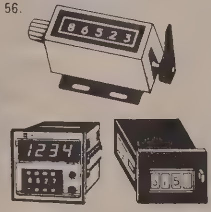
MOTOR PROTECTION
Thermal - OverCurrent
Open & Reverse Phase

55.



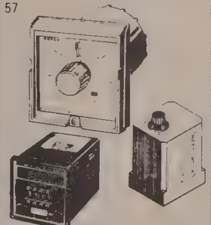
PRESSURE & TEMPERATURE CONTROLS

56.



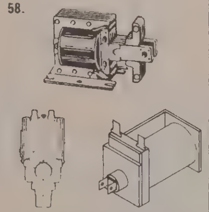
COUNTERS

57



TIMERS

58.

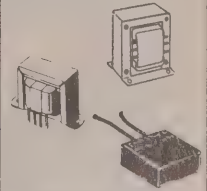


SOLENOIDS / SOLENOID VALVES

59.

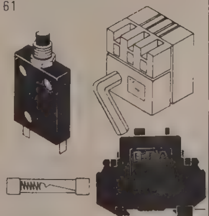
IMPACT PRINTERS

60.



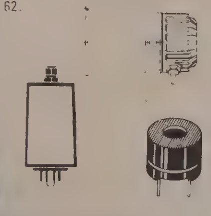
TRANSFORMERS
SURGE SUPPRESSORS

61



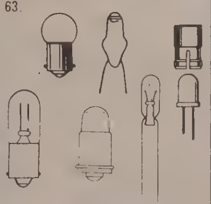
FUSES & CIRCUIT BREAKERS

62.



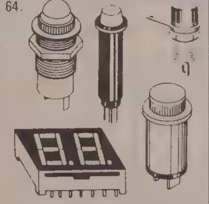
FLASHERS, HORNS & BUZZERS

63.



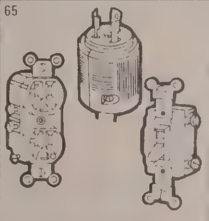
LEDS & NEON
Incandescents Mini-Lamps

64.



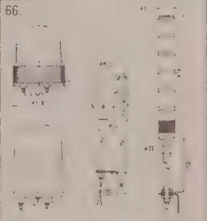
INDICATOR LIGHTS
LED DISPLAYS

65



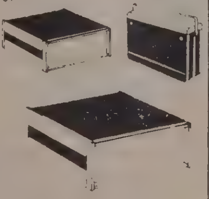
WIRING DEVICES

66.



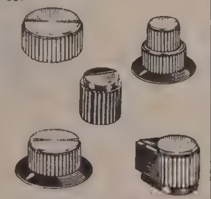
ANNUNCIATORS

67



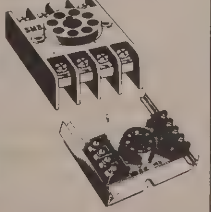
INSTRUMENT CASES
BAILS & HANDLES

68.



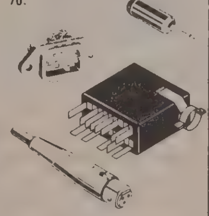
INSTRUMENT KNOBS
Commercial & Military

69.



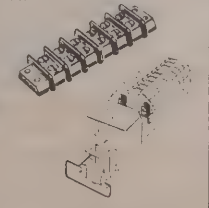
SOCKET SNAP–TRACKS

70.



PLUGS JACKS & CONNECTORS

71.



TERMINAL BLOCKS

72

BLANK RELEASE
BUSY
ON
OFF

CUSTOM LEGENDING

E S I

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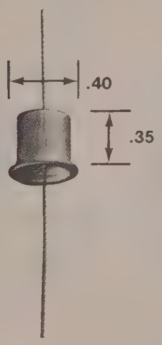
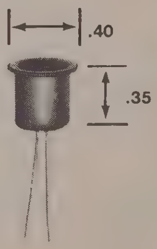
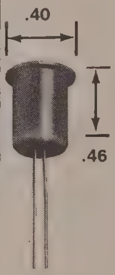
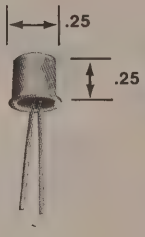
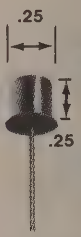
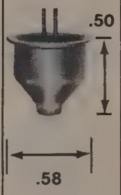
INC.

Miniature Mercury Tilt Switches

- **Versatile** — Available to sense tilt, vibration or impulses for commercial, industrial or military applications
- **Reliable** — Hermetically sealed, oxygen-free atmosphere provides typical life of 250,000 operations and more
- **Rugged** — Welded metal cases
- **Wide choice** — Omnidirectional or planar
- **Precise** — Operate to tight tolerances

Notes:

1. Response speed depends on the damping fluid used, and is related to jitter reduction. Rated on a scale of 0 to 5, with 5 being heavily damped (longest response time).
2. Switches with other dampening factors are available. Consult factory.
3. Jitter is tendency for switch to change state 3° from operational point. Ranked on a scale of 0 to 5, with 5 being very susceptible to vibrations.
4. Values shown are for switch viewed so that pins are side by side. For values with pins in line (one behind the other) ask for product data sheet.
5. Vibration resistant TS77VRG will not change mode when subjected to a 3g sinusoidal vibration within a frequency of 5 to 2000 Hz when tilted 15° off normal axis.

	Omnidirectional (NO)			Omnidirectional (NC)		Vibration Resistant (NO or NC)	Miniature Omni-directional (NC)		Single Plane	Omni-directional (NC) Snap Action
Dimensions									 Mounts Horizontally	
Part Number	**TS7-0**	**TS7-0J**	**TS7-10**	**TS7B-0**	**TS7B-10**	**TS77VRG** (5)	**TS8**	**TS68D**	**TS66D**	**STS411**
Operating Angle (°) (to close from 0°)	16±8	18±8	6±5	25±12 (4)	25±12 (4)	55±12 (4)	7±5 (4)	40±20	±3	42±6 (4)
Operating Angle (°) (to open from 0°)	12±8	12±8	4±5	35±12 (4)	35±12 (4)	140±12 (4)	13±10 (4)	60±20	±3	55±6 (4)
Switching Hysterysis (°)	4±4	6±4	2±3	10±6	10+6	85 Typ.	6±5 (4)	20	2 Typ.	13±5
Typical Repeatability (±°)	3	3	3	2	2	10	3	3	1	2
Load Current (resistive) @ 115 VAC (amps)	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.2	0.1	1.0
Load Current (resistive) @ 12 VDC (amps)	1.0	0.5	1.0	1.0	1.0	0.5	0.5	0.5	0.2	2.0
Insulation Resistance @ 500 VDC (megohms)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Breakdown Voltage (VAC)	1000	1000	1000	750	750	750	600	600	1000	1000
Typical Contact Resistance @ 1 mA (ohms)	0.3	0.7	0.5	0.15	0.50	0.15	0.25	0.25	0.5	0.1
Maximum Operating Temperature (°C)	125	125	125	125	125	125	125	125	135	125
Minimum Operating Temperature (°C)	−35	−35	−20	−35	−20	−35	−35	−35	−35	−35
Speed of Response (relative) (1)	0	0	2	0	2	NA	0	NA	0	1
Contact Jitter (relative) (3)	4	5	2	3	2	0	3	5	4	0

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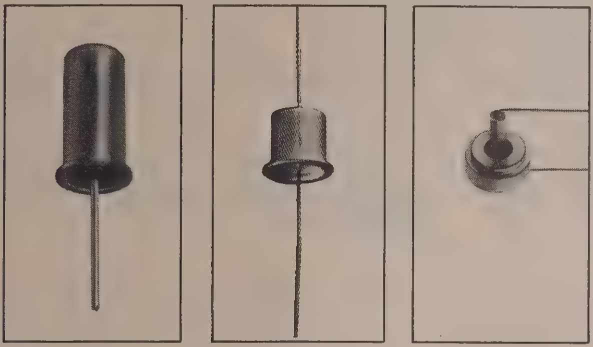
FIFTH
DIMENSION
INC.

Mercury *(wetted and nonwetted)* and Mercury-Free Impulse, Motion and Proximity Switches

Impulse and Motion Switches: Less than 1G to 1,000G's



Typical impulse and motion switches. Reliability is enhanced by hermetically sealed, welded-steel cases. Models available with operating temperatures as low as −55°C.

Fifth Dimension Inc. offers a broad range of impulse and motion switches with operating points from below 1G to over 2,000G's. Uses for these switches include rocket fuzing (both impact and safing modes) and motion detection for security equipment. They may also be used where actuation is required caused by shock, vibration, jitter or centrifugal force. Contact configurations include:

NO — all mounting modes

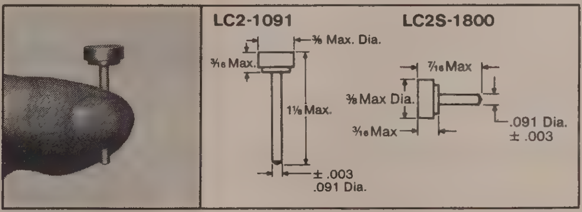
NC or NO — depending on mounting mode

Randomly Closed or Open — operates on leading edge of change of state occurring during motion

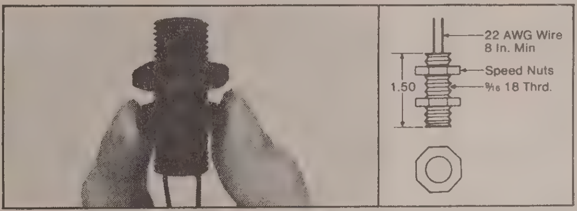
Additional details and specifications will be supplied in response to information about your requirements. Please call or write.

Magnetic Proximity Switches

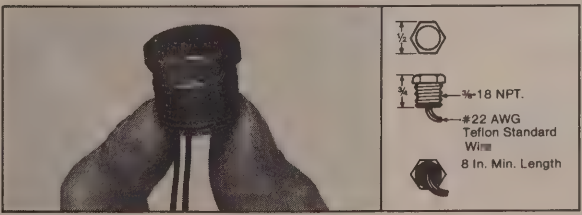
The LC2 mercury film switch used in Fifth Dimension magnetic proximity switches, unlike most mercury devices, operates in any mounting position. It can be triggered by a coil, for relay operation, or a by permanent magnet. It features: • Long life • No contact bounce • High reliability • Low contact resistance • High standoff voltage • Low cost.



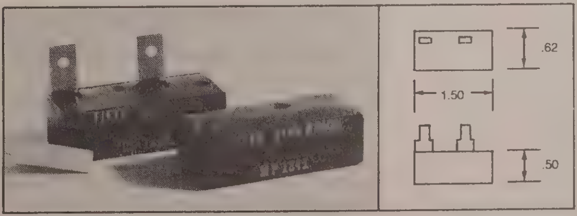
The basic LC2 mercury film switch may be mounted by adhesives or snap rings. Its welded steel contact chamber is hermetically sealed.



Easy-mount switch requires only a clearance hole for installation. Its entire body is threaded for easy adjustment. Matched drive magnet available.



Totally encapsulated limit switch is ideally suited to underwater operation. It mounts in a pipe thread. Various matching drive magnets available.



Versatile interlock switch is cast in epoxy in a high density polyethylene case. It can operate on magnetic or non-magnetic surfaces.

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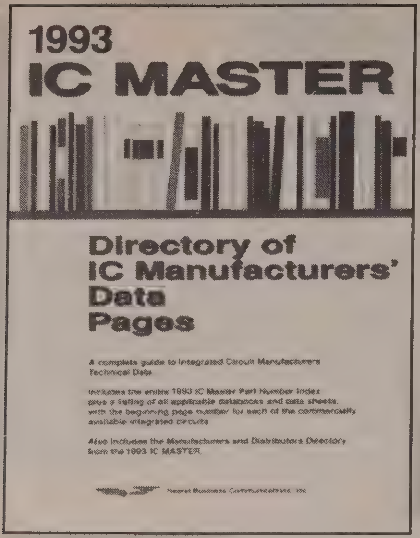

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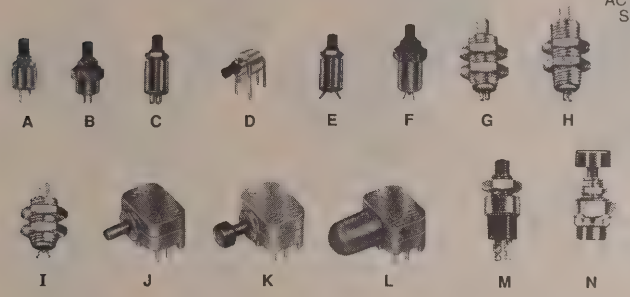
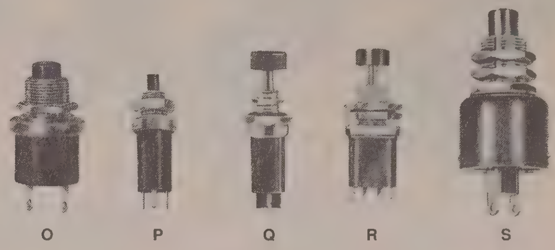
Pushbutton Switches

SMALL LOW CURRENT MOMENTARY SWITCHES WITH BUTT CONTACTS

50% ACTUAL SIZE



LOW CURRENT WIPING CONTACT SWITCHES AND HIGH CURRENT SNAP ACTION SWITCH



SPST = Single Pole/Single Throw, Momentary

SPDT = Single Pole/Double Throw, Momentary

NO or NC = Normally Open or Normally Closed

MINIATURE, BUTT CONTACT SWITCHES—FIG. A TO L

Gold contacts provide low level switching with maximum life in minimum space. PC, sealed, overtravel, right angle, and limit switch. SPST NO or NC, and SPDT types.

1 AMP BUTT CONTACT SWITCHES—FIG. M, N

Small, long wearing switches with silver contacts. SPST NO in standard, UL recognized and sealed types; SPST NC in standard and UL types.

1/2 & 1 AMP WIPING CONTACT SWITCHES—FIG. O

Self cleaning contacts for use in critical contact resistance circuits. SPST NO or NC, standard, and UL recognized.

1/4 AMP WIPING CONTACT SWITCHES—FIG. P, Q, R

Long wipe, double throw switches for low level switching. SPDT or DPDT, standard or sealed types.

10 AMP SNAP ACTION SWITCHES—FIG. S

Rapid make and break for higher current switching; audible click. SPST NO or NC, and SPDT types.

ORDERING INFORMATION

Circuitry & Description (PC=PC Mount, RA=Right Angle Mount)	Fig.	Part No., Red or Natural Button	Part No. Black Button	Make & Break Current*	Life Operations	Behind Panel	Max. Width
NO	A	39-1	39-3	500 mA	1,000,000	0.315	0.253
NO, PC	A	39-401 RED	39-401 BLK	150 mA**	1,000,000	0.215	0.253
NO, Sealed	B	39-351 RED	39-351 BLK	500 mA	250,000	0.350	0.361
NO, Overtravel	C	39-12	39-24	500 mA	100,000	0.455	0.253
NO, PC, Right Angle	D	39-501 RED	39-501 BLK	150 mA**	1,000,000	0.300	0.253
NC	E	39-2	39-6	250 mA	250,000	0.490	0.253
NC, Sealed	F	39-352 RED	39-352 BLK	250 mA	100,000	0.529	0.361
NO, Limit	G	39-101 (Natural)	—	500 mA	500,000	0.650	0.505
NO, Overtravel, Sealed	H	39-701 (Natural)	—	150 mA	100,000	0.800	0.505
NC, Limit, Sealed	I	39-702 (Natural)	—	250 mA	100,000	0.560	0.505
SPDT PC, Right Angle	J	39-251 RED	39-251 BLK	250 mA	500,000	0.400	0.500
SPDT PC, RA, Sealed	J,L	39-250 RED	39-250 BLK	250 mA	500,000	0.400	0.500
SPDT, PC, RA, Wide Button	K	39-261 RED	39-261 BLK	250 mA	500,000	0.400	0.500
SPDT PC, RA, Wide, Sealed	K,L	39-260 RED	39-260 BLK	250 mA	500,000	0.400	0.500
NO	M	30-1	30-3	1 Amp	1,000,000	0.592	0.375
NO, UL Recognized	M	30-1UL	30-3UL	5 Amps	6,000	0.592	0.375
NO, Sealed	N	30-251 RED	30-251 BLK	1 Amp	100,000	0.632	0.505
NO, Overtravel	M	30-15	30-37	1 Amp	500,000	0.677	0.375
NC	M	30-2	30-6	1 Amp	1,000,000	0.605	0.375
NC, UL Recognized	M	30-2UL	30-6UL	5 Amps	6,000	0.605	0.375
NO	O	4001	10–9	1 Amp	100,000	0.965	0.800
NO, UL Recognized	O	4001UL	10-9UL	3 Amps	6,000	0.965	0.800
NC	O	4002	10–10	1 Amp	100,000	0.965	0.800
NC, UL Recognized	O	4002UL	10-10UL	3 Amps	6,000	0.965	0.800
SPDT	P	46-101 RED	46-101 BLK	250 mA	250,000	0.890	0.437
SPDT, Sealed	Q	46-150 RED	46-150 BLK	250 mA	100,000	0.957	0.437
DPDT	R	46-200 RED	46-200 BLK	250 mA	250,000	0.921	0.625
DPDT, Sealed	R	46-270 RED	46-270 BLK	250 mA	100,000	0.957	0.650
NO	S	2201	7–7	10 Amps	25,000	1.239	0.880
NC	S	2202	7–8	10 Amps	25,000	1.239	0.880
SPDT	S	7-26 RED	7-26 BLK	10 Amps	25,000	1.239	0.880

*At 115 Vac resistive except as noted. **At 28 Vdc.

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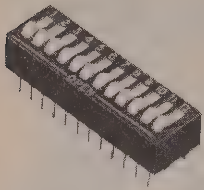
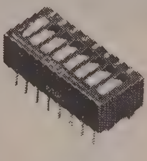
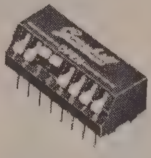
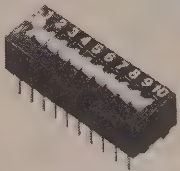
SPST DIP Switches

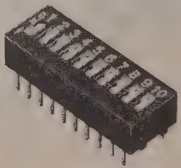
SINGLE POLE/SINGLE THROW DIP SWITCHES

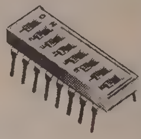

Raised Rocker

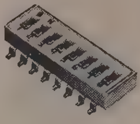

Recessed Rocker


PIANO-DIP®

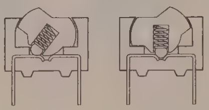

Raised Slide


Recessed Slide


Machine Insertable


Surface Mount

- **High Pressure, Reliable Contact**
- **Sealed Bases as Standard**
- **Shock and Vibration Immunity**



ROCKER DIP SWITCHES—SERIES 76

Raised and Recessed Rockers and PIANO-DIP®

Rated to make and break 1 mA, 5 Vdc: or 50 mA, 30 Vdc: or 150 mA, 30 Vdc for 10,000 operations per position. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380"(9,65mm); height is .315"(8,0mm) for raised rocker style, .267"(6,27mm) for recessed style, .301"(7,65mm) for the PIANO-DIP® switch. Grayhill Piano-Dip® standard is up-off. Contact Grayhill for up-on.

SLIDE DIP SWITCHES—SERIES 78

Raised and Recessed Slide Types

Rated to make and break 1 mA, 5 Vdc; or 50 mA, 30 Vdc; or 150 mA, 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380"(9,65mm); height is .315"(8,0mm) for raised slides and .265" (6,73mm) for recessed slides.

MACHINE INSERTABLE, MIDIP® SWITCH–SERIES 90

Compatible with leading TO-116 IC insertion equipment. Rated to make and break 10 mA, 30 Vdc; or 10 mA, 50 mVdc for 2,000 operations per position. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Terminals are molded (sealed) into base.Top seal is polyimide film. Width is .290"(7,37mm) max.; height above board is .180"(4,57mm) max.

SURFACE MOUNTABLE SWITCHES–SERIES 90HBW

Compatible with surface mount assembly, including infrared reflow and vapor-phase soldering temperatures up to 260°C. Rated to make and break 100 mA, 6Vdc; or 10 mA, 50 mVdc for 2,000 operations per position. Contacts are copper alloy, gold plated 10 microinches minimum over nickel. Non-conductive parts are UL94V-0 rated plastic; top seal is polyimide film. Width is .290"(7,37mm) max.; height above board is .190"(4,83mm) max. Outline conforms to S0GN-0004 per EIA Standard PDP-100.

MILITARY QUALIFIED DIP SWITCHES

Switch part numbers containing the letter M are qualified to MIL–S–883504 per the following slash sheets: 76MSB Type = /01; 76MRSB Type = /02; 78MB Type = /04; 76MPSB Type = /11; 90MB Type = /12. These switches may also be ordered by the appropriate "M" number cross reference. For additional qualified DIP switches with double throw circuitry, see next page.

*TOP SEAL OPTION

To order top tape sealed, add suffix S to part number. Part numbers for the Machine Insertable, Surface Mountable switches and Military Qualified switches already have the suffix. See also paragraph above.

For prices, contact your local Sales Office, an authorized Distributor, or GRAYHILL. **Available From Your Local GRAYHILL Distributor**

Switch Type	No. of Stations	Length Inch (mm)	Part No.* Standard	Part No.* Military
Raised Rocker Type	2	0.28 (7,1)	76SB02	76MSB02S
	3	0.38 (9,7)	76SB03	76MSB03S
	4	0.48 (12,2)	76SB04	76MSB04S
	5	0.58 (14,7)	78SB05	78MSB05S
	6	0.68 (17,3)	76SB06	76MSB06S
	7	0.78 (19,8)	76SB07	76MSB07S
	8	0.88 (22,4)	76SB08	76MSB08S
	9	0.98 (24,9)	76SB09	76MSB09S
	10	1.08 (27,4)	76SB10	76MSB10S
	12	1.28 (32,5)	76SB12	76MSB12S
Recessed Rocker Type	2	0.28 (7,1)	76RSB02	76MRSB02S
	3	0.38 (9,7)	76RSB03	76MRSB03S
	4	0.48 (12,2)	76RSB04	76MRSB04S
	5	0.58 (14,7)	76RSB05	76MRSB05S
	6	0.68 (17,3)	76RSB06	76MRSB06S
	7	0.78 (19,8)	76RSB07	76MRSB07S
	8	0.88 (22,4)	78RSB08	78MRSB08S
	9	0.98 (24,9)	76RSB09	76MRSB09S
	10	1.08 (27,4)	76RSB10	76MRSB10S
	12	1.28 (32,5)	76RSB12	76MRSB12S
PIANO-DIP® Slde Actuated Rocker Type	2	0.28 (7,1)	76PSB02	76MPSB02S
	3	0.38 (9,7)	76PSB03	76MPSB03S
	4	0.48 (12,2)	76PSB04	76MPSB04S
	5	0.58 (14,7)	78PSB05	78MPSB05S
	6	0.68 (17,3)	76PSB06	76MPSB06S
	7	0.78 (19,8)	76PSB07	76MPSB07S
	8	0.88 (22,4)	76PSB08	76MPSB08S
	9	0.98 (24,9)	76PSB09	76MPSB09S
	10	1.08 (27,4)	76PSB10	76MPSB10S
	12	1.28 (32,5)	76PSB12	76PSB12S
Raised Slide Type	2	0.28 (7,1)	78B02	78MB02S
	3	0.38 (9,7)	78B03	78MB03S
	4	0.48 (12,2)	78B04	78MB04S
	5	0.58 (14,7)	78B05	78MB05S
	6	0.68 (17,3)	78B06	78MB06S
	7	0.78 (19,8)	78B07	78MB07S
	8	0.88 (22,4)	78B08	78MB08S
	9	0.98 (24,9)	78B09	78MB09S
	10	1.08 (27,4)	78B10	78MB10S
	12	1.28 (32,5)	78B12	78MB12S
Recessed Slide Type	2	0.28 (7,1)	78RB02	N/A
	3	0.38 (9,7)	78RB03	N/A
	4	0.48 (12,2)	78RB04	N/A
	5	0.58 (14,7)	78RB05	N/A
	6	0.68 (17,3)	78RB06	N/A
	7	0.78 (19,8)	78RB07	N/A
	8	0.88 (22,4)	78RB08	N/A
	9	0.98 (24,9)	78RB09	N/A
	10	1.08 (27,4)	78RB10	N/A
	12	1.28 (32,5)	78RB12	N/A
Machine Insertable Slide Type MIDIP®	2	0.27 (6,9)	90B02S	90MB02S
	3	0.37 (9,4)	90B03S	90MB03S
	4	0.47 (11,9)	90B04S	90MB04S
	5	0.57 (14,5)	90B05S	90MB05S
	6	0.67 (17,0)	90B06S	90MB06S
	7	0.77 (19,6)	90B07S	90MB07S
	8	0.87 (22,1)	90B08S	90MB08S
	9	0.97 (24,6)	90B09S	90MB09S
	10	1.07 (27,2)	90B10S	90MB10S
Surface Mountable Slide Type	2	0.27 (6,9)	90HBW02S	N/A
	3	0.37 (9,4)	90HBW03S	N/A
	4	0.47 (11,9)	90HBW04S	N/A
	5	0.57 (14,5)	90HBW05S	N/A
	6	0.67 (17,0)	90HBW06S	N/A
	7	0.77 (19,6)	90HBW07S	N/A
	8	0.87 (22,1)	90HBW08S	N/A
	9	0.97 (24,6)	90HBW09S	N/A
	10	1.07 (27,2)	90HBW10S	N/A

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Special Circuit DIP Switches

SERIES 78 SLIDE SWITCHES

- 2PST, 3PST, 4PST
- SPDT & DPDT – Separate Circuits

Ⓐ

Ⓑ

2 POLE, 3 POLE, AND 4 POLE, SINGLE THROW SLIDE SWITCHES (FIG. A)

Rated for 10,000 operations to make and break the following loads: 1 mA, 5 Vdc; or 50 to 150 mA, 30 Vdc. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate.

Circuitry	No. of Positions	Length	Part Number
2PST	1	0.280	78F01
	2	0.480	78F02
	3	0.680	78F03
	4	0.880	78F04
	5	1.080	78F05
3PST	1	0.380	78G01
	2	0.680	78G02
	3	0.980	78G03
4PST	1	0.480	78H01
	2	0.880	78H02

To order top sealed switches, add the suffix S to the part number in the chart.

SPDT AND DPDT SLIDE SWITCHES WITH SEPARATE CIRCUITS (FIG. B)

Rating and materials are the same as the switches in Figure A. In Single Pole/Double Throw switches, each slide operates two adjacent separate circuits, opening one of them, while closing the other. (In Double Pole/Double Throw switches, 1 slide switches 4 circuits at once, opening circuits 1 and 3, while closing 2 and 4, etc.). This circuitry, used in telephone switching systems, makes these switches form, fit, and function equivalents. For true SPDT (DPDT) circuitry, adjacent terminal pairs may be tied with a printed circuit. Dot on the cover indicates the closed position of individual terminal pairs.

Circuitry	No. of Positions	Length	Part Number
SPDT	1	0.280	78J01
	2	0.480	78J02
	3	0.680	78J03
	4	0.880	78J04
	5	1.080	78J05
DPDT	1	0.480	78K01
	2	0.880	78K02

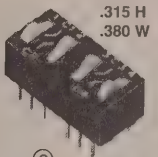
To order top sealed switches, add the suffix S to the part number in the chart.

For prices and discounts of all products on this page, contact your local Sales Office, an authorized Distributor. or Grayhill.

Available From Your Local GRAYHILL Distributor.

SERIES 76 ROCKER AND TOGGLE SWITCHES

- SPDT & DPDT – With Commons
- 3 Actuation Choices
- Standard or Military Qualified



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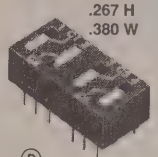

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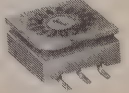
SPDT AND DPDT ROCKER AND TOGGLE SWITCHES WITH COMMON POLES (FIG. C, D, E)

Rated to make and break 50 mA 30 Vdc; and 125 mA 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. SPDT (DPDT) circuits are 3 (6) terminal circuits for true SPDT (DPDT) switching and compact spacing. Common pole terminals are marked with a C, and first and second throws are marked as 1 and 2. Military versions are qualified to MIL-S-83504.

Circuitry And Type	Positions	Length	Part No. Raised	Part No. Recessed	Part No. Toggle
SPDT, Standard	2	0.380	76SC02	76RSC02	76STC02
	3	0.580	76SC03	76RSC03	76STC03
	4	0.780	76SC04	76RSC04	76STC04
SPDT, Military	2	0.380	76MSC02S	76MRSC02S	76MSTC02
	3	0.580	76MSC03S	76MRSC03S	76MSTC03
	4	0.780	76MSC04S	76MRSC04S	76MSTC04
DPDT, Standard	1	0.380	76SD01	76RSD01	76STD01
	2	0.780	76SD02	76RSD02	76STD02
DPDT, Military	1	0.380	76MSD01S	76MRSD01S	76MSTD01
	2	0.780	76MSD02S	76MRSD02S	76MSTD02

To order top sealed switch (not available on TOGGLE-DIP), add the Grayhill part number.



Ⓖ

Surface Mount
Flush Actuator only
.39 x .38 x .21 H

Ⓗ

Perpendicular Thru-Hole
Flush Actuator
.39 x .38 x .20 H
Extended Act.
.39 x .38 x .47 H

Ⓘ

Right Angle Thru-Hole
Flush Actuator
.28 x .43 x .40 H
Extended Actuator
.55 x .43 x .40 H

OCTAL, BCD, HEXADECIMAL OUTPUT DIP SWITCHES

Series 94H (FIGS. G, H, I) are ideal back panel switches to provide coded input to logic circuitry. Internally sealed, survives process assembly. Rated at 30 mA at 30 Vdc for 10,000 cycles of operation. One cycle is complete rotation and return. After life parameters: Contact Resistance 150 milliohms max.; Insulation Resistance 1000 megaohms min.; Dielectric Strength 250 Vac rms. Operating Temperature -40° to +80° C. Top Actuated terminals on 0.1 x 0.3 centers; Side Actuated on 0.1 x 0.1 centers.

Code and Positions	Type of Mounting	Type of Actuator	Standard Code Part Number
Octal 8	Surface Mount	Flush	94HAB08W
	Perpendicular	Flush	94HAB08
	Perpendicular	Extended	94HBB08
	Right Angle	Flush	94HAB08RA
	Right Angle	Extended	94HBB08RA
BCD 10	Surface Mount	Flush	94HAB10W
	Perpendicular	Flush	94HAB10
	Perpendicular	Extended	94HBB10
	Right Angle	Flush	94HAB10RA
	Right Angle	Extended	94HBB10RA
Hexadecimal 16	Surface Mount	Flush	94HAB16W
	Perpendicular	Flush	94HAB16
	Perpendicular	Extended	94HBB16
	Right Angle	Flush	94HAB16RA
	Right Angle	Extended	94HBB16RA

Contact GRAYHILL, Inc. for Complement Code Output.

Grayhill INC.
An ISO-9001 Company

Rotary Switches

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE: (708) 354-1040

SERIES 42D AND 44D 1 AMP ADJUSTABLE STOP ROTARY SWITCHES

Enclosed, interchangeable with fixed stop switches. Make/break 1 amp, carry 10 amps at 115VAC, resistive. Insulation resistance: 10,000 megaohms minimum. Non-shorting contacts. 3/8-32NEF bushing projects .437 (11,10). Flatted shaft projects .874 (22,2). Behind-panel-depth: 1-deck, 1.025" (26.04); 2-deck, 1.371" (34.82). **Series 42D:** 10-position switch, 36° indexing, 1" (25.4) diameter. **Series 44D:** 12-position switch, 30° indexing, 1.162" (29.51) diameter.

Type	Poles	Decks	Max. Positions
42D36-01-1-AJN	1	1	10
42D36-01-2-AJN	2	1	5
42D36-02-1-AJN	1	2	10
42D36-02-2-AJN	2	2	5
44D30-01-1-AJN	1	1	12
44D30-01-2-AJN	2	1	6
44D30-02-1-AJN	1	2	12
44D30-02-2-AJN	2	2	6

Also available in fixed stops; 45°, 60° or 90° throw, up to 6 poles, up to 12 decks and military qualified types.

SERIES 50 AND 51 200MA, 0.5" (12,7) DIAMETER ROTARY SWITCHES

Series 50 and 51 single-deck adjustable stop switches with non-shorting contacts. Make/break 200mA, 115VAC or 30VDC for 5,000 cycles; 100 mA for 20,000. Insulation resistance 10,000 megaohms minimum. Type number with **P** is PC mount, others solder lug. Type number with **C** is military style, others are not. **Series 50** is 36° indexing, **Series 51** is 30°. Approx. .578 (14,63) behind panel PC mount, .658 (16,71) solder lug. Shaft projects .625 (15,88).

Type	Poles	Max. Pos.	Type	Poles	Max. Pos.
50CD36-01-1-AJN	1	10	50CDP36-01-1-AJN	1	10
50CD36-01-2-AJN	2	5	50CDP36-01-2-AJN	2	5
50D36-01-1-AJN	1	10	50DP36-01-1-AJN	1	10
50D36-01-2-AJN	2	5	50DP36-01-1-AJN	2	5
51CD30-01-1-AJN	1	12	51CDP30-01-1-AJN	1	12
51CD30-01-2-AJN	2	6	51CDP30-01-2-AJN	2	6
51D30-01-1-AJN	1	12	51DP30-01-1-AJN	1	12
51D30-01-2-AJN	2	6	51DP30-01-2-AJN	2	6

Also available in fixed stops; 45°, 60° or 90° throw, up to 4 poles and military qualified types.

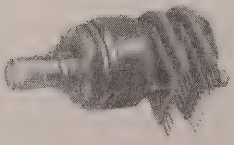
SERIES 56 200MA, 0.5" (12,7) DIAMETER ADJUSTABLE STOP ROTARY SWITCHES

Series 56 single-deck adjustable stop commercial grade switches with nonshorting contacts. Make and break 10,000 cycles at 200mA 30VDC resistive. Type number with **P** is PC mount others solder lug. Type number with **S** has shaft-and-panel seal, others do not. **30** indicates 30° indexing; **36**, 36° indexing. Approx. .377 (9,58) behind panel PC mount, .480 (12,91) solder lug. Shaft projects .625 (15,88).

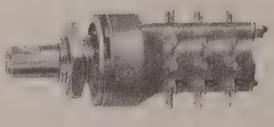
Type	Poles	Max. Pos.	Type	Poles	Max. Pos.
56D30-01-1-AJN	1	12	56DP30-01-1-AJN	1	12
56D30-01-2-AJN	2	6	56DP30-01-2-AJN	2	6
56D36-01-1-AJN	1	10	56DP36-01-1-AJN	1	10
56D36-01-2-AJN	2	5	56DP36-01-2-AJN	2	5
56SD30-01-1-AJN	1	12	56SDP30-01-1-AJN	1	12
56SD30-01-2-AJN	2	6	56SDP30-01-2-AJN	2	6
56SD36-01-1-AJN	1	10	56SDP36-01-1-AJN	1	10
56SD36-01-2-AJN	2	5	56SDP36-01-2-AJN	2	5

Also available in fixed stops, up to 4 poles.

SERIES 71 1/4-AMP, 0.5" (12,7) DIAMETER ADJUSTABLE STOP ROTARY SWITCHES



Style BF



Style B

Series 71 multi-deck switches are adjustable stop. Make/break 250mA for 20,000 cycles 115VAC or 30VDC. Insulation resistance: 10,000 megaohms minimum. Voltage breakdown: 500VAC minimum. Meet moisture, shock, salt spray, explosion and stop strength requirements of MIL-S-3786. **71AD** are standard style with solder lug terminals and 0.125" (3.18) diameter shaft and 1/4-32 bushing; **71BD** same but have 0.250" (6.35) diameter shaft and 3/8-32 bushing. **71ADF** are PC mount with 0.125" (3.18) diameter shaft; **71BDF** same but have 0.250" (6.35) diameter shaft. Switch diameter approx. 0.75 (19,05). **Suffix 30 or 36** indicates angle of throw by degrees. Behind-panel depth: 1-deck, 0.75" (19.05); 2-deck, 1" (25.4).

Type	Poles	Decks	Max. Positions
71AD36-01-1-AJN	1	1	10
71AD36-01-2-AJN	2	1	5
71AD36-02-1-AJN	1	2	10
71AD36-02-2-AJN	2	2	5
71AD30-01-1-AJN	1	1	12
71AD30-01-2-AJN	2	1	6

Type	Poles	Decks	Max. Positions
71AD30-02-1-AJN	1	2	12
71AD30-02-2-AJN	2	2	6
71BD36-01-1-AJN	1	1	10
71BD36-01-2-AJN	2	1	5
71BD36-02-1-AJN	1	2	10
71BD36-02-2-AJN	2	2	5
71BD30-01-1-AJN	1	1	12
71BD30-01-2-AJN	2	1	6
71BD30-02-1-AJN	1	2	12
71BD30-02-2-AJN	2	2	6
71ADF36-01-1-AJN	1	1	10
71ADF36-01-2-AJN	2	1	5
71ADF36-02-1-AJN	2	2	10
71ADF30-01-1-AJN	1	1	12
71ADF30-01-2-AJN	2	1	6
71ADF30-02-1-AJN	1	2	12
71ADF30-02-2-AJN	2	2	12
71BDF36-01-1-AJN	1	1	10
71BDF36-01-2-AJN	2	1	5
71BDF36-02-1-AJN	1	2	10
71BDF36-02-2-AJN	2	2	5
71BDF30-01-1-AJN	1	1	6
71BDF30-01-2-AJN	2	1	6
71BDF30-02-1-AJN	1	2	12

Also available with fixed stops, 45°, 60° or 90° throw; up to 6 poles; up to twelve decks and military qualified types.

For prices, contact a Sales Office, an authorized Distributor or Grayhill.
Available through your local Grayhill Distributor

Grayhill INC.
An ISO-9001 Company

Coded Output Switches

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE: (708) 354-1040

26 SERIES BINARY CODED–1/2" DIAMETER FRONT PANEL SWITCH

0 7 6
GRAYHILL

- Shaft and Panel Seal
- 1 Pole with Adjustable Stops for
- 2 thru 8 or 2 thru 16 Positions

26 Series switch is rated to make and break logic compatible loads for 25,000 operation; a cycle is 360° and a return thru all positions. The four output terminals are on 0.3x0.2" (7.62x5.08) centers with the common terminal in the center; terminals are marked on the switch. The switch may have continuous rotation, or be adjusted to limit the rotation. All switches have shaft and panel seal. The panel seal ring can be removed to expose the stop pin holes on the front of the switch. Two stop pins are supplied with the switch. One or both may be used to limit the rotation as desired. Approx. .322 (8,43) behind panel plus terminals. Shaft projects .625 (15,88)

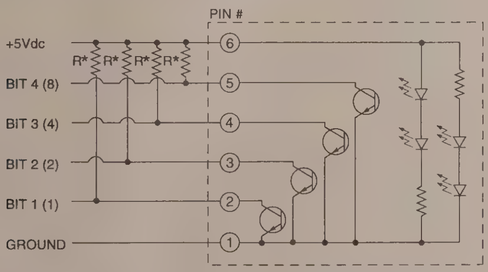
Type	Positions
26ASD22-01-1-AJS	16
26ASD45-O1-1-AJS	8

61 SERIES OPTICALLY-COUPLED ROTARY ENCODER SWITCH

61 Series is a solid state encoder that utilizes light passage or light interruption to be conductive or non-conductive in a phototransistor simulating contact closure or opening. Life is increased beyond 1 million cycles of operation. Encoder is rated at 5VDC, 30mA maximum; logic highs and lows depend on type of logic. Operating voltage: +5VDC. Switching current: 30mA max. Temperature range: -40°C to +65°C. Approx. .825 (20,96) diameter, 1.15 (29,21) behind panel, shaft projects .687 (17,45).

ABSOLUTE POSITION–BCD OR GRAY CODE OUTPUT

Unique output at each of sixteen positions. Same position is identified after power down and power up. No integral pushbutton available in this package size. Your choice of BCD or Gray code.

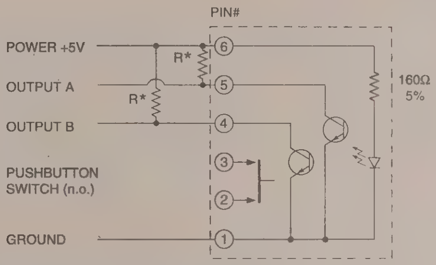


*External pull up resistors required for operation.
8.2kΩ is suggested for TTL; 3.3kΩ is suggested for CMOS.

Type	Code Output
61C22-03-01-01	Binary
61C22-04-01-01	Gray

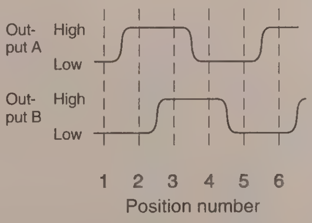
2 BIT QUADRATURE CODE OUTPUT

Code output can be detected for direction of rotation and number of steps. Provides ability to move cursor on a screen or manipulate a readout. Integral pushbutton switch provides data entry.



*External pull up resistors required for operation.
8.2kΩ is suggested for TTL; 3.3kΩ is suggested for CMOS.

Output as related to switch positions is shown at right. Waveform is shown at left.



CW Position	Output A	Output B
1		
2	●	
3	●	●
4		●

• Indicates Logic High.
Code repeats every 4 positions.

Type	Positions/Code
61C22-01-04-02	16 / 2 Bit Quadrature
61C11-01-08-02	32 / 2 Bit Quadrature

For prices, contact a Sales Office, an authorized Distributor or Grayhill.
Available through your local Grayhill Distributor

REED SWITCHES

HAMLIN INC

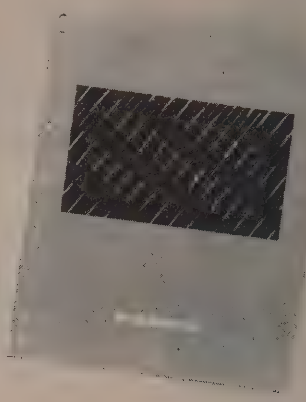
REED SWITCHES • REED RELAYS • POSITION SENSORS

QUALITY ELECTRONIC COMPONENTS SINCE 1949

HAMLIN INC.
612 East Lake Street
Lake Mills, WI 53551 USA
Phone 414/648-3000 FAX 414/648-3001

As the largest western manufacturer of reed switches, we offer the most diverse product line in the business. Dry and mercury wetted magnetic reed switches are designed and produced for reliable operation under the most hermetically sealed for safe dependable use in hostile atmospheres. We offer the benefits of both sputtered and electro plated contacts.

For detailed product information send for the Hamlin Reed Switch Catalog. The catalog provides complete information regarding specifications, dimensions, theory of operation, magnetic actuators, and reed switch application data.



MINIATURE MAGNETIC REED SWITCHES

SWITCH MODEL NUMBER	FORM	DIM. CODE	MAX. DC RATINGS	MAX. SWITCH AMPS	MAX. DC VOLTS	A.T. PULL-IN RANGE	SPECIAL FEATURES	SWITCH LIST PRICE	ACTUATOR MAGNET	MAGNET LIST PRICE
MITI-3-.084 **NEW**	A	10	3W	.25	150	10-25	Microminiature	2.54	H-31	.80
* MDSR-7-.084	A	1	10W	.50	200	10-25	Miniature Size	1.04	H-31	2.05
MDSR-5-.174 **NEW**	A	2	10W	.50	600	22-47	Breakdown 1500 Volts	3.45	H-33	1.15
MDRR-6-.104	A	3	10W	.50	300	12-38	High Voltage Hold-Off	.98	H-33	1.15
* MDRR-4-.104	A	3	10W	.50	200	12-38	Small Size	.81	H-33	1.15
MDSR-4-.104	A	2	10W	.50	200	12-38	.090 Diameter	.81	H-33	1.15
* MLRR-4-.174	A	3	20W	1.00	200	17-38	High Inrush	1.04	H-33	1.15
MLRR-2-.174	A	4	20W	1.00	200	17-43	High Inrush	1.04	H-33	1.15
* MARR-2-.125	A	4	10W	.75	200	12-38	Hi Rel	.86	H-33	1.15
MARR-8-.194	A	4	10W	.50	300	22-38	High Voltage	.98	H-33	1.15
* MARR-5-.174	A	4	10W	.50	1000	22-47	Breakdown 2000 Volts	2.99	H-33	1.15
MRPR-2-.174	A	5	50W	1.50	200	22-43	High Current	1.32	H-33	1.15
* MDRR-DT-.154	C	7	5W	.25	175	10-20	Small Size	3.45	H-33	1.15

STANDARD SIZE MAGNETIC REED SWITCHES

DRR-DTH-.556	C	8	30W	.50	500	50-100	High Breakdown	6.90	H-32	2.35
DRT-DTH-.356	C	8	50W	1.50	500	50-100	Inductive Loads	8.63	H-34	2.96

HIGH CURRENT MAGNETIC REED SWITCHES

DRR-129-.336	A	9	100W	3.00	400	52-102	High Current	3.85	H-34	2.96

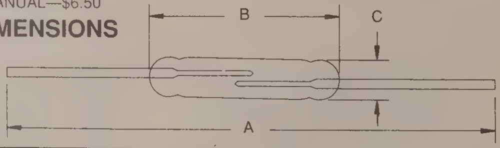
MERCURY WETTED MAGNETIC REED SWITCHES

MDC-3-.245	A	6	50W	2.00	500	35-65	Mercury Wet	4.60	H-33	1.05

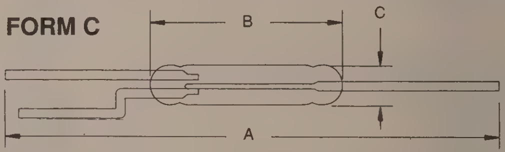
APPLICATION MANUAL—$6.50

SWITCH DIMENSIONS

FORM A



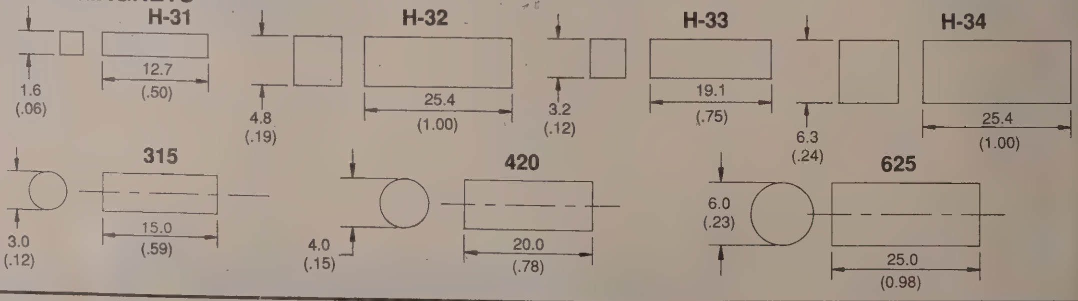
FORM C



**Dimension Code			1	2	3	4	5	6	7	8	9	10
A	Overall Length Nominal	Inch MM	1.590 40.38	1.590 40.38	1.590 40.38	2.230 56.65	2.230 56.64	1.580 40.13	2.066 52.47	3.375 85.72	3.250 82.55	1.235 31.36
B	Glass Length Max.	Inch MM	.500 12.70	.600 15.824	.600 15.24	.800 20.32	.800 20.32	.550 13.97	.580 14.73	1.562 39.67	2.000 50.80	.270 6.86
C	Glass Diameter Max.	Inch MM	.070 1.78	0.90 2.280	.105 2.660	.105 2.660	.112 3.300	.100 2.540	.105 2.660	.218 5.54	.207 5.250	.070 1.77

ALNICO V PERMANENT MAGNETS

MAGNET TYPE	PRICE 1-24
H-31	.80
H-32	2.05
H-33	1.15
H-34	2.45
315	1.30
420	1.50
625	3.00



HASCO / REED SWITCHES

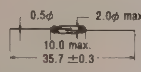
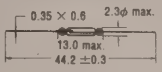
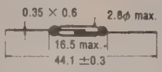
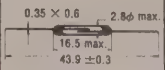
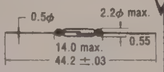
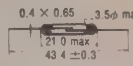
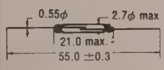
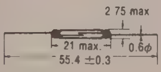
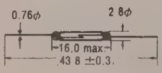
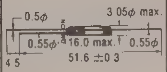
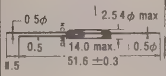
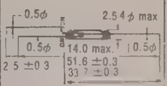
COMPONENTS INT'L., CORP.
SINCE 1976

OKI
electric industry company, ltd.

SAMPLES SENT SAME DAY!

Specifications

POLYMER FREE CONTACTS

							
		ORD-211	**ORD-221**	**ORD-225**	**ORD-2212**	**ORD-228**	**ORD-234**
Electrical Characteristics	Contact	1A	1A (offset)	1A	1A RLS/OP >0.8	1A	1A
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	150 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	150 min.	200 min.	250 min.	150 min.	200 min.	300 min.
	Insulation resistance [Ω]	10^9 min.	10^9 min.	10^{10} min.	10^9 min.	10^9 min.	10^{10} min.
	Electrostatic cap. [PF]	0.2 max.	0.3 max.	0.3 max.	0.3 max.	0.3 max.	0.5 max.
	Contact capacity [VA]	1.0	10	10	10	10	10
	Max. conductive curr. [A]	0.3	1.0	1.0	0.5	1.0	2.0
	Max. voltage [V]	24	100	100	100	100	200
Oper. Characteristics	Operate time [ms]	0.3 max.	0.3 max.	0.4 max.	0.3 max.	0.3 max.	0.5 max.
	Bounce time [ms]	0.3 max.	0.3 max.	0.4 max.	1.0 max.	0.3 max.	0.5 max.
	Release time [ms]	0.05 max.	0.05 max.	0.05 max.	0.1 max.	0.05 max.	0.05 max.
	Resonant frequency [Hz]	8600 ±500	2750 ±250	3700 ±300	4200 ±200	5300 ±300	2200 ±300
	Max operating freq. [Hz]	500	500	500	500	500	500
Standard Coil	Coil resistance [Ω]	600	450	450	450	450	500
	No. of turns [T]	5000	5000	5000	5000	5000	5000
	Dimensions [mm]	2.0 x 10	2.9 x 15	2.9 x 15	2.9 x 15	2.9 x 15	3.6 x 20
	Type No.	8	6	6	6	6	3
Features (Contact material)		Ultra-miniature Rh	Miniature offset (Rh)	General purpose miniature (Rh)	Drop-out Pull-in >0.8 (Rh)	General purpose miniature (Rh)	Long life (Rh)
					 0.5ϕ 3 05ϕ max. 0.55ϕ 16.0 max. 0.55ϕ 4 5 51.6 ±0 3	 0 5ϕ 2.5 4ϕ max 0.5 14.0 max. 0.5ϕ .5 51.6 ±0.3	 0.5ϕ 2.5 4ϕ max 0.5ϕ 14.0 max. 0.5ϕ 2 5 ±0 3 51.6 ±0.3 33 7 ±0 3
		ORD-229	**ORD-2210**	**ORD-2211**	**ORT-233**	**ORT-551**	**ORT-551-1**
Electrical Characteristics	Contact	1A	1A	1A	1C	1C	1C
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	100 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	700 min.	300 min.	200 min.	200 min.	200 min.	200 min.
	Insulation resistance [Ω]	10^{10} min.	10^{10} min.	10^9.	10^9 min.	10^9 min.	10^9 min.
	Electrostatic cap. [PF]	0.2 max.	0.5 max.	0.3 max.	1.5 max.		
	Contact capacity [VA]	20	70	30W max.	3	3	3
	Max. conductive curr. [A]	2.0	2.5	0.5; in-rush 3	0.5	0.5	0.5
	Max. voltage [V]	250	100	100	30	30	30
Operating Characteristics	Operate time [ms]	0.5 max.	0.5 max.	0.6 max.	1.0 max.	1.0 max.	1.0 max.
	Bounce time [ms]	0.5 max.	0.5 max.	0.4 max.	(NC) 1.0 max. (NO) 1.5 max.	(NC) 1.5 max. (NO) 1.0 max.	(NC) 1.5 max. (NO) 1.0 max.
	Release time [ms]	0.1 max.	0.1 max.	0.05 max.	0.5 max.	0.5 max.	0.5 max.
	Resonant frequency [Hz]	2200 ±300	2350 ±250	4600 ±500	6000 ±4000		
	Max. operating freq. [Hz]	500	500	500	200		
Standard Coil	Coil resistance [Ω]	500	500	450	570		
	No. of turns [T]	5000	5000	5000	5000		
	Dimensions [mm]	2.8 x 18	3.6 x 20	2.9 x 15	3.6 x 10		
	Type No.	7	3	6	10		
Features (Contact material)		High breakdown voltage (Rh)	High power (Rh)	High inrush	Miniature transfer (Rh)	Ultra Miniature transfer (Rh)	Ultra Miniature transfer (Rh)

For a comprehensive engineering Reed Switch Catalog, contact factory. (High Vaccum Available)

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In spite of severe control of the sealing process, there is a slight probability that foreign matter such as magnetic particles may enter the glass. After extensive study in the detection of micro impurities, OKI has adopted the highly reliable flux scanning method. In flüx scanning, external magnetism is moved so that foreign matter near the reed is forced to jump to the contact part. The contact resistance then measured is used as the standard for the selection of characteristics. We have thus succeeded in remarkably improving the reliability of reed switches by replacing conventional visual checking with the latest flux scanning method.

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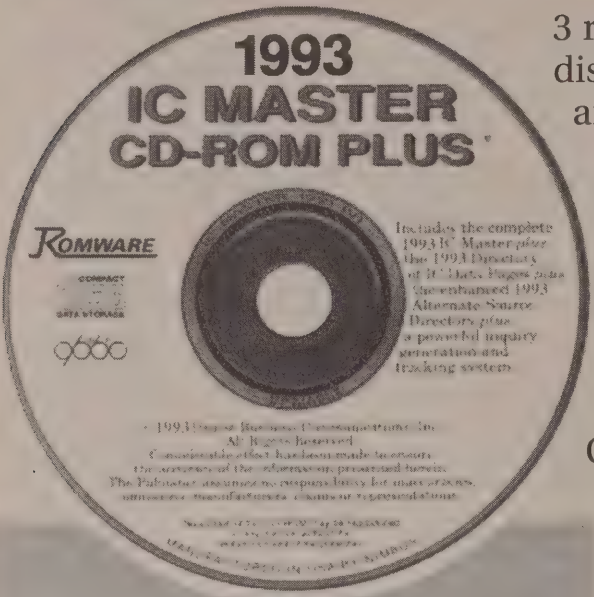
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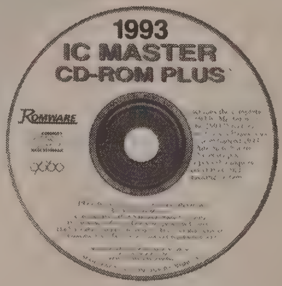
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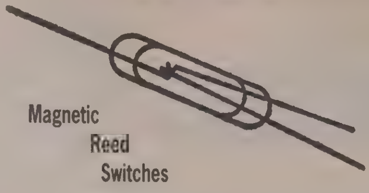
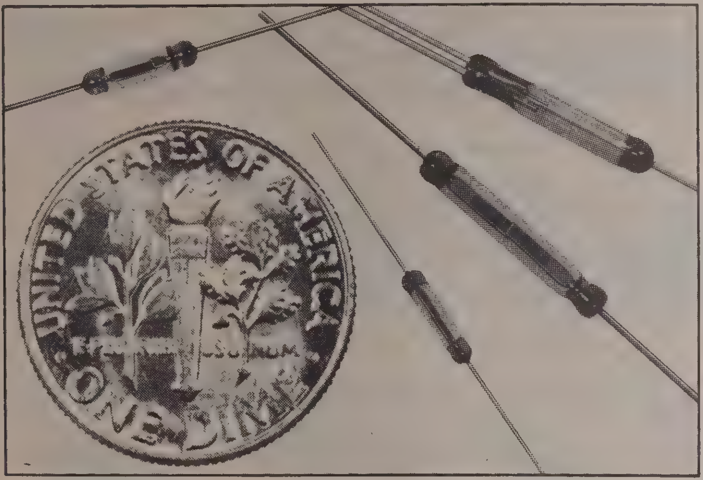
HERMETIC SWITCH





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Model	Form	Max D C. Watts	Max D C. Amps	Max D C. Volts	Stock Amp-Turn Pull-In Range	Overall Length Inches	Max Glass Dia. Inches	Max Glass Length Inches	Special Features
MICRO-MINIATURE									
HSR-003	A	.25	.01	30	5-20	1.050	.055	.210	AVAILABLE IN HI-REL AND COMMERCIAL GRADES
HSR-042	A	4	.20	100	10-35	1.850	.090	.370	
HSR-370	C	3	.10	30	15-35	1.490	.072	.485	
MINIATURE									
HSR-V100RF	A	10	1.0	220RMS	15-40	2.190	.110	.800	HIGH VOLTAGE RF SMALL GLASS DIAMETER
HSR-1015	A	10	.50	200	15-40	2.190	.101	.800	
HSR-520	C	3	.25	100	15-45	2.000	.125	.600	
STANDARD									
HSR-190	A	15	1.0	250	40-80	3.230	.210	2.100	FULL SIZE ECONOMICAL
HSR-780	A	25	1.5	500	60-100	3.200	.215	2.000	
HSR-630	C	25	1.0	150	40-80	3.390	.210	1.350	
HIGH POWER									
HSR-134	A	100	3.0	50	60-100	3.390	.210	1.300	POWER SWITCHING IN 100 TO 200 WATT RANGE
HSR-V205	A	200	3.0	2500	100-150	3.230	.210	2.100	
HSR-V936	C	100	3.0	2500	60-100	2.810	.210	1.400	
HIGH VOLTAGE									
HSR-790	A	50	2.5	1000	60-100	3.230	.215	2.000	UP TO 10,000 VDC DIELECTRIC
HSR-V7K	A	50	3.0	5000	60-125	3.230	.210	2.100	
HSR-V10K	A	50	3.0	7500	100-150	3.230	.210	2.100	

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IDEC Selection Guide Oiltight Pushbuttons

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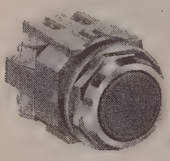
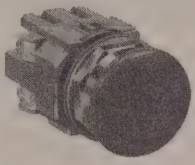
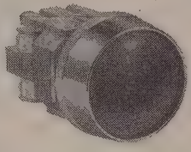
In Canada: (604) 946-1271, Fax: (604) 946-0368

TWTD Series ø1-13/64" (30mm) Pushbuttons NEMA Type 4, 4X, 13 (Watertight/Oiltight/Corrosion Resistant)

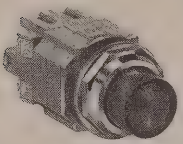
Non-Illuminated Pushbuttons

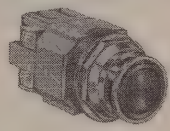

Flush Button

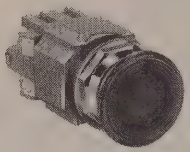

Mushroom


Mushroom Button w/Full Shroud

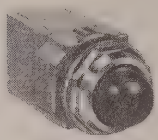
Illuminated Pushbuttons (LED & Incandescent)

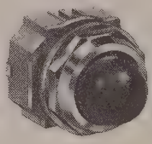

Extended Lens Full Voltage


Extended Lens w/Full Shroud Full Voltage

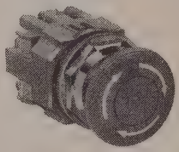

Mushroom Lens Full Voltage

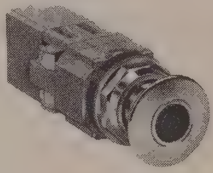
Pilot Lights (LED & Incandescent)


Dome Lens Transformer Type

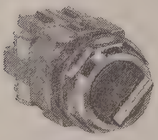

Dome Lens Full Voltage

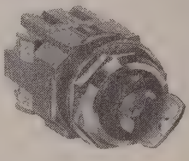
Special Function Pushbuttons


Non-Illuminated Pushlock Turn Reset


Illuminated Push-Pull Transformer Type

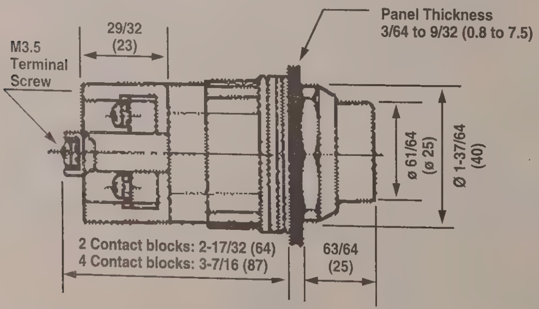
Selector Switches


Knob Selector


Key Selector

Dimensions Dimensions in inches (mm)

Illuminated Pushbutton, Full Voltage Type, Extended Lens


Panel Thickness
3/64 to 9/32 (0.8 to 7.5)
29/32
(23)
M3.5
Terminal
Screw
ø 61/64
(ø 25)
Ø 1-37/64
(40)
2 Contact blocks: 2-17/32 (64)
4 Contact blocks: 3-7/16 (87)
63/64
(25)

General Specifications

Contact Resistance: 50mΩ, maximum (initial value)

Insulation Resistance: 100MΩ , minimum,
Between live/dead parts

Dielectric Strength: 2,500V AC 1 minute
Between live/dead parts

Mechanical Life (Minimum Operations):
Pushbuttons & Lighted Pushbuttons:
Momentary: 5,000,000 operations
Others: 500,000 operations
Unlighted & Lighted Selector Switches:
500,000 opeations

Electrical Life (Minimum Operations):
500,000 operations (except pilot lights)
Operating Frequency: 30 operations/minute
Duty Rated: 40%

Approvals: UL Listed, CSA Certified

NEMA Ratings

Lighted Pushbuttons **Non-Lighted Pushbuttons** **Pilot Lights** **Lighted Selector Switches** **Non-Lighted Selector Switches**	Type 1, 2, 3, 3R, 4, **4X**, 5, 12, 13
Keylock Operated Switches	Type 1, 2, 3R, 5, 13

Contact Ratings

Rated Operational Current:	AC (Induct.)	DC (Resist.)
	120V/6A	120V/2A
	240V/3A	240V/1.1A
	480V/1.5A	480V/0.4A
	600V/1.2A	12V/4A
		24V/4A

Rated Thermal Current: 10A

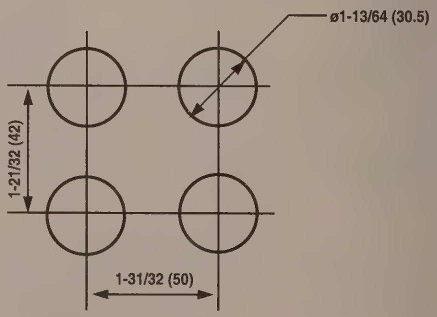
Minimum Switching Capacity: *5mA @ 3V AC/DC*

Rated Insulation Voltage: 600V AC/DC

UL Rating: 600V, maximum (Heavy Pilot Duty)

Panel Cut-Out Dimensions in inches (mm)

Note: Panel cut-out dimensions applicable for all pushbutton operators. Mushroom button with full shroud requires wider spacing between switches.



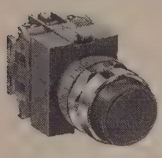
For Complete Information On IDEC's Oiltight Control Units, See Catalog No. U900.

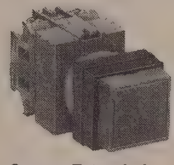
IDEC Selection Guide
Oiltight Pushbuttons

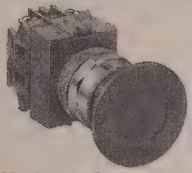
IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211
Telephone: (408) 747-0550, Fax: (408) 744-9055, Catalog Requests: 800-262-IDEC
In Canada: (604) 946-1271, Fax: (604) 946-0368

TW Series ø7/8" (22mm) Miniature Pushbuttons
NEMA Type 4, 4X, 13 (Watertight/Oiltight/Corrosion Resistant)

Non-Illuminated Pushbuttons

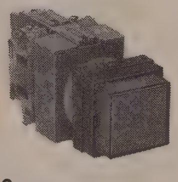

Extended Button

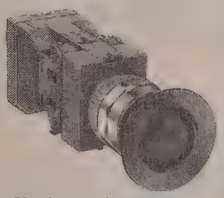

Square Extended


Mushroom Button

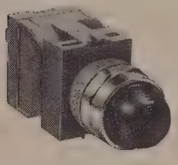
Illuminated Pushbuttons - LED & Incandescent

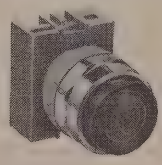
Extended Lens
Transformer Type

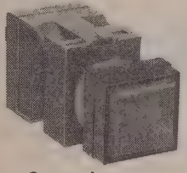

Square
Extended Lens
Full-Voltage


Mushroom Lens
Transformer Type

Pilot Lights - LED & Incandescent


Dome Lens
Transformer Type

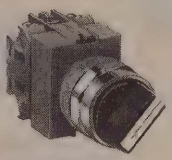

Flush Lens
Full Voltage


Square Lens
Transformer Type

Special Function Pushbuttons

Illuminated
Pushlock Turn Reset
Full Voltage

Selector Switches

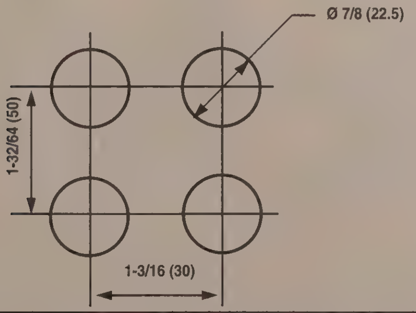

Knob Selector
(Keylock Selector
also available)

Monolever Switches

Standard Lever

Panel Cut-Out Dimensions in inches (mm)

Note: Panel cut-out dimensions applicable for all pushbutton operators. Mushroom button with full shroud requires wider spacing between switches.



General Specifications

Contact Resistance: 50mΩ, maximum (initial value)

Insulation Resistance: 100MΩ , minimum,
Between live/dead parts

Dielectric Strength: 2,500V AC 1 minute
Between live/dead parts

Mechanical Life (Minimum Operations):
Pushbuttons & Lighted Pushbuttons:
Momentary: 5,000,000 operations
Others: 500,000 operations
Unlighted & Lighted Selector Switches:
500,000 opeations

Electrical Life (Minimum Operations):
500,000 operations (except pilot lights)
Operating Frequency: 30 operations/minute
Duty Rated: 40%

Approvals: UL Listed, CSA Certified

NEMA Ratings

Lighted Pushbuttons Non-Lighted Pushbuttons Pilot Lights Lighted Selector Switches Non-Lighted Selector Switches	Type 1, 2, 3, 3R, 4, **4X**, 5, 12, 13
Keylock Operated Switches	Type 1, 2, 3R, 5, 13

Contact Ratings

Rated Operational Current:	AC (Induct.)	DC (Resist.)
	120V/6A	120V/2A
	240V/3A	240V/1.1A
	480V/1.5A	480V/0.4A
	600V/1.2A	12V/4A
		24V/4A

Rated Thermal Current: 10A

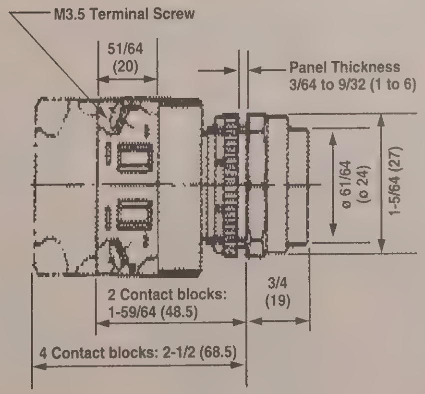
Minimum Switching Capacity:5mA @ 3V AC/DC

Rated Insulation Voltage: 600V AC/DC

UL Rating: 600V, maximum (Heavy Pilot Duty)

Dimensions Dimensions in inches (mm)

Non-Illuminated Pushbutton, Extended Button


M3.5 Terminal Screw
51/64 (20)
Panel Thickness 3/64 to 9/32 (1 to 6)
ø 61/64 (ø 24)
1-5/64 (27)
2 Contact blocks: 1-59/64 (48.5)
3/4 (19)
4 Contact blocks: 2-1/2 (68.5)

For Complete Information On IDEC's Oiltight Control Units, See Catalog No. U900.

idec
CORPORATION

Miniature Pushbuttons Thumbwheel Switches

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Catalog Requests : 800-262-IDEC
In Canada: Telephone: (604) 946-1271, Fax: (604) 946-0368

A Series Pushbuttons, Selector & Keylock Switches

Dimensions in inches (mm).

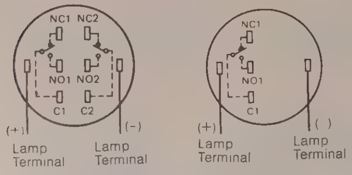
Features

- Compact .630"(16mm) diameter mounting
- Switching from 3A, 250V AC/DC maxmium down to 1mA, 5V AC/DC
- Oiltight IP65 or enclosed IP40 construction
- 1 Form C and 2 Form C contact configuration
- Pushbutton units available in non-illuminated and illuminated models
- Round, square and rectangular lens/buttons available in standard and large size
- Choice of LED and incandescent lamp
- Momentary or alternate switch action
- Keylock and selector switches available in 2 and 3 postions

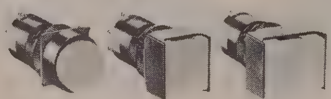
Contact Ratings

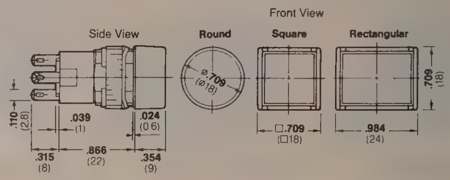
Contact Configuration: 1 or 2 Form C
Contact Material: Gold-clad Silver
Maximum Switching Load: 3A, 250V AC/DC
Minimum Switching Load: 1mA, 5V AC/DC

Terminal Arrangements

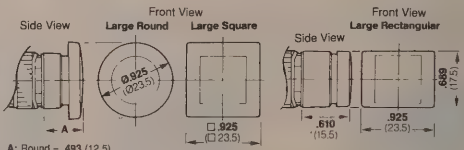

NC1
NC2
NO1
NO2
C1
C2
(+)
(-)
Lamp Terminal
Lamp Terminal
NC1
NO1
C1
(+)
( )
Lamp Terminal
Lamp Terminal

Standard Lens/Buttons



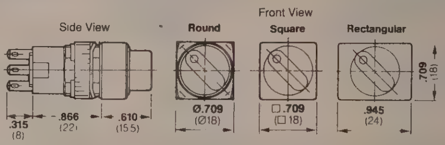

Front View
Side View
Round
Square
Rectangular
Ø.709 (Ø18)
.709 (18)
.110 (2.8)
.039 (1)
.024 (0.6)
□.709 (□18)
.984 (24)
.315 (8)
.866 (22)
.354 (9)

Large Lens/Buttons

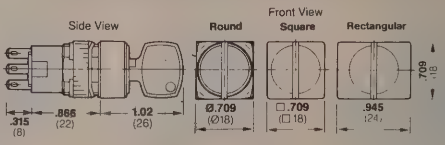

Front View
Side View
Large Round
Large Square
Front View
Large Rectangular
Side View
Ø.925 (Ø23.5)
.689 (17.5)
A
□.925 (□23.5)
.610 (15.5)
.925 (23.5)

A: Round = .493 (12.5)
Square = .610 (15.5)

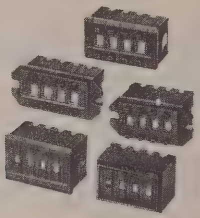
Selector Switches

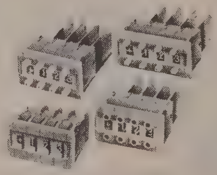

Front View
Side View
Round
Square
Rectangular
.709 (18)
.315 (8)
.866 (22)
.610 (15.5)
Ø.709 (Ø18)
□.709 (□18)
.945 (24)

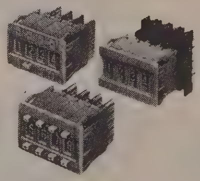
Keylock Switches

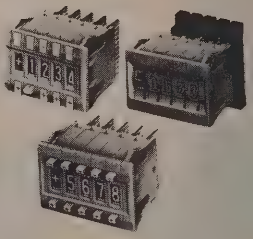

Front View
Side View
Round
Square
Rectangular
.709 (18)
.315 (8)
.866 (22)
1.02 (26)
Ø.709 (Ø18)
□.709 (□18)
.945 (24)

Thumbwheel Switches









Specifications	DL Series	DE & DJ Series	DF & DK Series	DG Series
No. of Positions	10	10	10, 12, 16	10, 12, 16
Output Codes	2-Position Repeat, BCD BCD Complementary	2-Position Repeat, BCD, Decimal	Decimal, BCD, Complementary BCD, BCD w/Odd Parity, Duodecimal, Hexadecimal	Decimal, BCD, Complementary BCD, BCD w/Odd Parity, Duodecimal, Hexadecimal
Terminal Style	Solder, PC Board	Solder, PC Board	Solder, PC Board	Solder, PC Board
Operator Style	Thumbwheel, Dual Button, Pen-Touch	Thumbwheel, Dual Button, Set-Lock, Pen-Touch	Thumbwheel, Dual Button, Set-Lock,	Thumbwheel, Dual Button, Set-Lock,
* Unit Assembly	Snap-Fit	Snap-Fit	Snap-Fit	Snap-Fit
Panel Mounting	Front & Rear	Front & Rear	Front & Rear	Front & Rear
Operational Voltage	50V AC, 5V to 28V DC	50V AC, 5V to 28V DC	50V AC, 5V to 28V DC	50V AC, 5V to 28V DC
Oprational Current	0.1A (Resistive Load)	0.1A (Resistive Load)	0.1A (Resistive Load)	0.1A (Resistive Load)
Thermal Current	0.5A (Non-Switching)	0.5A (Non-Switching)	0.5A (Non-Switching)	0.5A (Non-Switching)
Mechanical Life	50,000/oper. minimum	300,000/oper. minimum	1,000,000/oper. minimum	1,000,000/oper. minimum
Front Mount Unit Size - W x H	.197 (5) x .708 (18) .200 (5.08) x .708 (18) .236 (6) x .708 (18)	DE: .236 (6) x .708 (18) DJ: .300 (7.62) x .708 (18)	DF: .315 (8) x .944 (24) DK: .300 (7.62) x .944 (24)	.315 (8) x 1.30 (33)

Dimensions in inches (mm)

eem

MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

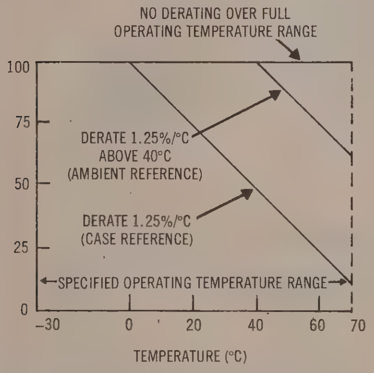


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

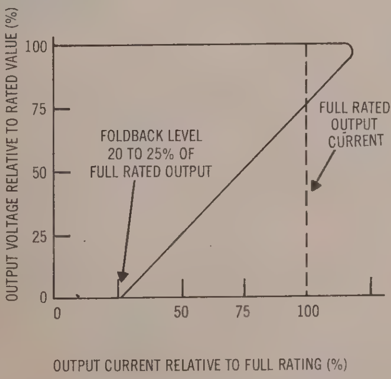


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

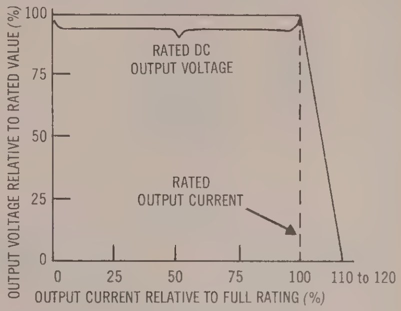


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

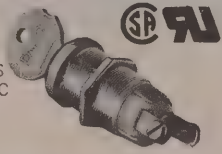
Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

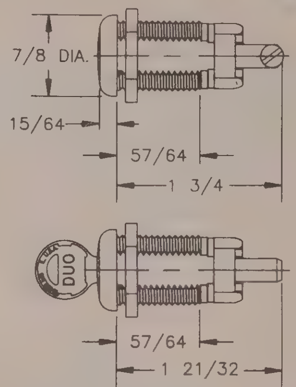
SWITCHLOCKS

Illinois Lock Company A DIVISION OF THE EASTERN COMPANY

LQ1



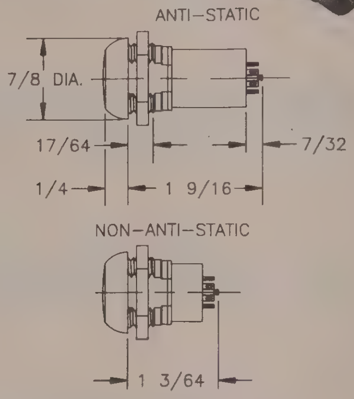
ELECTRICAL RATINGS
5 Amps @ 115 VAC
5 Amps @ 24 VAC


7/8 DIA.
15/64
57/64
1 3/4
DUO
57/64
1 21/32

AVAILABLE WITH THE 'DUO' HIGH SECURITY MECHANISM.

LQ17CC

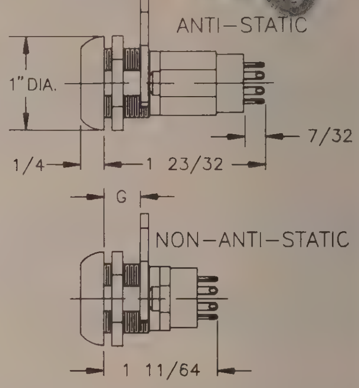
ELECTRICAL RATINGS
200 m.A. @ 28 VDC
150 m.A. @ 115 VAC


ANTI-STATIC
7/8 DIA.
17/64
7/32
1/4
1 9/16
NON-ANTI-STATIC
1 3/64

STANDARD & 20KVDC ANTI-STATIC
CENTER COMMON SWITCHES

LQ20

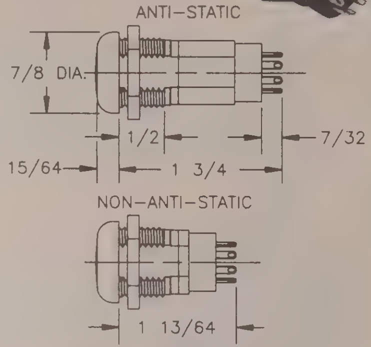
ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC


ANTI-STATIC
1" DIA.
7/32
1/4
1 23/32
G
NON-ANTI-STATIC
1 11/64

STANDARD & 20KVDC ANTI-STATIC
ROTARY SLIDE SWITCHES

LQ23

ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC


ANTI-STATIC
7/8 DIA.
1/2
7/32
15/64
1 3/4
NON-ANTI-STATIC
1 13/64

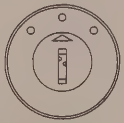
STANDARD & 20KVDC ANTI-STATIC
ROTARY SLIDE SWITCHES

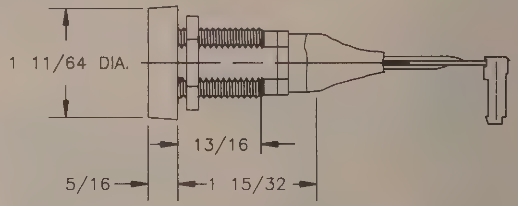
LQ21

SWITCHLOCK WITH ILLUMINATED POSITION INDICATORS
GREEN, RED, YELLOW, & ORANGE L.E.D.'S

ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC
OR
ELECTRICAL RATINGS
200 mA @ 28 VDC
150 mA @ 115 VAC

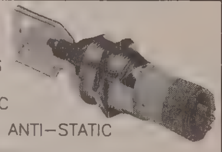
AVAILABLE WITH:
- 36°, 45°, OR 90° INDEXING
- MAINTAINING-MOMENTARY OR DOUBLE-MOMENTARY
- HARNESSING TO YOUR SPECIFICATIONS
- UP TO 4 L.E.D.'S



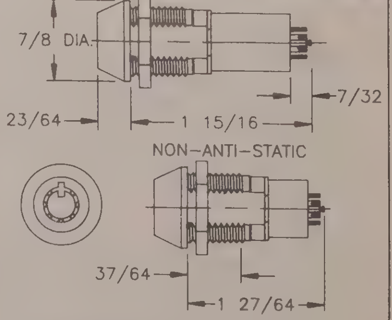

1 11/64 DIA.
13/16
5/16
1 15/32

NEW!
NOW AVAILABLE WITH BI-COLOR L.E.D.'S

LQ13CC

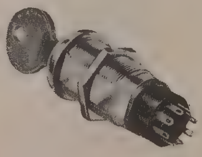


ELECTRICAL RATINGS
200 mA @ 28 VDC
150 mA @ 115 VAC

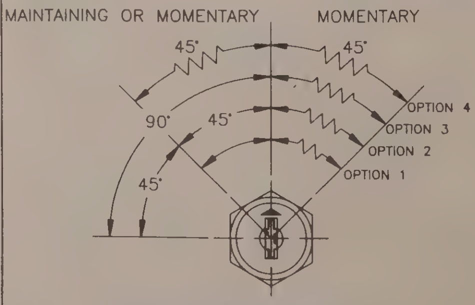

ANTI-STATIC
7/8 DIA.
23/64
7/32
1 15/16
NON-ANTI-STATIC
37/64
1 27/64

STANDARD & 20KVDC ANTI-STATIC
CENTER COMMON SWITCHES

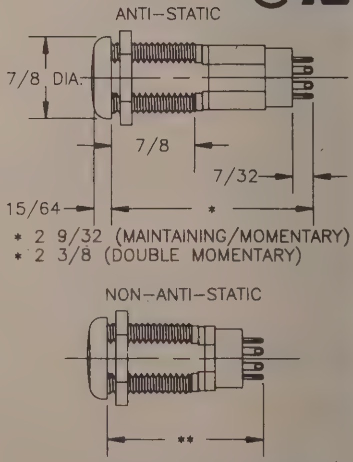
LQ14



ELECTRICAL RATINGS
4 Amps @ 125 VAC
2 Amps @ 250 VAC
4 Amps @ 28 VDC


MAINTAINING OR MOMENTARY
MOMENTARY
45°
45°
90°
45°
45°
OPTION 4
OPTION 3
OPTION 2
OPTION 1

STANDARD & 20KVDC ANTI-STATIC
ROTARY SLIDE SWITCHES


ANTI-STATIC
7/8 DIA.
7/8
7/32
15/64
*
NON-ANTI-STATIC
**

* 2 9/32 (MAINTAINING/MOMENTARY)
* 2 3/8 (DOUBLE MOMENTARY)

** 1 3/4 (MAINTAINING/MOMENTARY)
** 1 27/32 (DOUBLE MOMENTARY)

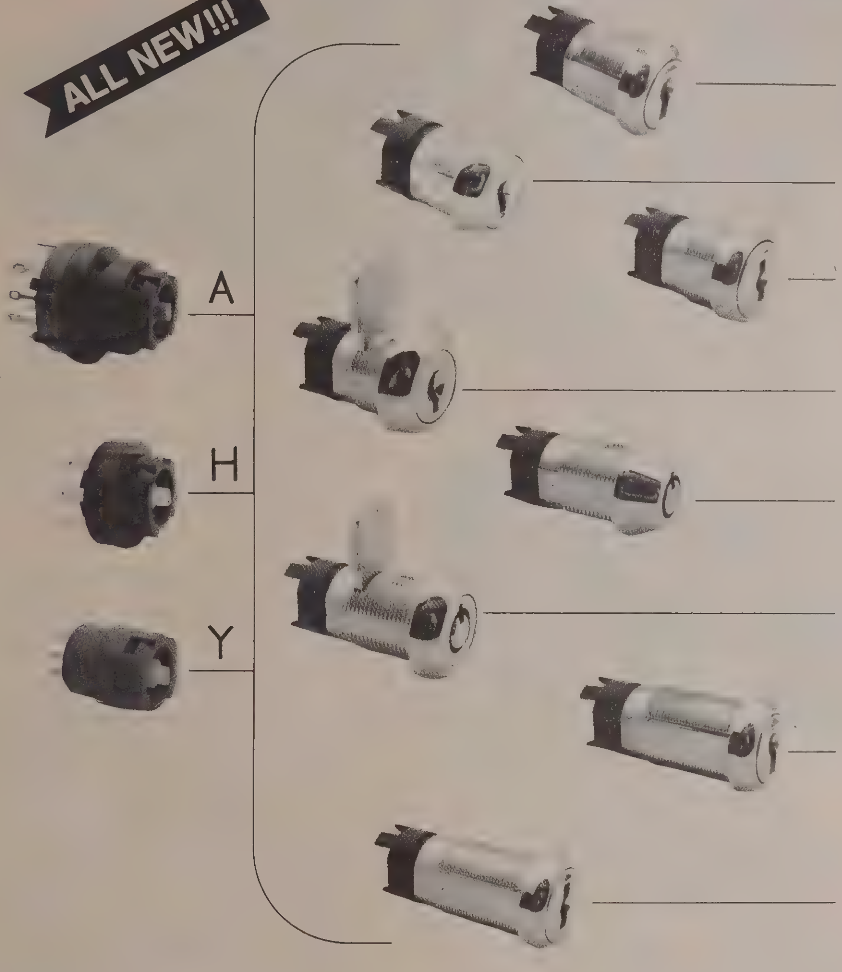
301 West Hintz Road, Wheeling IL 60090-5754 *Phone (708)537-1800 * Fax (708)537-1881*

SWITCHLOCKS

Illinois Lock Company A DIVISION OF THE EASTERN COMPANY

VERSATILE SWITCHLOCK LINE OFFERING VARYING LEVELS OF SECURITY ALONG WITH A WIDE RANGE OF ELECTRICAL RATINGS IN A CONVENIENT SNAP TOGETHER UNIT.

ALL NEW!!!



LQ25 5 TUMBLER MECHANISM. SINGLE BITTED KEY.

LQ26 4 TUMBLER MECHANISM. SINGLE BITTED KEY.

LQ27 6, 8, OR 10 TUMBLERS. DOUBLE BITTED KEY.

LQ28 CAM/SWITCHLOCK. 4 TUMBLER MECHANISM. SINGLE BITTED KEY.

LQ29 7 PIN TUMBLERS. TUBULAR KEY.

LQ30 CAM/SWITCHLOCK. 7 PIN TUMBLERS. TUBULAR KEY.

LQ31 MAINTAINING/MOMENTARY OR DOUBLE MOMENTARY. 5 TUMBLER MECHANISM. SINGLE BITTED KEY.

LQ32 THE 'DUO' MECHANISM. FEATURING A 14 TUMBLER SECURITY MECHANISM WITH A TRIPLE BITTED KEY

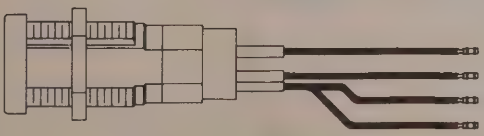
ELECTRICAL RATINGS

A SERIES
CONTACT RATING: Switch—2.5 AMPS @ 125 V AC or 28 V DC; 150 mA @ 250 V AC or DC (UL/CSA).

H SERIES
CONTACT RATING: 12 AMPS @ 125 V AC or 28 V DC; 6 AMPS @ 250 V AC; 1 AMP @ 125 V DC (UL/CSA).

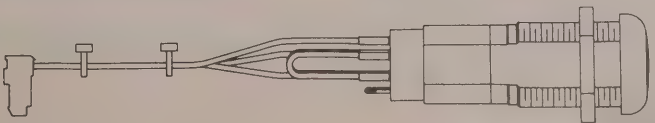
Y SERIES
CONTACT RATING: 4 AMPS @ 125 V AC or 28 V DC; 2 AMPS @ 250 V AC (UL/CSA).

LET **Illinois Lock Company** BE YOUR HARNESS SUPPLIER.



SEND US YOUR REQUIREMENTS AND YOU CAN RECEIVE YOUR SWITCHLOCK QUOTATION WITH AND WITHOUT THE WIRE HARNESS.

WORLD'S LARGEST SELECTION OF SWITCHLOCKS FOR STANDARD AND OEM APPLICATIONS.



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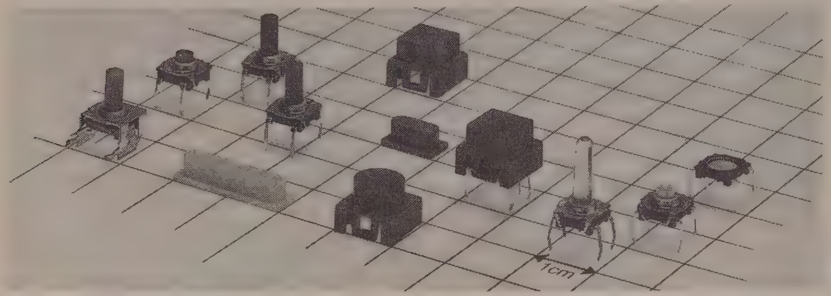
ITT Schadow

Key switches and Push Button Switches

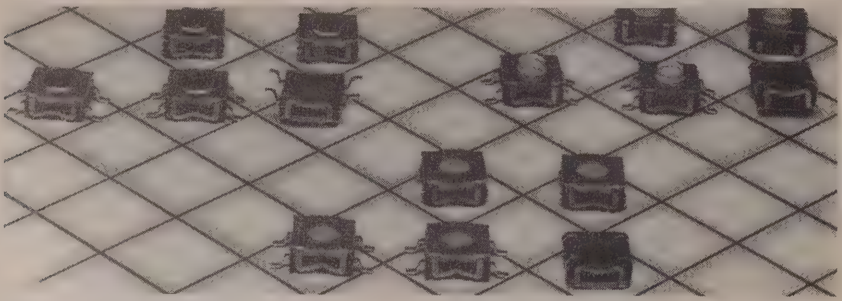


KSA SERIES

High Volume - Key Switches

The KSA family of Ultra-Miniature key switches are designed for applications needing compact PC board spacing. Furthermore, reduced processing cost and simpler material handling are direct results of the innovative KSA design. Constructed in a standard IC dimension, the KSA can be auto insertable and is available sealed to an EIA standard for soldering and washing.

- ☐ Sealed to flux
- ☐ Straight terminals for auto insertion
- ☐ Silver or Gold contacts
- ☐ Sealed for soldering and immersion cleaning per EIA 448-2 optional
- ☐ Bent terminals for board retention
- ☐ .200 x .300 (5.08 x 7.62) footprint size for compact designs
- ☐ ESD terminal for component protection
- ☐ Custom actuator lengths available, please consult factory.

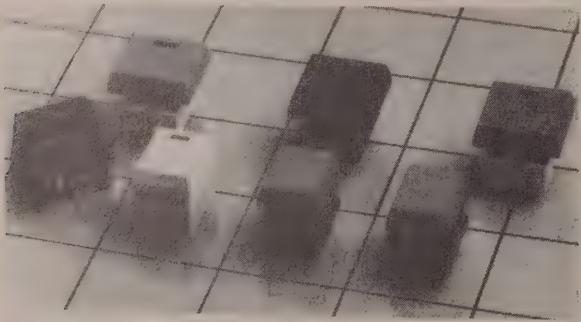


KSC SERIES

Surface mount Key switches

The KSC family of ultra low profile SPST key switches are designed for surface mounting technology (SMT). The KSC is the first surface mount key switch to sustain all the major (SMT) soldering processes. The KSC is also compatible with most automatic insertion equipment for reduced manufacturing assembly costs.

- ☐ Positive tactile feedback
- ☐ With or without raised actuator
- ☐ Operating force 160, 300, or 500 grams
- ☐ Silver or Gold contacts
- ☐ Tin plated terminals for easy soldering
- ☐ Gull wing or J-type terminal
- ☐ Conform to main soldering methods for surface mounted components
- ☐ Can be used with Major Automatic "Pick & Place" Machines
- ☐ Package is thermoformed tape on reel of 2000 pieces



DIGITAST

High Performance - Key Switches

Digitast is a versatile modular electronic component specially designed for use with dual in-line packages. The switch has vibration free, short smooth travel through it's pivoting cap design.

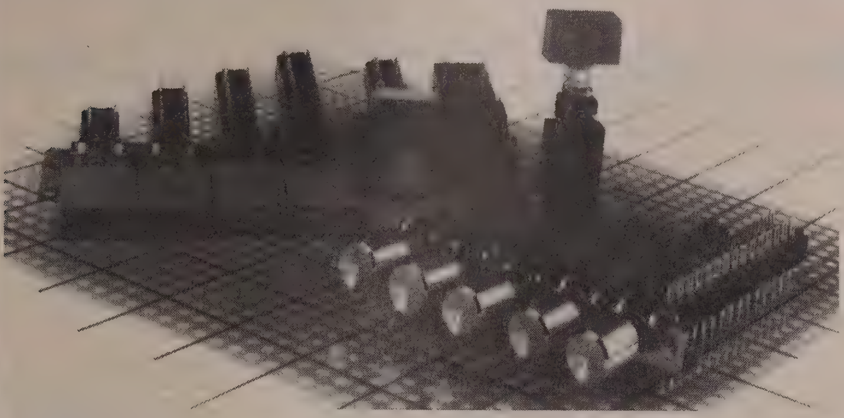
- ☐ Short travel .120 (3.00mm)
- ☐ Over center spring contact system
- ☐ Dual in line package dimensions
- ☐ Two standoffs for ease of cleaning and parallel mounting
- ☐ Long life: over 5 million operations momentary action
- ☐ Gold contacts
- ☐ Push/push action
- ☐ Custom caps available
- ☐ Tactile feel
- ☐ "Outstanding Design" award winner
- ☐ Double or triple caps for keyboard use
- ☐ Sealed terminals standard
- ☐ Incandescent STFB option
- ☐ Legending, 27 Cap styles
- ☐ SPDT contacts, ESD protection

ITT Schadow

8081 Wallace Road, Eden Prairie, MN 55344 • Tel: (612) 934-4400 • Fax: (612)934-9121

ITT Schadow

Key switches and Push Button Switches



F SERIES

Miniature Push Button Switches

F Series Push Button Switches form a versatile system of modules, and with almost infinite variations cover a wide range of applications.

- ☐ Constant coil spring tension at the contact points provide positive self-cleaning action
- ☐ Up to 16 poles per module
- ☐ Terminal styles optional
- ☐ Mounting frames (chassis) with maximum 23 positions and six variations of spacing
- ☐ Configurations with illuminated push buttons
- ☐ Configurations with lampless status indicators
- ☐ Custom designs
- ☐ Plunger extensions
- ☐ Enclosed housing
- ☐ Choice of power switches
- ☐ Line switches UL, CSA and VDE recognized and certified

Technical Data	**Digitast**	**KSA Silver**	**KSA Gold**	**KSC**	**F Series**
Electrical Data					
Contact arrangement	SPDT	SPST	SPST	SPST	2PDT-16PDT
Contact material	Cu/Zn*	silver	gold	silver	silver
Switching current max.	10mA	50 mA	10 mA	50 mA	0.4A
Switching current min.		1 mA	1 mA	1 mA	
Switching voltage max.	24V DC	50 V	50 V	50 V	125 V
Switching voltage min.		20 mV	20 mV	20 mV	
Switching power max.	240 mW	1 VA	0.2 VA	< 1VA	50 W
Operating life	5,000,000	500K-1000K		500,000	100,000
Contact resistance initial	≤ 50 mΩ max.	50 mΩ	50 mΩ	100 mΩ	Typ <10mΩ
Insulation resistance min.	$\geq 10^9\Omega$	100K MΩ	100K MΩ	10^3MΩ	≥1 x $10^9\Omega$
Dielectric strength min. Vrms 1 min.		300 Vrms	300 Vrms	250Vrms	**
Contact bounce max.	≤2.5 ms	1 ms	1 ms	≤1 ms	
Mechanical Data					
Keycap travel	≤ .118 (3.00)	.019 to .023 (0.5 ±0.2)		0.25 to 0.4	
Operating force	150 grams	130-150 grams		160 grams	10 oz min
Function	Momentary Push/push	Momentary		Momentary	Momentary Push/push
Mounting	PC Board pins	PC Board pins		PC Board pins	PC/solder lugs
Illumination	Visible indication by LED	N/A		N/A	Incandescent LED
Environmental Data					
Operating Temperature Range	-25°C to +85°C	-25°C to +85°	-40°C to +125°	-40°C to + 90°C	-20°C to + 70°C
Storage Temperature Range				-55°C to +90°C	-40°C to +70°C
Soldering				+255°C/5 sec	+255°C/5 sec

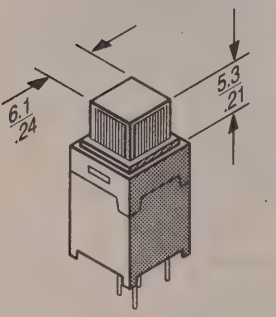
* alloy gold plated ** F series Dielectric Strength - frame to adjacent contacts, 1500 V - Contact gap, 1500 V - Between general use changeovers, 2500 V

ITT Schadow 8081 Wallace Road, Eden Prairie, MN 55344 • Tel: (612) 934-4400 • Fax: (612) 934-9121

ITW PUSHBUTTON SWITCHES

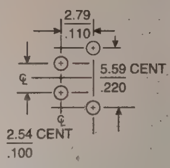
SERIES 39 LED MINIATURE

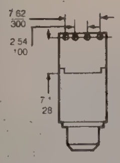
STANDARD SWITCH



RECOMMENDED P.C. BOARD PATTERN

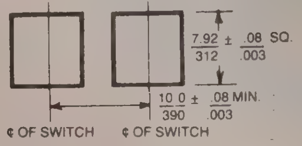
Direct Mount
Hole Sizes 1.00/.040
Pattern Tolerances ± .08/.003


2.79
.110
5.59 CENT
.220
2.54 CENT
.100

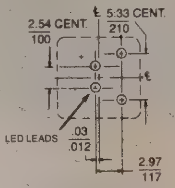

7.62
300
2.54
100
7.1
28

Right-angle mount connector

PANEL CUTOUT RECOMMENDATIONS

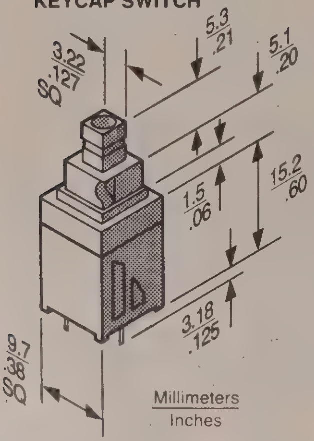

7.92 ± .08 SQ.
312 .003
10.0 ± .08 MIN.
390 .003
¢ OF SWITCH
¢ OF SWITCH

Maximum panel thickness 1.78/.070

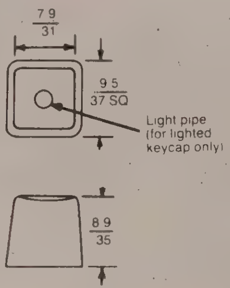

5:33 CENT.
210
2.54 CENT.
100
LED LEADS
.03
.012
2.97
117

In-line mount connector

KEYCAP SWITCH


3.22
.127
SQ
5.3
.21
5.1
.20
1.5
.06
15.2
.60
3.18
.125
9.7
.38
SQ
Millimeters
Inches

SQUARE KEYCAP


7.9
.31
9.5
.37 SQ
Light pipe
(for lighted
keycap only)
8.9
.35

FEATURES:

- Circuitry: SPST-NO-DB
- Momentary or maintained
- Bifurcated silver plated contacts
- Available in LED, lighted, non-lighted and indicator only versions
- Button styles: Standard–lighted & non-lighted; Keycap: Square–lighted and non-lighted
- Variety of colored lens and keycaps
- Electrical Rating: .25 amp @ 30 VDC max. RES
- CONNECTOR MOUNTING OPTIONS:
  39-800001–In-line mount connector
  39-800002–Right-angle mount connector

KEYCAP STYLE BUTTONS

Part No.	Lighted	Color
80-390101	Yes*	White
80-390102	Yes*	Light Grey
80-390103	Yes*	Dark Grey
80-390104	Yes*	Black
80-390105	No	White
80-390106	No	Light Grey
80-390107	No	Dark Grey
80-390108	No	Black

*Requires light pipe–P/N 80-390100

SWITCHES

Part No.	Lighted	LED Color	Button Color	Button Style	Switch Action
39-12101	Yes*	—	Clear	Standard	Momentary
39-12111	Yes*	—	Red	Standard	Momentary
39-12112	Yes*	—	Green	Standard	Momentary
39-12502	No	—	White	Standard	Momentary
39-12503	No	—	Red	Standard	Momentary
39-12506	No	—	Yellow	Standard	Momentary
39-12509	No	—	Black	Standard	Momentary
39-12601	Yes	Red	Clear	Standard	Momentary
39-12611	Yes	Red	Red	Standard	Momentary
39-12712	Yes	Green	Green	Standard	Momentary
39-12801	Yes	Yellow	Clear	Standard	Momentary
39-12813	Yes	Yellow	Yellow	Standard	Momentary
39-13101	Yes*	—	Clear	Standard	Maintained
39-13111	Yes*	—	Red	Standard	Maintained
39-13113	Yes*	—	Yellow	Standard	Maintained
39-13611	Yes	Red	Red	Standard	Maintained
39-22100	Yes*	—	—	Keycap	Momentary
39-22500	No	—	—	Keycap	Momentary

*LED not included–LED support P/N–80-390003 supplied in bulk

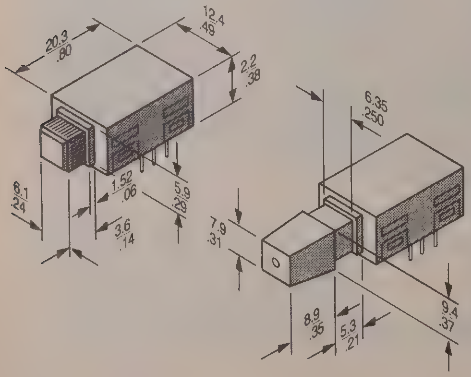
SERIES 39 PUSHBUTTON KIT

This kit is filled with over 300 Series 39 switches, buttons, keycaps, light pipes, connectors to build hundreds of Series 39 switch combinations.

To order: 39-KIT

SERIES 39 MR. CLEAN

Wave Solderable Miniature Pushbutton


12.4
.49
20.3
.80
2.2
.38
6.35
.250
6.1
.24
1.52
.06
5.9
.29
3.6
.14
7.9
.31
8.9
.35
5.3
.21
9.4
.37

DESCRIPTION

Only the terminal base of this unique switch is exposed to the soldering and cleaning process. The Mr. Clean Series 39 base is compatible with fluorinated, chlorinated and aqueous cleaning methods. After the cleaning process is complete, the switch body is snapped onto the switch base for a contaminant-free, reliable switch.

Bifurcated, silver plated switch contacts provide the proven switching integrity required for logic loads. The Mr. Clean Series 39 switch has a unique wiping, self-cleaning action that maintains contact reliability.

SWITCH SPECIFICATIONS

Characteristics:

Contact rating: 0.25 AMP @30 VDC max. resistive

Dielectric withstanding voltage: 1,000 VRMS (1 milliamp max. leakage)

Life: Momentary: 250,000 cycles

Maintained: 25,000 cycles

Button travel: .120 nominal

Operating Force: 8 Oz. nominal

Resistance to solder heat: 500°F (260°C) for 2 Sec.

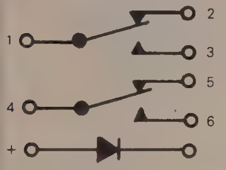
ITW Switches
6615 W. Irving Park Rd. • Chicago, IL 60634
(312) 282-4040 • FAX (312) 545-4450

ITW PUSHBUTTON SWITCHES

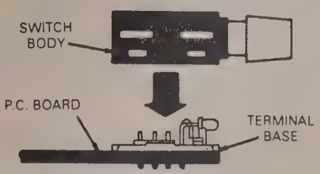
SERIES 39 MR. CLEAN

Wave Solderable Miniature Pushbutton

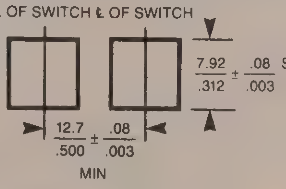
SCHEMATIC DPDT (FORM CC)



INSTALLATION

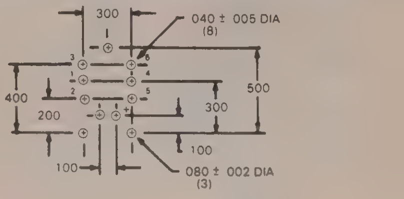

SWITCH BODY
P.C. BOARD
TERMINAL BASE

PANEL CUTOUT RECOMMENDATIONS


℄ OF SWITCH ℄ OF SWITCH
7.92 ± .08 SQ
.312 .003
12.7 ± .08
.500 .003
MIN

Maximum panel thickness: 1.78 / .070

RECOMMENDED P.C. BOARD HOLE PATTERN (COMPONENT SIDE)


300
040 ± 005 DIA (8)
400
500
200
300
100
100
080 ± 002 DIA (3)
1
2
3
4
5
6
+

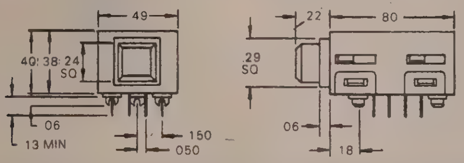
• Button Style Assemblies **39 - 4 2 3 2 08**

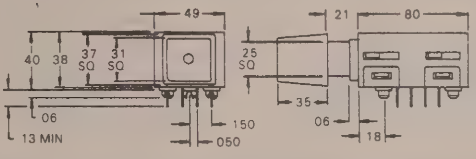
FORM	FUNCTION	LIGHTING OPTION	BUTTON COLOR NON-LIGHTED	LIGHTED
2 Switch module and terminal base unassembled	2 DPDT-SB, momentary 3 DPDT-SB, maintained	1 Non-lighted 5 High-bright red LED 6 High-bright green LED 7 High-bright yellow LED	06 Black	08 Red 09 Green 10 Yellow

• Keycap Style Assemblies **39 - 5 2 2 1 01**

FORM	FUNCTION	LIGHTING OPTION	KEYCAPS
2 Switch module and terminal base unassembled	2 DPDT-SB, momentary 3 DPDT-SB, maintained	1 Non-lighted 5 High-bright red LED 6 High-bright green LED 7 High-bright yellow LED	01 Plunger (Keycap and Light Pipe ordered separately)

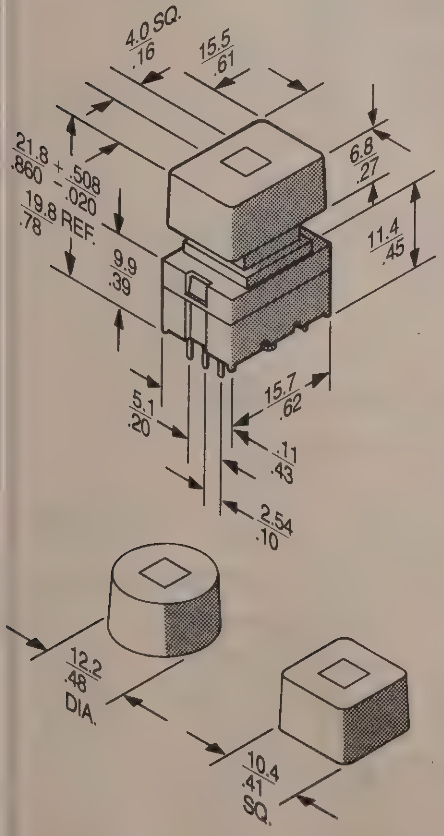
* see keycap in Series 39 LED Miniature Section


49
40: 38: 24 SQ
06
13 MIN
150
050
22
80
.29 SQ
06
18


49
40
38
37 SQ
31 SQ
06
13 MIN
150
050
21
80
25 SQ
35
06
18

SERIES 37

Wave Solderable/Washable Pushbutton


4.0 SQ.
.16
15.5
.61
21.8 + .508
.860 - .020
19.8 REF.
.78
6.8
.27
11.4
.45
9.9
.39
5.1
.20
15.7
.62
.11
.43
2.54
.10
12.2
.48
DIA.
10.4
.41
SQ.

MECHANICAL AND LED INDICATOR FEATURES

- ESD (Electrostatic discharge) resistant to 15 kV
- Compact size
- Contacts are designed for reliable low energy switching
- Switch contacts have Low audible noise—Low voltage noise
- Momentary and maintained action versions
- Compatible with most common soldering and cleaning processes*

*Deionized aqueous wash is recommended. Consult ITW Switches regarding your specific procedures.

MECHANICAL INDICATOR FEATURES

- Maintained action provides LSR function (Last Status Retention)
- "Snap-in, stay-put" design (patent applied for) keeps the switch in position during wave soldering
- Unique indicator provides dual color-coded status
- Status indicator function requires no power

ORDERING INFORMATION

Consult factory regarding any special requirements.

Mechanical 37-☐ ☐ ☐ ☐

Indicator	Switch Function	Free Position Indicator Color	Maintained Position Indicator Color
1-No Indicator 2-Mechanical Indicator	2-Momentary 3-Maintained	0-No Indicator 1-White 2-Red 3-Green 9-Black	0-No Indicator 1-White 2-Red 3-Green 9-Black

LED 37-3☐ ☐ 0

Switch Function	LED Color
2-Momentary 3-Maintained	2-Red 3-Green 4-Yellow

KEYCAPS

No Indicator 80-3701-☐ ☐

Style	Color
1-Square 2-Rectangle 3-Round	1-Black 2-White 3-Grey

Mechanical 86-3702-☐ ☐

Style	Color
1-Square 2-Rectangle 3-Round	1-Black 2-White 3-Grey

LED 86-3703-☐ ☐

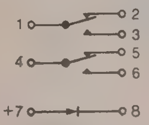
Style	Color
1-Square 2-Rectangle 3-Round	1-Black 2-White 3-Grey

LED INDICATOR FEATURES

- Utilizes high efficiency LED for maximum brightness and wide viewing angle
- Locator pin ensures proper installation for correct polarity

SPECIFICATIONS

Contact arrangement: DPDT
Contact Rating: .25 Amps 12 VDC max.
Electrical Life: 100,000 cycles
Electrostatic Discharge: 15 kV
Contact bounce: 500 micro seconds max.
Contact resistance: 25 m Ω initial;
50 m Ω after life

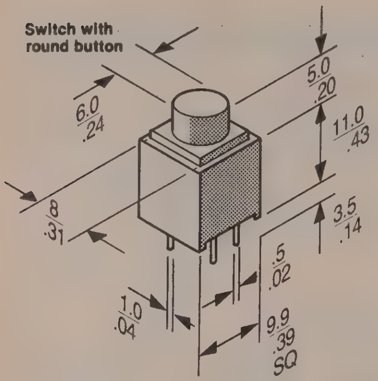


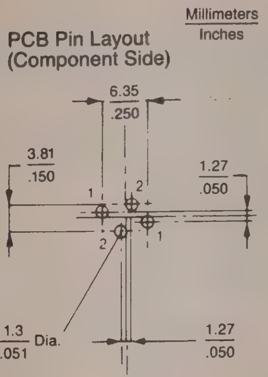
Circuit Form

ITW Switches 6615 W. Irving Park Rd. • Chicago, IL 60634
(312) 282-4040 • FAX (312) 545-4450

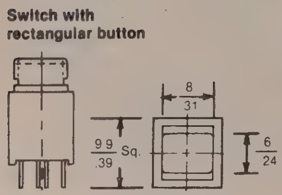
ITW PUSHBUTTON SWITCHES

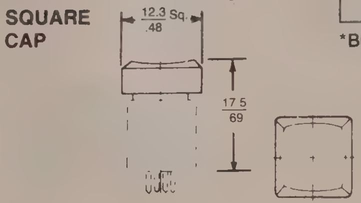
SERIES 60 DATASWITCH


Switch with round button
5.0
.20
6.0
.24
11.0
.43
8
.31
3.5
.14
.5
.02
1.0
.04
9.9
.39
SQ


Millimeters
Inches
6.35
.250
3.81
.150
1.27
.050
1
2
2
1
1.3
.051
Dia.
1.27
.050

PCB Pin Layout (Component Side)


Switch with rectangular button
8
.31
9.9
.39
Sq.
6
.24


SQUARE CAP
12.3 Sq.
.48
17.5
.69

FEATURES:

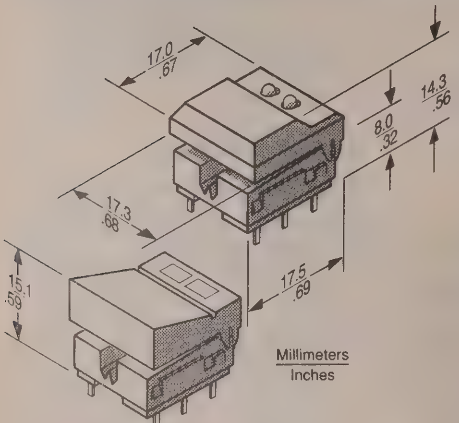
- Circuitry: SPST-NO momentary
- PCB terminals
- Switch is .39″ square
- Square and rectangular buttons; variety of colors
- Designed for flow soldering and automatic cleaning. Solvents must be compatible with 'ABS' and glass-loaded 'Noryl'.
- Legends can be engraved or printed onto switch tops
- Contact Rating: 20 ma-35 VDC

SWITCHES/LED SUPPORT/BUTTONS

Part No.	Description	Color
60-1000	Switch/rectangular button	—
60-2000	Switch/round button	—
60-4001	Button/square*	Black
60-4002	Button/square*	Red
60-4003	Button/square*	Green
60-4004	Button/square*	Lt. Grey

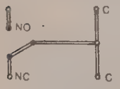
*Button caps fit on 60-1000 switch

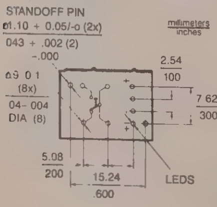
SERIES 61 MINIATURE PC MOUNT DATA SWITCH


17.0
.67
14.3
.56
8.0
.32
17.3
.68
15.1
.59
17.5
.69
Millimeters
Inches

The above dimensions are for 1½ station keycaps. For single station keycap substitute 12.3/.48 for 17.3/.68

SINGLE LED UNITS USE .300 MOUNTING CENTERS




STANDOFF PIN
ø1.10 + 0.05/-o (2x)
043 + .002 (2)
-.000
ø.9 0 1
(8x)
04- 004
DIA (8)
millimeters
inches
2.54
100
7 62
300
5.08
200
15.24
.600
LEDS

FEATURES

- Flexibility of keycaps
- 4 colors as standard
- Tactile feel
- Short travel
- Momentary or alternate
- Gold contacts

TECHNICAL DATA

Contact Arrangement	SPDT
Travel	≤ 3 mm/.12 in
Housing and key top material	ABS or Polyester
Contact Material	Brass + Ni + Ag or Au
Operating Life – momentary	5,000,000 cycles
Operating Life – Alternate	500,000 cycles
Temperature range	-25 + 85°C/-13° + 185°F

LED SPECIFICATIONS

	Alpha				Gamma			
Color		Red	Green	Yellow		Red	Green	Yellow
Typical Ratings					@ 10 mA			
Forward Voltage (v)	@ 20 mA	1.7	2.1	2.1		1.6	2.4	2.4
Intensity (mcd)	@ 10 mA	0.8	3.8	3.8		0.8	1.0	1.0
Forward Current ([mA] max)		40	30	20		50	30	30
Reverse Voltage (v)		5	5	5		6	6	6

ORDERING INFORMATION

Alpha	Momentary	Alternate	Gamma	Momentary	Alternate
	61-101XX00	61-201XX00		61-113XX00	61-213XX00
	61-102XX00	61-202XX00		61-114XX00	61-214XX00
	61-1A1XX0Y²	61-2A1XX0Y²		61-1A3XX0Y²	61-2A3XX0Y²
	61-1A2XX0Y²	61-2A2XX0Y²		61-1A4XX0Y²	61-2A4XX0Y²
	61-105XXY¹Y²	61-205XXY¹Y²		61-117XXY¹Y²	61-217XXY¹Y²
	61-106XXY¹Y²	61-206XXY¹Y²		61-118XXY¹Y²	61-218XXY¹Y²

KEYCAP AND LED SPECIFICATION CODES

Keycap Colors
Where XX
00 – Red
04 – Black
06 – Light Grey
08 – White

LEDS

(Left position)
Where Y¹
1 – Red
2 – Green
3 – Yellow

(Right or center position)
Where Y²
1 – Red
2 – Green
3 – Yellow

ITW Switches
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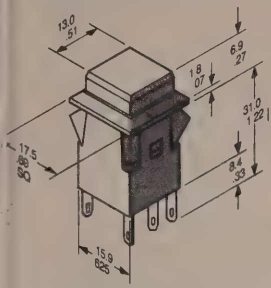
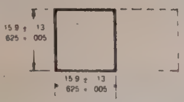
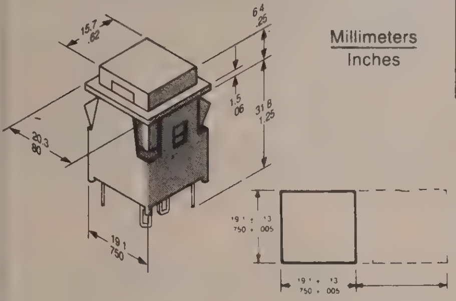
ITW PUSHBUTTON SWITCHES

SERIES 05





SERIES 05-6



Millimeters
Inches

FEATURES

- Single and double pole
- Momentary and maintained action
- Contacts are silver plated
- Lighted & non-lighted LED or T-1¾ wedge base incandescent lamp
- .110 quick disconnect or PC board terminals
- Circuitry options:
  05 — SPST-NO, SPDT, DPST-NO
  05-6 — SPST-NO
- Options include: variety of colored lens caps, hot stamping and pad printing, lens barriers
- Ratings: 05 — 1 amp RES, 125 VAC, UL Recognized and CSA Certified 10 MA @ 5VDC
  05-6 — 1 or 3 amps @ 125 VAC max., available UL Recognized and CSA certified

SWITCHES

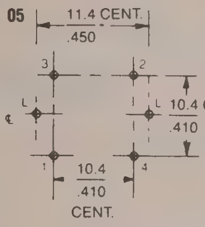
Part No.	Lamp Type	Terminal	Circuitry/Action
05-115	Incandescent	.110 QC	SPST-NO/Mom.
05-125	Incandescent	.110 QC	DPST-NO/Mom.
05-135	Incandescent	.110 QC	SPDT/Mom.
05-145	Incandescent	.110 QC	SPDT/Maint.
05-165	Incandescent	PCB	SPST-NO/Mom.
05-215	None	.110 QC	SPST-NO/Mom.
05-235	None	.110 QC	SPDT/Mom.
05-265	None	PCB	SPST-NO/Mom.
05-46501	Red LED	PCB	SPST-NO/Mom.
05-46601*	Red LED	PCB	SPST-NO/Mom.
05-62125	Incandescent	.110 QC	SPST-NO/Mom.
05-65125	Incandescent	PCB	SPST-NO/Mom.

*Non bezel

BUTTONS

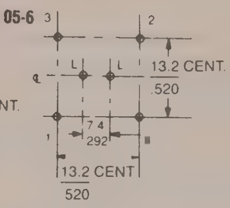
Part No.	Lamp Type	Color
80-050007*	Incandescent	White
80-050008*	Incandescent	Red
80-050009*	Incandescent	Green
80-050011*	Incandescent	Yellow
80-050014*	Incandescent	Clear
80-050602**	Incandescent	White
80-050603**	Incandescent	Red
80-050604**	Incandescent	Green
80-050606**	Incandescent	Yellow
86-050017**	LED/Red	Black

* Used on 05
** Used on 05-6



All P.C. Board hole sizes 1.0 ± .05 / .040 ± .002 diameter.

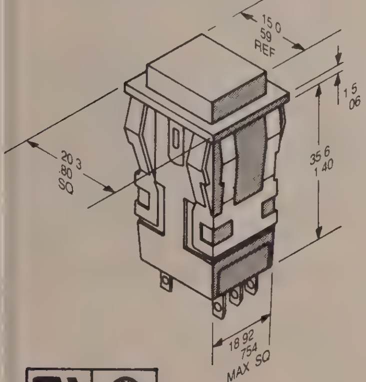
Panel thickness range .79 mm–2.4 mm (.031"–.093").

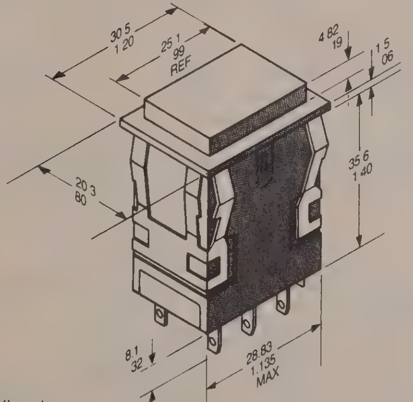


P.C. Board pattern recommended hole size 1.0 ± .05 / .040 ± .002 diameter.

PANEL THICKNESS RANGE 1.57–3.18 mm (.062–.125")

SERIES 50





Millimeters
Inches

FEATURES

- Square, rectangular and indicator only versions available
- LED or T-1¾ wedge base incandescent lamp available
- Circuitry options: SPDT or DPDT
- Gold or silver contacts
- Momentary or maintained action
- Terminals: .110 quick connect or .025 x .025 PC board available
- Panel cutouts: Square—.750"; Rectangular—.750" x 1.141"
- Ratings: UL Recognized File No. E27957 CSA Certified File No. LR42096 VDE approved
- Three button heights available—.19", .32", & .43" high (above front panel)
- Variety of button cap colors
- Optional center and end barriers

BUTTONS/LAMPS

Part No.	Description
50-51C10G	Square, .19, Green
50-51C10K	Square, Black, LED
50-51C10R	Square, .19, Red
50-51C10W	Square, .19, White
50-51F10K	Rectangular, .19, Black
50-51F10R	Rectangular, .19, Red
50-51F10W	Rectangular, .19, White
80-011368	Lamp, 6V
80-011367	Lamp, 28V

SWITCHES

Part No.	Lamp Type	Style	Terminal	Circuitry/Action	Contacts
50-21BBA2AA	None	Square	.110QC	SPDT/mom	Silver
50-21CBA2AA	Incandescent	Square	.110QC	SPDT/mom	Silver
50-21CBA2AD	Incandescent	Square	.110QC	DPDT/maint	Silver
50-21CBA2BA	Incandescent	Square	.110QC	SPDT/mom	Gold
50-21CBA2BB	Incandescent	Square	.110QC	SPDT/maint	Gold
50-21CBA3BA	Incandescent	Square	PCB	SPDT/mom	Gold
50-21FBA2AA	Incandescent	Rectangular	.110QC	SPDT/mom	Silver
50-22CBC3AA	Red LED	Square	PCB	SPDT/mom	Silver
50-22CBC3AB	Red LED	Square	PCB	SPDT/maint	Silver

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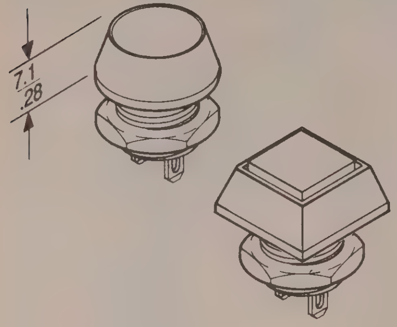
ITW PUSHBUTTON SWITCHES

SERIES 59

Miniature Sealed Pushbutton Switch



FEATURES

- Non-spark material—
  To British NCB 481/1965
- Wide temperature range—Up to 125°C (257°F)
- Sealed product—To IP67
- High environmental specification
- Impact resistant
- Gold contacts
- U.S. Mil-S-8805D

ELECTRICAL DATA

- Dielectric strength—1000 VAC
- Insulation resistance—1 G Ω
- Contact resistance (max)—50 m Ω
- Current rating (typical)
  - —400 mA at 32 VAC resistive
  - —100 mA at 50 VDC resistive
  - —125 mA at 125 VAC resistive
- Life (max)—5 x 10⁵ cycles @ max power
- Switching power (max)—16 VA AC

MECHANICAL CHARACTERISTICS

Travel (nom)	2.3 mm (0.090 in)
Life(max)	6 x 10⁵ cycles
Operating force (nom)	3 N (14 oz)
Contact bounce (nom)	1 mS
Panel thickness (max)	3 mm (0.118 in)

ENVIRONMENTAL AND PHYSICAL DATA

Ingress protection	IP67 OF IEC 144
Shock	100G
Operating temp range	−55°C to +125°C (−67°F to +257°F)

MOUNTING INFORMATION

The Series 59 mounts easily into panels of minimum 1 mm (0.025 in) and maximum 3 mm (0.118 in) thickness. Front panel sealing to IP67 is achieved by a sealing 'O' ring fitted into a pre-machined groove on the body of the switch before it is inserted into the panel hole cut out.

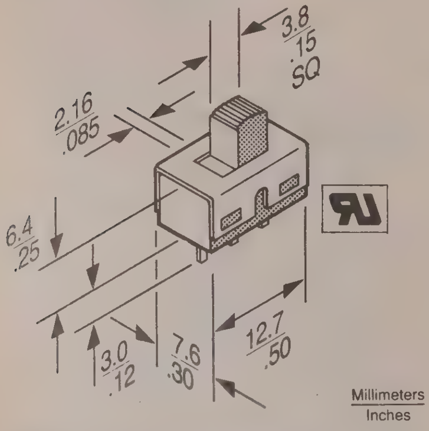
Button Color	Std. Round Bezel	Square Bezel
Black	59-111	59-211
Red	59-112	59-212
Green	59-113	59-213

Consult factory for non-standard options.

ITW SLIDE SWITCHES

MINI MIKE™

Miniature Snap-Action Slide



FEATURES

- Available in SPST, SPDT, DPDT, Form Z circuits
- Contacts are hard gold over barrier
- Terminal types—straight, PC, right angle PC
- Some versions UL recognized
- Available button heights from .10 to .50
- Custom actuators, terminals, button colors and hot stamping available
- Temperature range: −40°C to +100°C

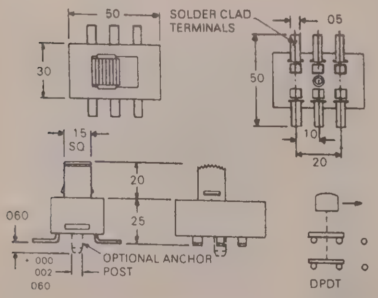
Part No.	Circuit	Mount	Height	Color	Rating
023-021-031	SPST	Right Angle PC	.20	Black	1 amp @ 125 VAC
023-021-040	SPST	PC	.20	Black	1 amp @ 125 VAC
023-021-105	SPDT	PC	.20	Black	250 ma @ 30 VDC
023-021-112	SPDT	Panel	.20	Black	250 ma @ 30 VDC
023-021-113	DPDT	Panel	.20	Black	100 ma @ 125 VAC
023-021-114	DPDT	PC	.20	Black	100 ma @ 125 VAC
023-021-125	DPDT	PC	.20	White	100 ma @ 125 VAC
023-021-304	Form Z	PC	.14	Black	500 ma @ 125 VAC

MR. CLEAN® SMD

Contamination-Free Surface Mounted Slide Switch

Part No. 224-440-020

Inches



FEATURES

- Low cost anti-contamination two-piece construction
- Optional anchoring pin insures stability
- Eliminates solder flux and cleaning residue problems
- Designed specifically for surface mount applications
- 24mm tape or tube with terminal bases for automatic insertion
- Compatible with medium size pick and place machines handling standard SOIC and PLCC components
- Conforms to EIA Packaging Spec. #481A
- Glass-filled Ryton base withstands any type IR or VaporPhase processing
- Gold contacts are ideal for high reliability and low energy use

HOW IT WORKS

① Mount lower base half onto P. C. board manually or automatically. Then solder same as other components on board. Clean board in standard manner.

② After board is cleaned and dried—simply snap the clean uncontaminated upper switch half in place—by hand. No tools, special equipment or orientation needed.

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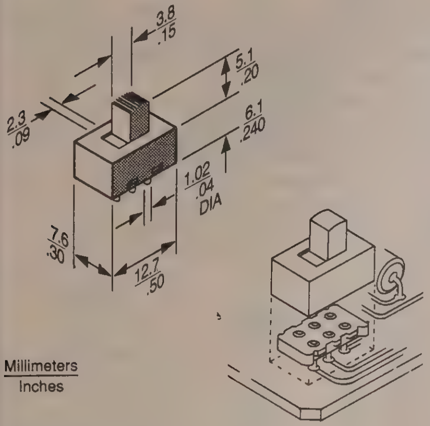
ITW SLIDE SWITCHES

MR. CLEAN®

Wave Solderable, Miniature Slide



FEATURES

- Low cost
- Anti-contamination design
- Unique 2-piece assembly
- Gold contacts
- Insert molded base
- Standard configurations: SPDT, DPDT,
- Life expectancy (mechanical): 10,000 actuations
- Temperature range: −40°C to +100°C

Part No.	Circuit	Terminal	Rating
124-240-020	SPDT	PC	250 ma @ 125 VAC
124-440-020	DPDT	PC	250 ma @ 125 VAC

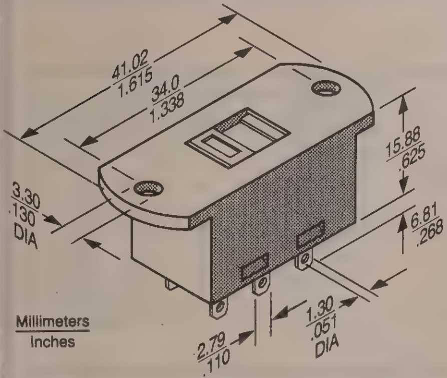
HOW IT WORKS

① Insert lower base half into P.C. board by hand or with automatic insertion equipment. Then wave solder same as other components on board. Clean board in standard manner to remove excess flux.

② After board is cleaned and dried — simply snap the clean uncontaminated upper switch half in place — by hand. No tools, special equipment or orientation needed.

SERIES SE

Line Voltage Selector



CEE24

FEATURES

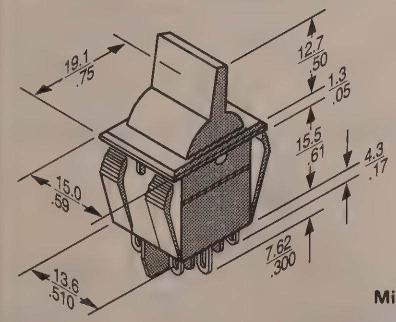
- Variety of terminals
- Top of flush handle stamped to indicate which voltage is selected; various markings available
- Snap-in version available
- Electrical Life: 10,000 cycles
- Handle Height: Flush or ¹¹/₃₂
- International Approvals: UL-CSA-VDE-SEMKO Designed to meet requirements of CEE Publication 24 and the IEC
- Contact Ratings: UL, CSA & VDE – 10 amp 125 VAC; 5 amp 250 VAC T85

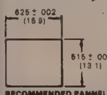
Part No.	Terminals	Dimensions
18-000-0016	110 QC	1.615L x .650W x .625H
18-000-0019	Right-angle PC	1.030L x .650W x .625H
18-000-0022	PC	1.030L x .650W x .625H
18-000-0040	Solder	Snap-in .677 x 1.240 Cutout

ITW ROCKER SWITCHES

SERIES P271/R271

Double-Pole Mini-Paddle and Rocker Switches





RECOMMENDED PANNEL CUTOUT: INCHES (MILLIMETERS)
SNAPS INTO PANEL FROM: .030" TO .093" THICK.
(0.8 TO 2.4) THICK

FEATURES

- Highly reliable double pole Mini-Paddle or Rocker Switches in the smallest sizes ever
- DPST or DPDT circuits available
- Large diameter solder terminal holes for faster soldering operations
- UL, CSA, VDE, SEMKO, DEMKO, NEMKO and SETI approved versions
- Quick and easy snap-in panel mounting
- Fits tiny .625 x .515 panel cutout
- Industry standard paddle and rocker styling and color
- Electrical Ratings

	125 VAC	250 VAC
Paddle	6A	4A
Rocker	5A	3A

ORDERING INFORMATION

□ 271 — 22 □ — □ □ 9

P- Paddle
R- Rocker

Mini-Paddle or Rocker Switch

Body
9-Black

Paddle or Rocker
2-Sunset Red

Terminal
2-Solder

Non-Lighted

Circuit Code
10 DPST On-Off
12 DPDT Maintained 2 Position

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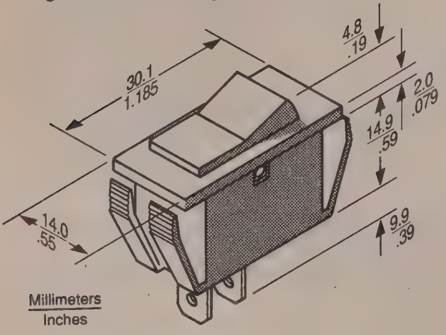
ITW ROCKER SWITCHES

SERIES 16X
SERIES 17X

Double-Pole and Single-Pole Lighted and Non-Lighted



FEATURES

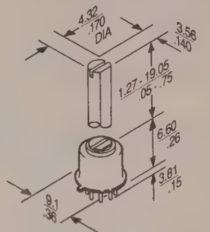
- Snaps into panels from .015″ (0.4) to .125″ (3.2) thick
- Recommended cutout (16X): .48″ (12.2) x 1.08″ (27.4)
  (17X): .880″ + .005/–.000 (22.4) x 1.080″ ± .005 (27.4)
- Wide range of circuits, some VDE approved
- Variety of incandescent and neon lamps
- Terminal options—quick connect and solder lugs
- Variety of colors; including custom
- Matte or gloss finish
- Hot stamping & metal bezels
- Matching panel lights available
- Paddle versions available; non-lighted only
- Ratings: UL Recognized and CSA Approved
  161 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  162 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  163 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

  171 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  172 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  173 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

Part No.	Rating	Color		Circuit	Lighted or Non-Lighted
		Rocker	Case		
161-009-009	10A	White	Black	SPST	Non
161-029-004	10A	Red	Black	SPST	Incandescent
161-029-006	10A	Red	Black	SPST	Neon
161-049-006	10A	Amber	Black	SPST	Neon
161-099-009	10A	Black	Black	SPST	Non
161-099-029	10A	Black	Black	SPDT	Non
163-029-006	16A	Red	Black	SPST	Neon
163-099-009	16A	Black	Black	SPST	Non
171-029-109	10A	Red	Black	DPST	Non
171-099-109	10A	Black	Black	DPST	Non

ITW ROTARY SWITCHES

SERIES TO-5 SPASAVER ROTARY



FEATURES

- Subminiature package size (.36" diameter)
- Up to 8 positions at 45° indexing, 1 pole
- Low energy switch contacts (gold over nickel plating)
- Glass to metal sealed header
- 0.025" PC terminals on 0.200" bolt circle
- Shaft diameter 0.172"
- Shaft length 0.31" on 0.56" from PC board
- Contact rating: 500 ma @ 125 VAC
- Life expectancy: in excess of 10,000 operations
- Options available: Vinyl protective boot and plastic knob

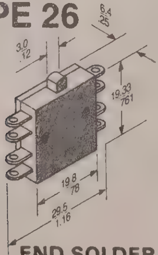
ORDERING INFORMATION

Part Number	Positions	Shaft Length
030-202-018	2	.18″
030-202-030	2	.30″
030-303-018	3	.18″
030-404-005	4	.05″
030-404-018	4	.18″
030-505-005	5	.05″
030-505-018	5	.18″
030-808-005	8	.05″

*Shaft length measures with no bushing. With bushing .30″ actuator is flush with top of bushing.

ITW BASIC SNAP-ACTION SWITCHES

TYPE 26



END SOLDER

MIL Spec

Millimeters
Inches

FEATURES

- DPDT (Form ZZ) contact arrangement
- Provides the option of controlling up to 4 isolated circuits
- May be wired externally to provide two commons to form standard DPDT (Form CC) switch
- Standard contacts are fine silver or gold plated
- End or side solder terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 8 Amps @ 125/250 VAC 75-80% PF
- 26-888051 and 26-988051 meets requirements of MIL-S-8805/77

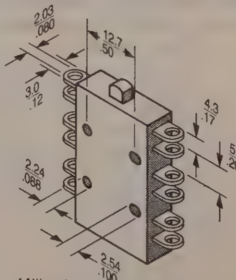
MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Over travel: .012 min.
Operating Force: 12 ± 4 oz.
Release Force: 5 oz. min.
Movement Differential: .020 = .010 - .005
Operating Point - .396 ± .015 (from mounting holes)

Part No.	Temperature Index	Simultaneity	Contact Material	Terminal
26-804	275°F	Simultaneous*	Silver**	End Solder
26-904	275°F	Simultaneous*	Silver**	Side Solder
26-888051	M8805/77	Ref. M 8805/77-001	Gold Plated	End Solder
26-988051	M8805/77	Ref. M 8805/77-002	Gold Plated	Side Solder

* Within .004" of plunger travel
** For electrical loads under 250 mA., consult factory

TYPE 36



END SOLDER

MIL Spec

FEATURES

- Uses three momentary double-break Butterly® switching mechanisms; 3PDT-DB Form ZZZ
- Standard contacts are fine silver
- End terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 7.5 Amps @ 125/250 VAC 75-80% PF
- Meets requirements of MIL-S-8805/78

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .012 min.
Operating Force: 16 ± 4 oz.
Release Force: 4 oz. min.
Movement Differential: .020 = .010
Operating Point - .396 ± .015 (from mounting holes)

Part No.	Temperature Index	Simultaneity	Contact Material	Terminal
36-604	275°F	Simultaneous*	Silver**	End Solder

* Within .004" of plunger travel
** For electrical loads under 250 mA., consult factory

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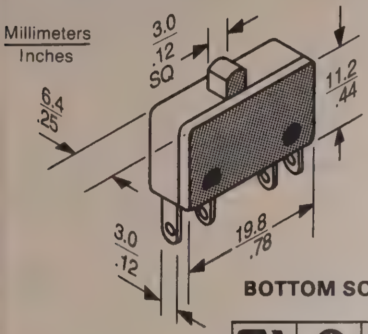
ITW BASIC SNAP-ACTION SWITCHES

TYPE 16



BOTTOM SOLDER

MIL Spec

FEATURES

- Features the Butterfly® double-break momentary mechanism
- Wide variety of terminal configurations and styles
- Gold plated or silver contacts standard
- Variety of actuators available
- Ratings: UL Recognized at 10.1 Amps @ 125/250 VAC; CSA Certified at 10.1 Amps @ 125/250 VAC
- 16-188051 meets requirements of MS25476-1; 16-388051 meets requirements of MS27217-2; 488051 meets requirements of MS27217-1

ELECTRICAL RATINGS @ 28 VDC

		Sea Level	70,000 Feet
Form C 2 Circuit	Res. Ind.* Lamp	10 3 3	10 1.5 —
Form Z 2 Circuit	Res. Ind.* Lamp	10 Amps 5 Amps 3 Amps	10 Amps 2 Amps —

*L/R = .026

Pretravel:	.050 max.
Overtravel	.012 min.
Operating Force:	5 oz. + 3 oz. - 2 oz.
Release Force:	2 oz. min.
Movement Differential	.020 ± .005
Movement Differential Type 16-403 Only:	.012 ± .005
Operating Point: (from mounting hole centers)	.406 ± .015

SPECIFICATIONS

			Contacts		Terminal
Part Number	Circuit	Temperature Index	Fine Silver	Gold Plated	
16-104	SPDT Form Z	To 275°F Ambient	X**		End Solder
16-1042		To 400°F Ambient	X**		
16-188051		Ref. MS 25476-1		X	

			Contacts		Terminal
Part Number	Circuit	Temperature Index	Fine Silver	Gold Plated	
16-204	SPDT Form Z	To 275°F Ambient	X**		End, Screw
16-304		To 275°F Ambient	X**		Side Solder
16-388051		Ref. MS 27217-2		X	
16-4034*	SPDT Form C	To 275°F Ambient	X**		Bottom Solder

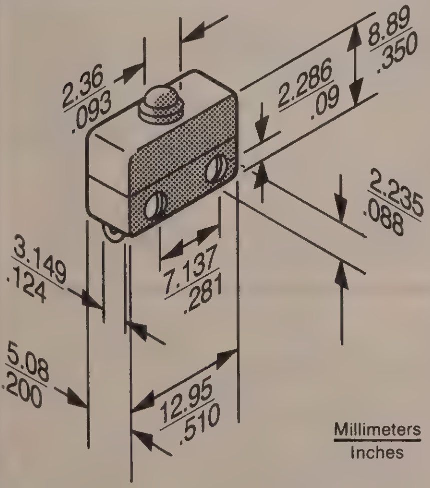
			Contacts		Terminal
Part Number	Circuit	Temperature Index	Fine Silver	Gold Plated	
16-4044*	SPDT Form Z	To 275°F Ambient	X**		Bottom Solder
16-40441*				X	
16-40421		To 400°F Ambient		X	
16-488051	SPDT-DB Form Z	Ref. MS 27217-1		X	
16-5044*	SPDT Form Z	To 275°F Ambient	X**		Bottom, O.C. Taper Tab

* Thermoplastic case and cover

** For electrical loads under 250 mA., consult factory

TYPE 18

Sub-Miniature, 7 Amp Double-Break



FEATURES

- Single-pole, double-break
- Utilizes Butterfly® double-break mechanism
- Gold-plated contacts
- 18-488051 meets requirements of MIL-S-8805/76
- Ratings: UL Recognized File No. E27957, 7 amps 125/250 VAC 75-80% PF

MECHANICAL CHARACTERISTICS

Operating Force:	5+3−2 oz
Release Force:	1½ oz min
Pretravel:	.030 max
Overtravel:	.006 min
Movement Differential:	.015 ± .005
Operating Point (From mntg. hole centers)	.320 ± .015

ELECTRICAL CHARACTERISTICS

Form Z	Voltage	Current
Two Circuit (SPDT-DB)	28VDC 28VDC	5 amp Res 3 amp Ind*
Single Circuit	28 VDC 28 VDC	8 amp Res 7 amp Ind*

UL Recognized File No. E27957. 7 amps 125/250 VAC 75-80% PF.

Materials on standard switches recognized by UL for use at temperatures up to 130.C. For switch ratings up to 150°C, consult factory.

*L/R = .026

ORDERING INFORMATION

Part Number	Circuit	Contacts	Terminals
18-40421	SPDT-DB (Form Z)	Gold-Plated	Solder Lug
18-488051 (MS27257-1)	SPDT-DB (Form Z)	Gold-Plated	Solder Lug

MIL Spec

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ITW BASIC SNAP-ACTION SWITCHES

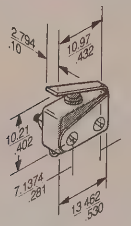
ACTUATORS FOR TYPE 16, 26, 36

NOTE: Characteristics may vary depending on type of basic switch used in assembly. All actuators supplied with mounting hardware.

Actuator P/N & Style	Switch Series	Oper. Force	Release Force	Pretravel	Over-travel	Movement Diff.
76-1200 Roller Lever	16 26 36	4 oz max 6 oz max 12 oz max	1 oz min 1½ oz min 1½ oz min	.125 max .130 max .125 max	.025 min .025 min .025 min	.045 ± .011 .054 ± .022 .055 ± .022
76-1210 Lever	16 26 36	2.5 oz max 7 oz max 9 oz max	1 oz min 2 oz min 2 oz min	.125 max .155 max .155 max	.025 min .025 min .025 min	.047 ± .013 .065 max .065 max
76-1220 Short Roller Lever	16	5 + 3 oz - 2 oz min	2 oz min	.050 max	.023 min	.020 ± .005
	26	16 oz max	5 oz min	.050 max	.012 min	.020 + 010 − .005
	36	16 ± 4 oz	4 oz min	.050 max	.012 min	.020 +.010 − .005
76-1420 Long Lever	16 26 36	1.5 oz max 2½ oz max 3½ oz max	10 grams min ½ oz min ½ oz min	.312 max .450 max .450 max	.080 min .030 min .030 min	.135 ± .035 .200 max .200 max

ACTUATOR FOR TYPE 18

NOTE: All actuators supplied with mounting hardware.

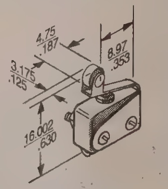


78-3000

78-3000 Spring Lever Actuator. Integral with Mounting Bracket.

MECHANICAL CHARACTERISTICS

Pretravel:	.125″ max.
Overtravel:	.030″ min.
Movement Differential:	.030 ± .015
Operating Force:	6 ± 2 oz.
Release Force:	2 oz. min.
Operating Point:	.325 ± .030



Note: Switches shown for reference only and are ordered separately.

78-3100

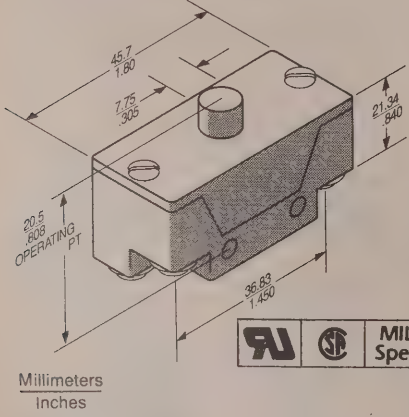
78-3100 Pivot Roller. For cam and slide operation.

MECHANICAL CHARACTERISTICS

Pretravel:	.125″ max.
Overtravel:	.030″ min.
Movement Differential:	.035 ± .015
Operating Force:	6 ± 2 oz.
Release Force:	2 oz. min.
Operating Point:	.560 ± .030

TYPE 14

20 Amp, Double-Break



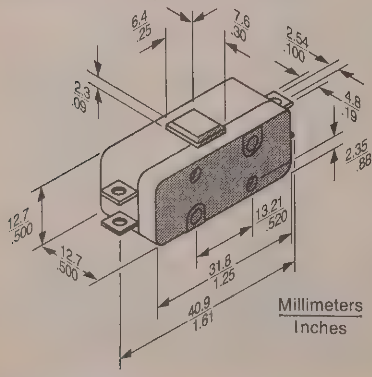
FEATURES

- Designed to handle loads up to 20 amps
- Features Butterly® double-break mechanism
- Available in standard and heavy duty mounting, with basic button, overtravel plunger or pivoted lever actuators
- Sealed button version also available
- Semirefractory contacts and offset #6 screw type terminals with cup washers are standard
- Ratings: UL Recognized File No. E27957, 20 Amps @ 125/250/480 VAC. 75-80% PF; CSA Certified No. 16388, 1 HP, 125 VAC, 2 HP 250 VAC

Part No.	Circuitry	Mounting	Terminal	Operating Force	Release Force	Pre-Travel	Over-Travel	Standard Movement Differential	Operating Point	Actuator Style
14-124	SPDT-DB Form Z	Standard	#6 Screw with Cup Washer	12 ± 3 oz.	4 oz. Min.	.074 Max.	.030 Min.	.020 ± .007	.808 ± .013	Standard Button Actuator
14-324	SPDT-DB Form Z	Standard		12 ± 3 oz.	4 oz. Min.	.074 Max.	.219 Min.	.020 ± .007	.800 ± .036	Overtravel Panel Mount
14-724	SPDT-DB Form Z	Standard		5 ± 2 oz.	2 oz. Min.	.156 Max.	.060 Min.	.046 ± .012	1.406 ± .031	Roller Lever Actuator
14-72403	SPDT-DB Form Z	Screw		5 ± 2 oz.	57 grams Min.	.156 Max.	.060 Min.	.046 ± .017	1.406 ± .034	Roller Lever

TYPE 11

Miniature, 10 Amp, Double-Break



FEATURES

- Available in standard and low force momentary action, as well as reset action
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals and actuators
- Ratings: UL Recognized File No. E27957; CSA File No. 16388
- 11-388051 meets requirements of MIL-S-8805/11

ELECTRICAL CHARACTERISTICS

Circuity	125/250 VAC	28 VDC
SPST-DB N.C. (Form Y) or N.O. (Form X)	10 amp (75-80% PF) ½ HP 125 VAC ¾ HP 250 VAC	10 amp IND. 15 amp RES.
SPDT-DB (Form Z)		
SPDT-SB (Form C)		4 amp IND. 6 amp RES.

SPECIFICATIONS

Part No.	Circuit	Terminal
11-104	SPDT-DB (Form Z)	End Solder
11-204	SPDT-DB (Form Z)	#4 Screw
11-304	SPDT-DB (Form Z)	Side Solder
11-314	SPDT-DB (Form Z) Reset	Side Solder
11-504	SPDT-DB (Form Z)	Quick Disconnect .250

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .015 min.
Operating Force: 8 ± 3 oz.
Release Force: 4 oz. min.
Movement Differential: .020 = .007
Operating Point - .150 ± .011 (from upper mounting hole)

ITW Switches 6615 W. Irving Park Rd. • Chicago, IL 60634
(312) 282-4040 • FAX (312) 545-4450

ITW BASIC SNAP-ACTION SWITCHES

ACTUATORS FOR TYPE 11

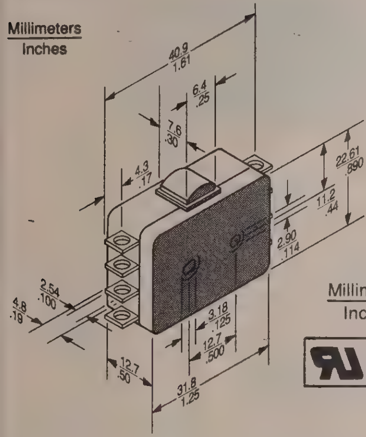
ACTUATORS MECHANICAL CHARACTERISTICS**

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
71-1040	Roller Lever	3.5 oz. Max.	2 oz. Min.	.093 Max.	.062 Min.	.030 .015	671 ± 031
71-2010	Over Travel	8 oz. ± 3 oz.	4 oz. Min.	.050 Max.	.215 Min.	.020 .005	.828 ± .015

**Mechanical characteristics when used with Basic Switch 11-104

TYPE 22

Miniature 10 Amp, Double-Break



MIL Spec

MECHANICAL CHARACTERISTICS

Pretravel: .060 max.
Overtravel: .015 min.
Operating Force: 17 ± 5 oz.
Release Force: 4 oz. min.
Movement Differential: .030 ± .009
Operating Point: .505 ± .011 (from mounting holes)

FEATURES

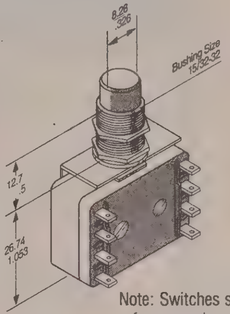
- Contains two individual switching elements which function simultaneously (within .004″ of plunger travel)
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals styles and actuators
- Ratings: UL Recognized File No. E27957, 10 Amps @ 125/250 VAC, 75-80% PF ½ HP @ 125 VAC, ¾ HP @ 250 VAC
- MIL-S-8805/15 listed units available

ELECTRICAL CHARACTERISTICS

Circuity	Voltage	Current
DPST-DB N.O. or N.C. (Form XX or YY)	28VDC	15 amp RES. 10 amp IND.
DPDT-DB (Form ZZ)	28VDC	10 amp RES. 7 amp IND.

SPECIFICATIONS

Part No.	Circuit	Terminal
22-104	DPDT-DB (Form ZZ)	End Solder
22-204	DPDT-DB (Form ZZ)	#4 Screw
22-304	DPDT-DB (Form ZZ)	Side Solder
22-504	DPDT-DB (Form ZZ)	¼″ Quick Disconnect



Note: Switches shown for reference only and are ordered separately.

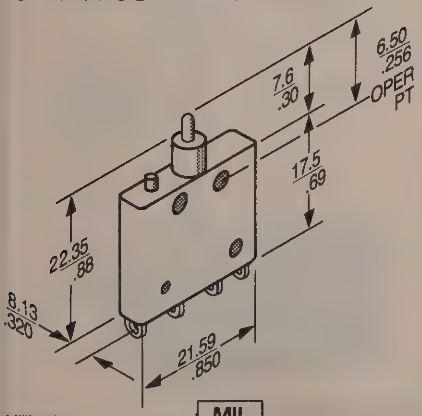
ACTUATORS–MECHANICAL CHARACTERISTICS*

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
72-2080	Over Travel (2)* Plunger	17 ± 5 oz.	4 oz. Min.	.060 Max.	.215 Min.	.030 ± .007	.828 .031

(1)* when used with 22-104 Basic Switch or 22-204 Basic Switch
(2)* when used with 22-304 Basic Switch

ITW SEALED SWITCHES

TYPE 65



MIL Spec

FEATURES

- Ratings up to 15 amps resistive @ 28 VDC
- Provides the ruggedness and reliability to meet demands of industrial & military applications
- Available with variety of basic switches: Type 11, Type 16, Type 22
- Meets the (watertight) requirements per MIL-S-8805 enclosure design symbol 3
- Wide choice of circuitry, actuators and mountings
- Optional electrical connections — solder, quick disconnect or screw terminals
- Wire leads with or without connectors or plugs
- Temperature range for standard units −65°F to +185°F

SUBMINIATURE SEALED SWITCHES (SOLDER LUG TERMINALS STANDARD)

Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.	M.D.
65-2010	Pin Plunger	SPDT-DB Form Z	.050 max.	.012 min.	24 ± 8 oz.	8 oz. min.	010- 030
65-3010	Roller Lever	SPDT-DB Form Z	.120 max.	.025 min	16 oz. max.	5 oz. min	058 max
65-4010	Over Travel	SPDT-DB Form Z	.070 max.	.187 min.	.025 max.	8 oz. min.	.020 ± .010

Electrical Ratings: 5A IND — 28 VDC 5A RES — 125/250 VAC

MINIATURE SEALED SWITCHES

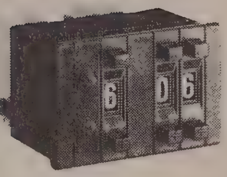
Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.
65-430098	Over Travel	SPDT-DB Form Z	.070 max.	.140 min.	4.0 lb. max.	1.8 lb min

Electrical Ratings: 7.5A RES, 7.5A IND – 28VDC 10A RES – 125/250 VAC

ITW Switches
6615 W. Irving Park Rd. • Chicago, IL 60634
(312) 282-4040 • FAX (312) 545-4450

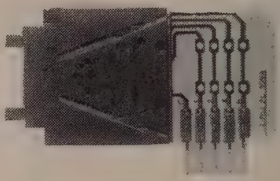
Pushwheel Switches
Modular LED Displays

The "snap-together" design allows you to make customized assemblies in only seconds. Pushwheel switches can also be combined with IVO modular LED displays.



Front mount
Models C002,C003,C005,C006

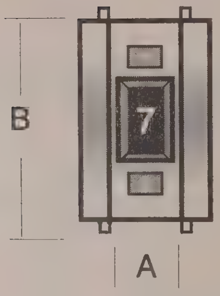
Rear mount
Models C022,C055,C077



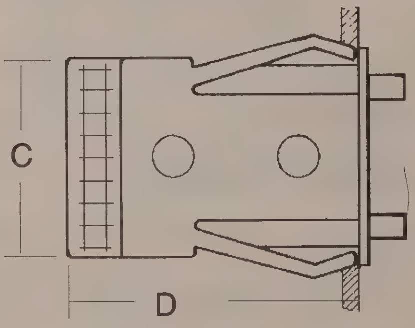
Right angle
Models C222,C777

Call or fax for our latest product catalog today!

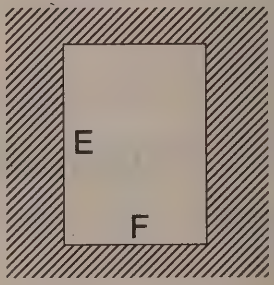
Front View



Side View



Panel Cutout



Model	Dimensions *(in mm)*					
front m.	A	B	C	D	E	F
C002	7.62	15.0	14.0	24.0	14.0	n x 7.62 +3.2
C003	7.62	24.0	22.0	32.0	22.5	n x 7.62 +3.5
C005	10.0	33.0	30.5	38.5	31.0	n x 10.0 +10.5
C006	8.0	33.0	30.5	38.5	31.0	n x 8.0 +8.5
rear m.						
C022	7.62	15.0	14.0	24.0	14.0	n x 7.62 +3.2
C055	10.0	30.5	30.5	38.5	30.5	n x 10.0 +20
C077	8.0	18.0	24.0	35.4	19.0	n x 8.0 +16
Rt. Ang.						
C222	7.62	15.0	14.0	34.5	14.0	n x 7.62 +3.2
C777	8.0	24.0	24.0	44.4	19.0	n x 8.0 +16

Switch / Display combination

IVO INDUSTRIES INC.
201 Industrial Way West
Eatontown NJ 07724
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Fax: **908-542-2938**

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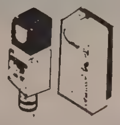
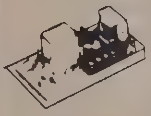
TOGGLE SWITCHES

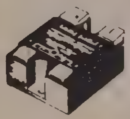


PHOTOELECTRICS

RELAYS



LIQUID LEVEL CONTROLS



SOLID STATE RELAYS

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- Aromat
- Curtis
- Custom Connector
- Idec
- Lumberg
- Master Electronics
- Panduit
- Potter & Brumfield
- Souriau
- Vernitron-Beau
- Welcon/Wells

COUNTERS
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- Hecon
- IVO
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- Red Lion
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- Elec-Trol
- Fujitsu
- Gordos
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- MEC
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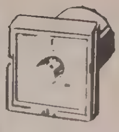
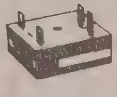


TEMPERATURE CONTROLS

TIMERS

PADDLE SWITCHES

TRANSFORMERS



TIMERS

COUNTERS

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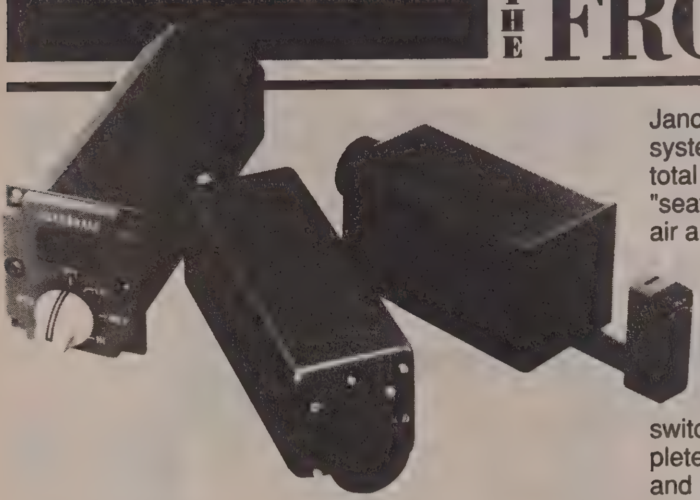


Janco MIL Spec, QPL rotary switches and switching systems are engineered for maximum reliability. This total dedication to quality has earned Janco switches a "seat" on virtually every commercial, space, and military air and spacecraft in the free world. These two pages provide basic specifications for Janco's five extensive families of standard rotary switches —all extensively field proven for critical applications. Working from these proven technologies, Janco engineers can easily customize a switch optimum for your application. Or for more complex switching functions, Janco can design and build complete switching systems that combine multiple switching and related electromechanical functions while decreasing component count, weight, and overall system size.

SERIES A

Miniature Rotary Selector Switches

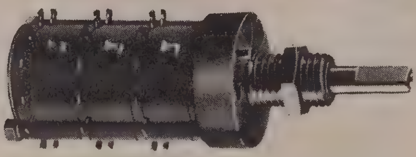
- Built to MIL-S-3786
- Life 10,000 Cycles
- Carry 10 Amp Continuous
- Make & Break 2-5 Amp Res. 115VAC/28VDC
- Torque to 5 In. Lbs.
- M Series QPL to MIL-S-3786/4

Index	Positions	Poles/Deck
15°	24	1,2,3,4,6
20°	18	1
22.5°	16	1,2,4
30°	12	1,2,3,4,6
36°	10	1,2
45°	8	1,2
60°	6	1
90°	4	1

SERIES AA

Designed for Maximum versatility, Series AA switches feature Series A configuration and performance with adjustable stops.

SERIES B

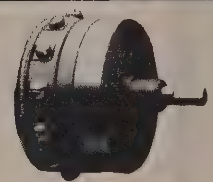


Micro-Miniature Rotary Selector Switches

- Built to MIL-S-3786
- Life 10,000 Cycles
- Carry 8 Amp Continuous
- Make & Break .25 Amp Res. 115VAC/28VDC
- Torque to 2 In. Lbs.
- M Series QPL to MIL-S-3786/13

Index	Positions	Poles/Deck
30°	12	1,2,3
36°	10	1,2
45°	8	1,2

SERIES C



Power Rotary Switches

- Built to MIL-S-6807
- Life 10,000 Cycles
- Carry 15 Amp Continuous
- Make & Break 5-10 Amp Res. 115VAC/28VDC
- Screw Terminals Only
- Torque to 8 In. Lbs.

Index	Positions	Poles/Deck
22.5°	16	1
30°	11	1,3
36°	9	1
45°	7	1,2
90°	4	1,2

TYPICAL APPLICATIONS OF JANCO SWITCHES

- ☐ E.C.M. System Switch, Instrumentation Console
- ☐ Windscreen Wiper Switch
- ☐ Fire Control Unit
- ☐ Engine Fire Shut Off Switch
- ☐ Tank Turret Sight Control Switch
- ☐ NVIS Green Lighting (Night Vision Imaging System)
- ☐ Temperature Selector Switch
- ☐ Software Data Loader
- ☐ APU Fire Control Switch
- ☐ Heating System (Cabin Temperature Control Switch)
- ☐ Combat Systems Display Console
- ☐ Safety Critical Power Switch
- ☐ Radar Warning Control

Janco

Janco Corporation Box 3038 • 3111 Winona Ave., Burbank, CA 91504
Phone: (818)846-1800 • Fax: (818) 842-3396 • TWX: #910-498-2701

SWITCHING TECHNOLOGY

General Specifications

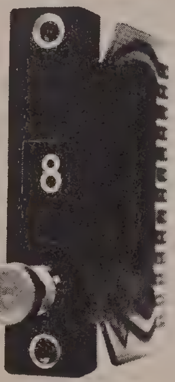
- All Switches Meet or Exceed Environmental Condition Requirements of MIL-S-3786 and MIL-S-22710.
  - Explosion Proof / MIL-STD-202
  - Salt Spray / MIL-STD-202
  - Sand and Dust / MIL-STD-202
  - Shock High Impact / MIL-STD-202
  - Shock Medium / MIL-STD-202
  - Vibration / MIL-STD-202
  - Altitude to 70,000 Feet
  - Moisture Resistance / MIL-STD-202
  - Thermal Shock / MIL-STD-202
  - Panel Seal
- All Switches Offer Maximum Protection Against RFI/EMI
- All Switches Are Totally Enclosed.

Options

- O-Ring Shaft and Panel Seal
- Combination of Decks
- Bridging Contacts
- Momentary Positions
- Adjustable Stops
- Solenoid Driven
- Solenoid Latched
- Keylock
- Gang Switches
- Concentric Shaft Switches
- Isolated / Guarded Positions

SERIES D

Pushbutton Rotary Switches

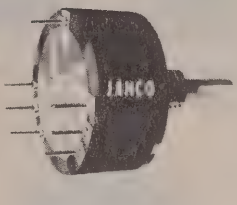


- Built to MIL-S-22710
- Life 50,000 Cycles
- Carry 3 Amp Cont.
- Make & Break. .125 Amp Res. 115VAC/28VDC
- Available with Standard or Coded Outputs, Special Codes Also Available
- M Series QPL to MIL-S-22710/18/23/30

	MIL-S-22710/23			MIL-S-22710/30	MIL-S-22710/18		
	30°	36°	45°	22.5°	30°	36°	45°
Max. Positions	12	10	8	16	12	10	8

SERIES E

Miniature/Micro-Miniature Printed Circuit Rotary Selector Switches



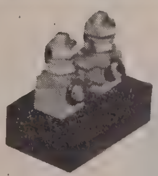
Index	Max. Positions
SERIES EA, EB, EC	
15°	24
18°	20
22°	16
30°	12
36°	10
45°	8
SERIES ED, EE	
30°	12
36°	10
45°	8

- Built to MIL-S-3786; MIL-S-22710
- Life 25,000 Cycles
- Carry 3 Amp Cont.
- Make & Break. .125 Amp Res. 115VAC/28VDC
- Available with Standard or Coded Outputs, Special Codes Also Available
- Printed Circuit Construction

TYPICAL APPLICATIONS OF JANCO SWITCHES

☐ Flare Dispenser
☐ Missile Safe/Arm Switch
☐ Flap Control Switch
☐ Autobrake Switch
☐ Engine Start Switch
☐ Program Integrated Panel
☐ Throttle Friction Switch
☐ In Flight Refuelling Equipment
☐ YAW Trim Switch for Tactile Tests
☐ Master Ignition Switch (Helicopter)
☐ Propeller De-Icing
☐ Wing De-Icing
☐ Switch for Digital Flight Data Recorder System
☐ Rudder Trim Switch
☐ Engine Speed Control Switch
☐ Airborne Radar System Switch
☐ Automatic Pilot Transfer Switch

OTHER PRODUCTS



Electrical Hardware Products for Aircraft

- External Ammeter Shunts MIL-S-61-B
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- Bus Bars
- Bonding Jumpers

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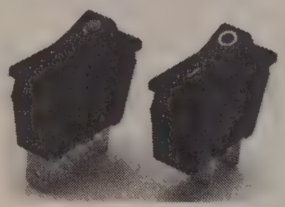
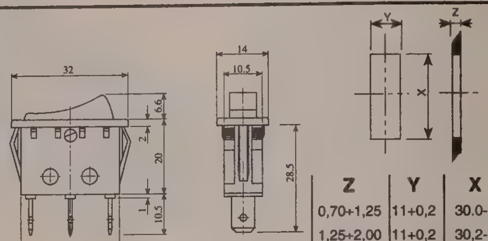
81 SERIES



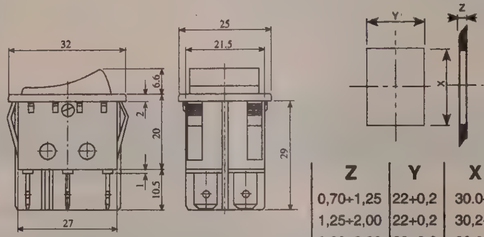


Z	Y	X
0,70÷1,25	11+0,2	30.0-1
1,25÷2,00	11+0,2	30,2-1
2,00÷3,00	11+0,2	30,6-2
3,00÷4,00	11+0,2	30,8-2

81 SERIES

RATING: 20A/125VAC, 16A/250VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black,
Brown and White.
Others available on request.
FUNCTIONS: SPST, SPDT,
Momentaries,
Illuminated AC

82 SERIES

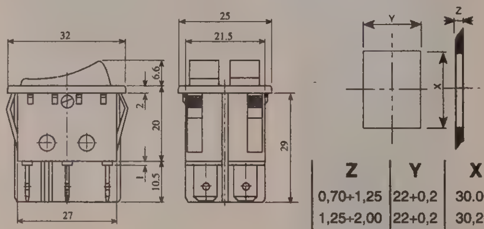


Z	Y	X
0,70÷1,25	22+0,2	30.0-1
1,25÷2,00	22+0,2	30,2-1
2,00÷3,00	22+0,2	30,6-1
3,00÷4,00	22+0,2	30,8-1

82 SERIES

RATING: 20A/125VAC, 16A/250VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black,
Brown and White.
Others available on request.
FUNCTIONS: DPST, DPDT,
Momentaries,
Illuminated AC

83 SERIES

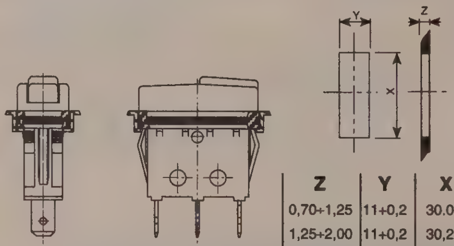


Z	Y	X
0,70÷1,25	22+0,2	30.0-1
1,25÷2,00	22+0,2	30,2-1
2,00÷3,00	22+0,2	30,6-1
3,00÷4,00	22+0,2	30,8-1

83 SERIES

RATING: 20A/125VAC, 16A/250VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black,
Brown and White.
Others available on request.
FUNCTIONS: SPST, SPDT, DPST,
DPDT, Momentaries,
Illuminated AC

A3 SERIES



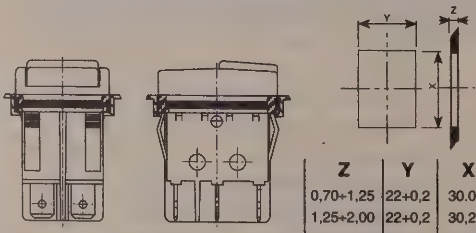
Z	Y	X
0,70÷1,25	11+0,2	30.0-1
1,25÷2,00	11+0,2	30,2-1
2,00÷3,00	11+0,2	30,6-2
3,00÷4,00	11+0,2	30,8-2

A3 SERIES

-New Waterproof Switches

RATING: 20A/125VAC, 16A/250VAC
TEMP: 65°C/ UL & CSA
105°C/ Euorpean
COLORS: Standard: Red, Black,
Brown and White.
Others available on request.
FUNCTIONS: SPST, SPDT,
Illuminated AC

A4 SERIES



Z	Y	X
0,70÷1,25	22+0,2	30.0-1
1,25÷2,00	22+0,2	30,2-1
2,00÷3,00	22+0,2	30,6-1
3,00÷4,00	22+0,2	30,8-1

A4 SERIES

-New Waterproof Switches

RATING: 20A/125VAC, 16A/250VAC
TEMP: 65°C/ UL & CSA
105°C/ Euorpean
COLORS: Standard: Red, Black,
Brown and White.
Others available on request.
FUNCTIONS: DPST, DPDT,
Illuminated AC

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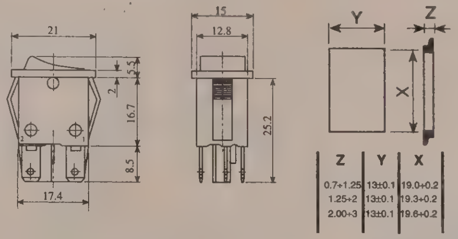
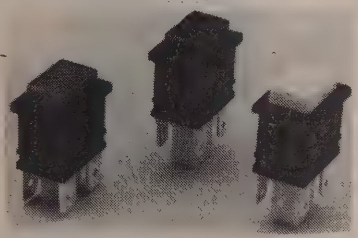
C SERIES

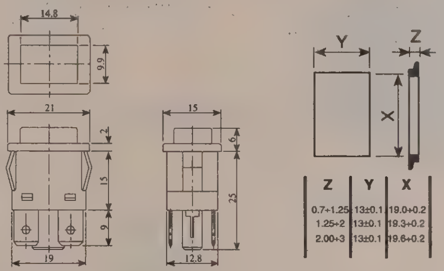

21
5.5
2
16.7
8.5
17.4
15
12.8
25.2
Y
Z
X
Z Y X
0.7+1.25 13±0.1 19.0+0.2
1.25+2 13±0.1 19.3+0.2
2.00+3 13±0.1 19.6+0.2

C SERIES

RATING: 10A/125-250VAC
TEMP: 65°C/ UL & CSA
125°C/ European
COLORS: Standard: Red, Black, and White.
Others available on request.
FUNCTIONS: SPST, SPDT, DPST, DPDT, Momentaries, Illuminated AC

L SERIES

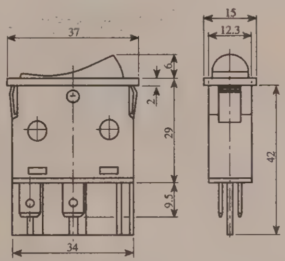



14.8
9.9
21
2
15
9
19
15
6
25
12.8
Y
Z
X
Z Y X
0.7+1.25 13±0.1 19.0+0.2
1.25+2 13±0.1 19.3+0.2
2.00+3 13±0.1 19.6+0.2

L SERIES

RATING: 16, 20A/125VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black, Brown and White.
Others available on request.
FUNCTIONS: SPST, DPST, Momentaries, Illuminated AC

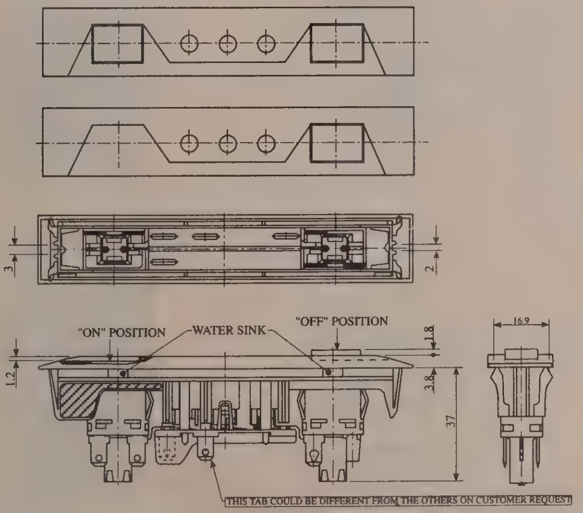
V8 SERIES


37
6
2
29
9.5
34
15
12.3
42

V8 SERIES

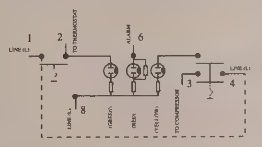
RATING: 10, 16A/250VAC
TEMP: 65°C/ UL & CSA
125°C/ European
COLORS: Standard: Red, Black, and White.
Others available on request.
FUNCTIONS: SPST, SPDT, DPST, DPDT, Momentaries, Illuminated AC

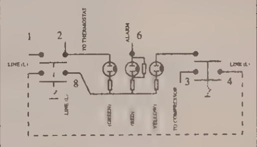
Z2 SERIES FREEZER ALARMS

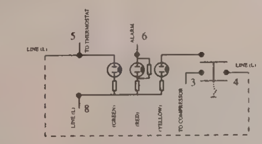

3
2
"ON" POSITION
WATER SINK
"OFF" POSITION
1.8
1.2
3.8
37
16.9
THIS TAB COULD BE DIFFERENT FROM THE OTHERS ON CUSTOMER REQUEST

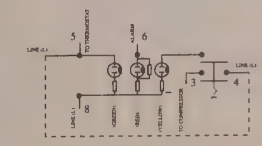
ELECTRICAL DIAGRAMS

ELECTRICAL DIAGRAMS


1
2
LINE (L)
TO THERMOSTAT
ALARM
6
LINE (L)
3
4
8
LINE (L)
(GREEN)
(RED)
(YELLOW)
TO COMPRESSOR


1
2
TO THERMOSTAT
ALARM
6
LINE (L)
LINE (L)
8
3
4
LINE (L)
(GREEN)
(RED)
(YELLOW)
TO COMPRESSOR


5
TO THERMOSTAT
ALARM
6
LINE (L)
LINE (L)
3
4
8
LINE (L)
(GREEN)
(RED)
(YELLOW)
TO COMPRESSOR


5
TO THERMOSTAT
ALARM
6
LINE (L)
LINE (L)
3
4
8
LINE (L)
(GREEN)
(RED)
(YELLOW)
TO COMPRESSOR

RATINGS UP TO 12(4)A 250V
6(6)A 250V

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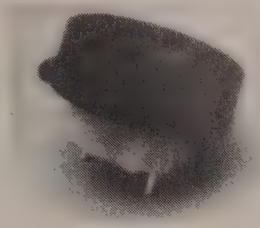
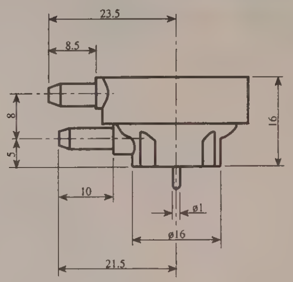
P SERIES

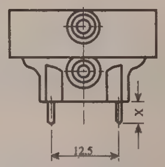
RATING: 20mA, 250VAC
FUNCTIONS: SPNO, SPNC
TEMP: 85°C
PRESSURE CONNECTIONS:
- 1 pole Normally open
- 1 pole Normally closed

CALIBRATION RANGE:
- 10-500mbar (standard)
- other ranges on request

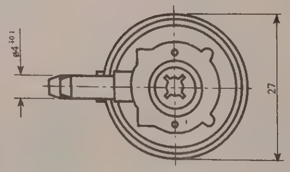


P SERIES


23.5
8.5
8
5
16
10
ø1
ø16
21.5



X=3.5mm (Standard)
7.0mm (On request)



79 SERIES

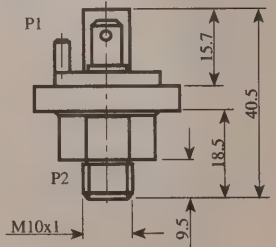
RATING:

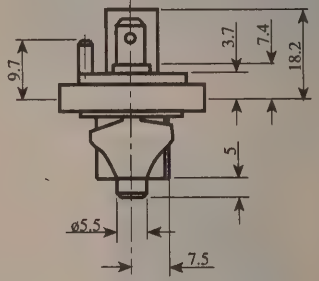
SPNO	4(1) - 2.5(0.5)A/250VAC 20mA, 250VAC
SPNC	2.5(0.5) - 1A/250VAC 20mA, 250VAC

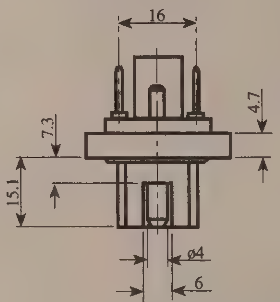
TEMP: 85°C
PRESSURE CONNECTIONS:
- Inlet Ø 4mm
- Inlet Ø 5.5mm
- Threaded Inlet M10x1
- Threaded Inlet 1/4"

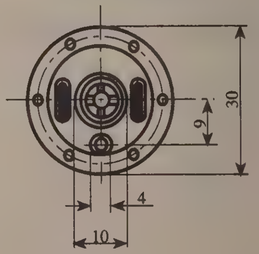
VACUUM: Inlet Ø 4mm
CALIBRATION RANGE:
- NO 4-170 mbar
- NC 5-4800 mbar

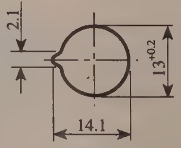
79 SERIES

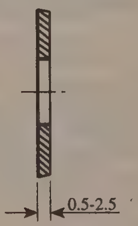

P1
15.7
40.5
18.5
P2
M10x1
9.5


9.7
3.7
7.4
18.2
5
ø5.5
7.5


16
7.3
4.7
15.1
ø4
6







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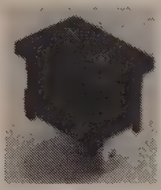
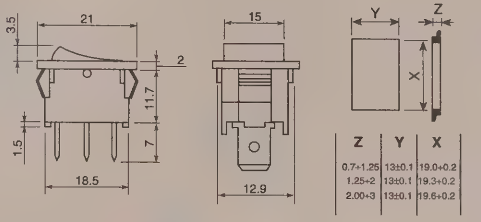
A1 SERIES



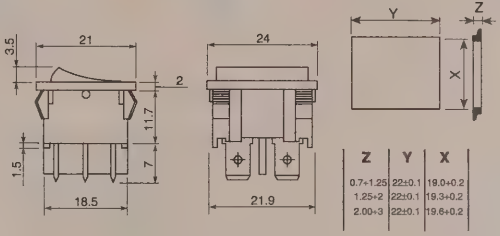

21
3.5
2
11.7
1.5
7
18.5
15
12.9
Y
Z
X

Z	Y	X
0.7+1.25	13±0.1	19.0+0.2
1.25+2	13±0.1	19.3+0.2
2.00+3	13±0.1	19.6+0.2

A1 SERIES

RATING: 10A, 15A/125VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black, Brown and White.
Others available on request.
FUNCTIONS: SPST, SPDT, Momentaries, Illuminated AC

A4 SERIES

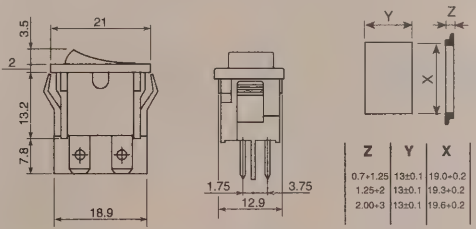

21
3.5
2
11.7
1.5
7
18.5
24
21.9
Y
Z
X

Z	Y	X
0.7+1.25	22±0.1	19.0+0.2
1.25+2	22±0.1	19.3+0.2
2.00+3	22±0.1	19.6+0.2

A4 SERIES

RATING: 10A/125-250VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black, Brown and White.
Others available on request.
FUNCTIONS: DPST, DPDT, Momentaries, Illuminated AC

A8 SERIES

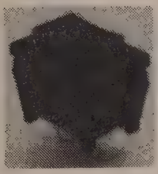

21
3.5
2
13.2
7.8
18.9
1.75
3.75
12.9
Y
Z
X

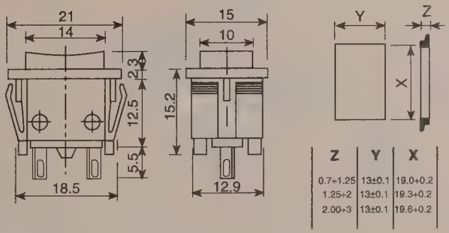
Z	Y	X
0.7+1.25	13±0.1	19.0+0.2
1.25+2	13±0.1	19.3+0.2
2.00+3	13±0.1	19.6+0.2

A8 SERIES

RATING: 10A/125-250VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black, Brown and White.
Others available on request.
FUNCTIONS: DPST, Illuminated AC

5840 SERIES



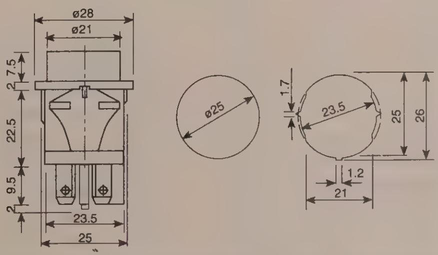

21
14
2.3
12.5
5.5
18.5
15
10
15.2
12.9
Y
Z
X

Z	Y	X
0.7+1.25	13±0.1	19.0+0.2
1.25+2	13±0.1	19.3+0.2
2.00+3	13±0.1	19.6+0.2

5840 SERIES

RATING: 2, 6A/125V AC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black, and White.
Others available on request.
FUNCTIONS: SPNO

SPL 60 SERIES


ø28
ø21
7.5
2
22.5
9.5
2
23.5
25
ø25
1.7
23.5
25
26
1.2
21

SPL 60 SERIES

RATING: 16A/120VAC
TEMP: 65°C/ UL & CSA
105°C/ European
COLORS: Standard: Red, Black, and White.
Others available on request.
FUNCTIONS: SPST, DPST, Momentaries, Illuminated AC

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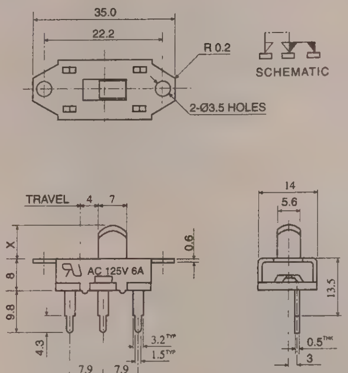
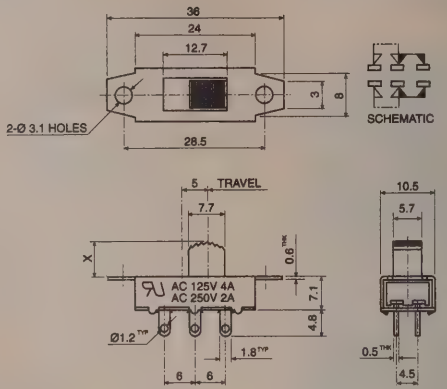
SPDT CL-04-SS


35.0
22.2
R 0.2
SCHEMATIC
2-Ø3.5 HOLES
TRAVEL 4 7
14
5.6
X
8
9.8
4.3
0.6
AC 125V 6A
13.5
3.2TYP
1.5TYP
0.5THK
3
7.9 7.9

SPECIFICATIONS:

RATING	125V AC 6A
CONTACT RESISTANCE	≤30mΩ (initial)
INSULATION RESISTANCE	500MΩ AT 500V DC
WITHSTAND VOLTAGE	1,000V AC for 1 min.
OPERATION FORCE	400 +/- 200 g
SWITCHING LIFE	10,000 cycles (15-18c/m unloading)
'X' OPTIONS	G (1.8, 4mm)

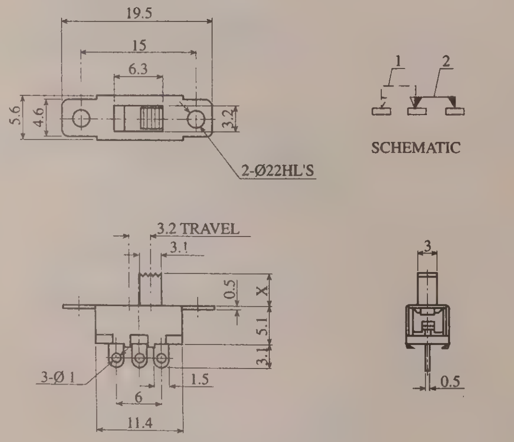
DPDT JD-22DWL-G


36
24
12.7
3
8
SCHEMATIC
2-Ø 3.1 HOLES
28.5
5 TRAVEL
7.7
10.5
5.7
X
0.6THK
AC 125V 4A
AC 250V 2A
7.1
4.8
Ø1.2TYP
1.8TYP
0.5THK
6 6
4.5

SPECIFICATIONS:

RATING	250V AC 2A, 125V AC 4A
CONTACT RESISTANCE	≤30mΩ (initial)
INSULATION RESISTANCE	500MΩ AT 500V DC
WITHSTAND VOLTAGE	1,000V AC for 1 min.
OPERATION FORCE	400 +/- 200g
SWITCHING LIFE	10,000 cycles (15-18c/m unloading)
'X' OPTIONS	G (3.8mm)

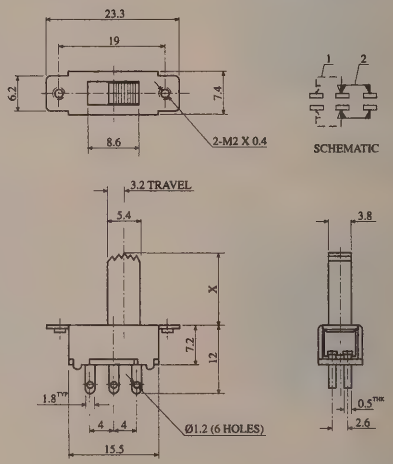
SPDT SS-12F15


19.5
15
6.3
5.6
4.6
3.2
2-Ø22HL'S
1
2
SCHEMATIC
3.2 TRAVEL
3.1
0.5
X
5.1
3.1
3-Ø 1
1.5
6
11.4
3
0.5

SPECIFICATIONS:

RATING	50V DC 0.5A
CONTACT RESISTANCE	≤30mΩ (initial)
INSULATION RESISTANCE	500MΩ AT 500V DC
WITHSTAND VOLTAGE	500V AC for 1 min.
OPERATION FORCE	350 +/- 200 g
SWITCHING LIFE	10,000 cycles (15-18c/m unloading)
'X' OPTIONS	G (3, 6, 8mm) T (5, 7mm)

DPDT SS-22F25


23.3
19
6.2
7.4
8.6
2-M2 X 0.4
1
2
SCHEMATIC
3.2 TRAVEL
5.4
3.8
X
7.2
12
1.8TYP
4 4
Ø1.2 (6 HOLES)
15.5
0.5THK
2.6

SPECIFICATIONS:

RATING	50V DC 0.5A
CONTACT RESISTANCE	≤30mΩ (initial)
INSULATION RESISTANCE	500MΩ AT 500V DC
WITHSTAND VOLTAGE	500V AC for 1 min.
OPERATION FORCE	400 +/- 250g
SWITCHING LIFE	10,000 cycles (6-10c/m unloading)
'X' OPTIONS	G (6, 9, 12, 15mm) T (9, 12, 15, 18mm) M (10, 11, 13, 15, 16, 17mm)

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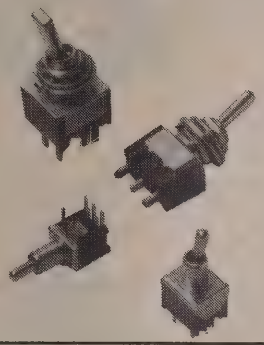
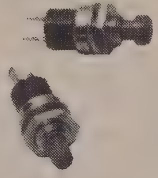
Toggles



Direct cross to:
- Alco
- C&K
- ECG
- Mors/ASC

Push Button

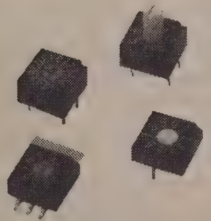


Direct cross to:
- Alco
- C&K
- ECG

Tactile

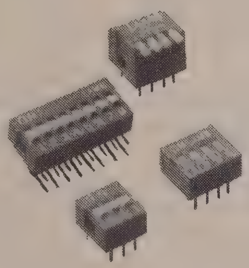
Direct cross to:
- Alco
- C&K
- ECG
- Omron
- Panasonic

Miniature DIP Rotaries



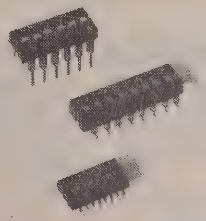
Direct cross to:
- Alco
- EECO
- Grayhill

DIP / Piano DIP



Direct cross to:
- Alco
- C&K
- CTS
- Grayhill

Auto Insertable Surface Mount



Direct cross to:
- Alco
- C&K
- CTS
- Grayhill

Ledex Switches

Rotary Manual Switches (Standard Models)

- Custom designs available
- Economy with simplified circuitry
- Eliminates auxiliary circuit components
- Minimizes wiring

Model Series	Poles-Throws/Deck	Combinations	Contact Ratings	Make/Break	Carry	Dielectric
206	6P60°T	6	Brass/silver plated	0.5A/28 VDC	5 A	750 V
208	8P45°T	4		(0.25/110 VAC)		contact to contact
210	10P36°T	5	Solid silver	1.0A/28 VDC		
212	12P30°T	6		(0.5A/110 VAC)		
304	4P90°T	2				
306	6P60°T	6				
312	12P30°T	6				
404	4P90°T	2	Brass/silver plated	1.0A/28 VDC	5 A	1,000 V
406	6P60°T	6		(0.5A/110 VAC)		contact to contact
412	12P30°T	7	Solid silver	2.0A/28 VDC		500 V
504	4P90°T	2		(1.0A/110 VAC)		when contacts
506	6P60°T	6				are insulated
512	12P30°T	7				back to back
524	24P15°T	8				

Stepping Switches (Stock Models)

- Custom designs available
- Dielectric clip-to-clip VRMS: 1,000
- Dielectric insulated back-to-back clips: 500
- Control deck: notched

Electrical Positions	Poles-Throws/Deck	Number of Load Cells	Additional Circuit on Control Deck	Total Circuitry	Carry Resistive Max.	Break Resistive Max.	Coil to Case Dielectric VRMS	Weight (lb)
4	3P4T	4	1P4T	13P4T	5 A	2.5A/28 VDC	1,200	0.375
6	2P6T	5	1P6T	11P6T		(0.5A/120 VDC)	1,200	0.406
8	3P8T	2	1P8T	7P8T			1,200	1.250
10	1P10T	7	—	7P10T			1,200	1.313
10	2P10T	4	—	8P10T			1,200	1.281
12	1P12T	5	—	5P12T			1,000	0.438
12	1P12T	9	—	9P12T	10 A	5.0A/28 VDC (1.0A/120 VDC)	1,200	1.250

Packaged Switches (Stock Models)

- Handles high density transfer switching without relays in extreme environments
- Custom designs available

Poles-Throws/Deck	Operating Voltage VDC	Current @ Rated Coil Voltage	Coil Duty Cycle	Dielectric Strength (VRMS) Coil	Coil Resistance @ 20°C (Ohms ±5%)	Dielectric Strengths (VRMS) Decks	Carry Resistive Max.	Break Amps Resistive
13PT2	28	2.5	1/10	1,000	11.03	500	5 A	1.0A/28 VDC (0.5A/120 VAC)
18P2T	28	3.5	1/10	1,200	8.02	500	5 A	2.0A/28 VDC
22P2T	28	3.5	1/10	1,200	8.02			(1.0A/120 VAC)
35P2T	28	5.0	1/10	1,200	5.67			
39P2T	28	5.7	1/10	1,200	4.91			
40P2T	28	3.6	1/4	1,200	7.72			

MasterCard VISA

- **Use your Visa or Mastercard to save time**
- **Same day shipment on stock models**
- **Two-week prototyping service for custom designs**

Lucas

LUCAS CONTROL SYSTEMS PRODUCTS
Ledex Actuation Products
P.O. Box 427 • Vandalia, OH 45377-0427 • 1/800/326-2966 • FAX: 513/898-8624

engineered switches

McGILL®

McGILL ELECTRICAL PRODUCT GROUP
VALPARAISO, IN 46383 (800) 233-8828

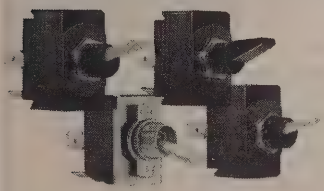
TOGLITE™ LIGHTED TOGGLE SWITCHES

AUTO
MAN
UP
DOWN

- **Broad Selection** of bat styles, colors, indicating plates and legends to fit design and functional requirements.
- **Reliable, long-life mechanisms** for exceptional performances.
- **Variety of circuit arrangements.**
- **Environmental ratings**—150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.
- **Choice of lights:** 6V, 14V, 28V or 250V AC, 125V AC Standard.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole
Case Dimensions
1.35″ x .80″
15/32″-32 thd. bushing
UL Listed
CSA Approved

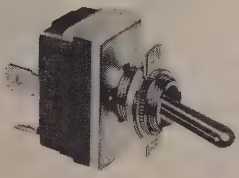
DESIGNER LINE TOGGLE SWITCHES



- **Choice of designer-style lighted or unlighted bats** in colors to your specifications.
- **Reliable, long-life mechanism** for exceptional performance.
- **Polycarbonate or die-cast zinc coverplates.**
- **25,000-hour 14V incandescent standard** (other incandescent and neon lamps available on special order).
- **Environmental ratings:** 150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole.
Case Dimensions: 1.35″ x .80″
15/32″ thd. bushing
UL Listed
CSA Approved

STANDARD TOGGLE SWITCHES



- **Wide selection of circuitry, ratings, terminals.**
- **Time-proven, reliable long-life mechanism.**
- **Variety of bat styles and colors.**
- **SP, DP, 3+4 pole models available.**

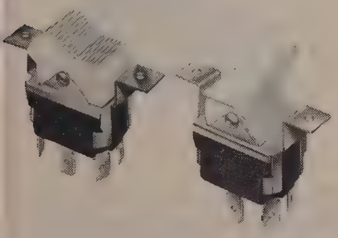
UL Listed
CSA Approved

20 A 125 V AC
10 A 250 V AC
1 HP 125-250 V AC
20 A 250 V AC Non-Inductive
Also available 25 A 125-250 V AC
Non-Inductive

UL Listed
C.S.A. Approved

Silver cadmium oxide contacts
Brown general-purpose phenolic cases
Nickel plated bats

ROCKER AND PADDLE SWITCHES



- **Distinctive styling**—With your choice of standard or specially designed actuators to meet style requirements.
- **Reliability**—Mechanical excellence from one of the most experienced manufacturers of switches of this type.
- **Extra electrical capacity**—20 Amp models provide an extra margin of reliability.
- **Broad range of variations**—Terminals, circuitry, coverplates, actuators are available or can be engineered to fit your needs.

0801 SP and 0801 DP Series

UL Listed	CSA Approved
20 Amp 277V AC	16 Amp 277V AC
1 1/2HP 125-250V AC	1 1/2HP 125-250V AC

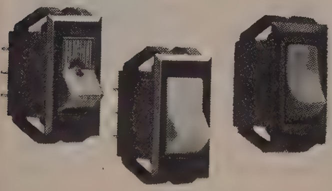
20 Amp 12V DC

1801 SP and 1801 DP Series

UL Listed	CSA Approved
6 Amp 125V AC	
3 Amp 250V AC	
1/4HP 125-250V AC	

6 Amp 12V DC
Case Dimensions: 1 15/64″ x 51/64″

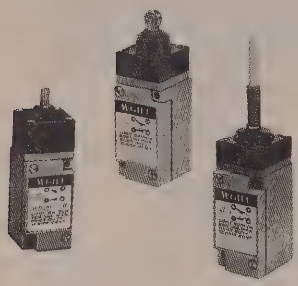
MINIATURE ROCKER SWITCHES



- **Choice of Stylette™**—(new softer designer lines that enhance product styling) **or standard miniature rocker switches.**
- **Choice of illuminated or solid** two surface smooth colored rocker.
- **Rocker colors available**—
  Light-Clear-Amber-Red-*Green-*Blue
  Non-lighted-White-Black-Red
  (other colors, consult factory).
- **Plastic snap-in bezels**—for fast easy installation.
- **Available in black & white bezels** (other colors, consult factory).
- **Terminals**—1/4″ quick disconnect-standard. Also available 16-ga. wire.
- **Lamps**—115V AC neon standard. Also available 6V AC or DC, 14V AC or DC, 28V AC or DC & 250V AC neon.

McGILL ELECTRICAL PRODUCT GROUP, VALPARAISO, IN 46383

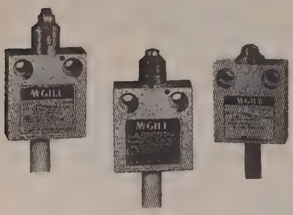
1506 SERIES ROTARY ACTUATED SWITCHES



- plug-in and non plug-in body styles with convenient on-the-spot adjusting
- wobble actuated switches have flexible levers that operate with any movement except direct pull
- rollers on side plungers in horizontal position
- head adjusts clockwise and counterclockwise
- light on indicator versions wire to N.O. circuit
- Meet NEMA 1,3,4, and 13 standards

Circuitry: SPDT, DPDT
Types: Side/Top Rotary, Maintained, Center Neutral, Plain Top, Roller, Roller-Side Plungers, Wobble, Coil Spring
Body Styles: Plug-in, Non-Plug-in 1/2″ or 3/4″ conduit
Make/Break Voltages: 120, 240, 480, 600 VAC; 120, 240 VDC
UL Listed
CSA certified

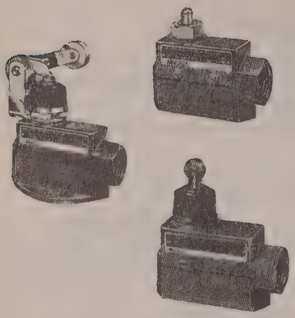
1505 SERIES MINIATURE PRE-WIRED ENCLOSED SWITCHES



- pre-wired at factory with industrial quality cable (SJTO)
- eliminate need to wire at switch, so they're ideal for use in limited access areas
- gang-mountable to build multi-plunger switch .63″ between plunger
- seals keep liquids from entering switch cavity
- complete range of actuators, including plain and roller plungers, and side rotary
- Meet NEMA 1, 3, 4, 12 and 13

Circuitry: SPDT
Types: Plain, Boot-Sealed, Roller and Cross-Roller Plunger, Side Rotary
Make/Break Voltages: 120, 240 VAC; 28 VDC
UL Listed
CSA certified

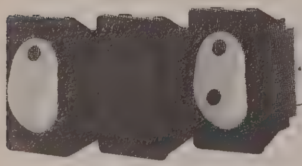
1502 SERIES COMPACT ENCLOSED SWITCHES



- side and flange mounted switches available with or without actuator seal boots
- combination insulator/seal cemented inside bottom enclosure
- lead washers seal mounting holes on side mount switches
- side mounts installed with #6 screwshead adjusted clockwise and counterclockwise operation
- removal of bottom enclosure exposes terminals for easy wiring
- NEMA 1 rated

Circuitry: SPDT, DPDT
Types: Straight, Roller Plunger, Roller Lever, One-Way Roller Lever, Manual, Coil Spring
Body Styles: Side or Flange mounted, with/without seal boot
Make/Break Voltages: 125, 250, 480, 600 VAC; 125, 250 VDC
UL Listed
CSA certified

0852 EURO-STYLED ROCKER SWITCHES



- patented sleek, rounded ultra-modern design
- rugged, reliable rocker mechanism proven in millions of applications
- fits standard cutouts
- available with moisture-resistant seals
- .187 spade, screw terminals, solder and wire leads optional

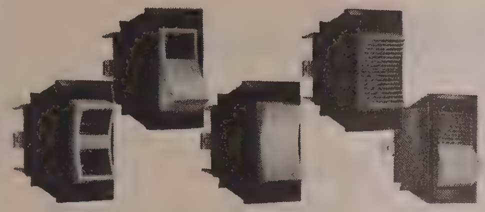
Circuitry: SPDT, DPDT
Types: one-light, two-lights, non-lighted with three different rocker colors: red, white, black
Electrical: 15A, 277V AC; 3/4 HP, 125-277V AC; 6-28V DC Incandescent; 115V Neon
Terminals: 1/4″ Spade
UL Listed
CSA certified

engineered switches

McGILL®

McGILL ELECTRICAL PRODUCT GROUP
VALPARAISO, IN 46383 (800) 233-8828

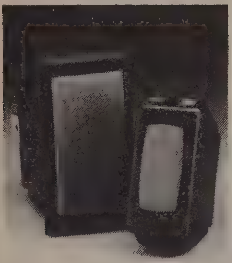
LIGHTED ROCKER SWITCHES WITH SNAP-ON COLORED CAPS



0851, 1851, 1861, 0871, 1871, 0881 and 1881 switch series standard construction features:
These switches have black plastic bezels for snap-in-mounting, 1/4″ quick-disconnect spade terminals, 115V neon lamps. Available with 6-28V DC incandescent lamp consult factory. Optional splash-resistant gasket model available—request new Sealtite™ switch.

Underwriters' Lab. Inc. Listed
CSA Approved
0851, 0861, 0871, 0881
15 Amp 277V AC
3/4 HP-125 277V AC

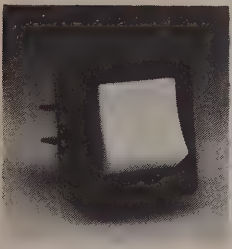
1851, 1861, 1871, 1881
6 Amp 125V AC
3 Amp 277V AC
1/4 HP-125 277V AC



0820/0890 Series Indicator Lights

0820 miniature (.550x1.125") and 0890 standard (.830x1.450") series indicator lights offer durable performance. Choose from a wide range of translucent colors with custom colored bezel and lens options.

14V 125V AC	UL Listed
28V 125V AC	CSA Approved



0825 Series 20 Amp Double Pole Rocker Switches

McGill's new 0825 miniature rockers are available in virtually any color you need to match your panel design requirements. These switches fit standard 1x1.125" cutouts in marine and RV panels and are available in double- and single-throw, lighted and non-lighted models.

15A 277V AC	UL Listed	6(6)A 250V AC;
20A 125V AC	CSA Approved	16(6)A 250V AC
$^3/_4$ HP 125-277V AC	VDE Rated	

Lock-Out Switches

McGill's new lock-out switch is ideal for applications where safety is critical. Activating the switch requires two separate actions—so accidental operation of equipment or vehicles is virtually impossible. Based on a proven design, the switch is available in single and double pole models in a variety of colors and can be custom imprinted.

15A 277V AC	UL Listed
$^3/_4$ HP 125-277V AC	CSA Approved

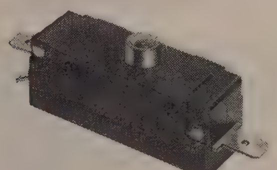
15A 277V AC, 20A 125V AC $^3/_4$ HP NON-LIGHTED

Part Number	Rocker Color	Circutry	
0825-1213	Black	DPST ON/OFF	
0825-1243	Black	DPDT ON/ON	

15A 277V AC, 20A 125V AC $^3/_4$ HP LIGHTED

Part Number	Rocker Color	Circutry	Lamp Voltage
0825-5213	Red	DPST ON/OFF	125V Neon
0825-5214	White	DPST ON/OFF	125V Neon
0825-5216	Red	DPST ON/OFF	28V Incandescent
0825-5218	White	DPST ON/OFF	28V Incandescent
0825-5215	Red	DPST ON/OFF	14V Incandescent
0825-5217	White	DPST ON/OFF	14V Incandescent

SNAP-ACTION SWITCHES

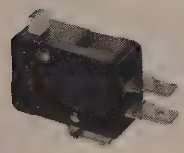


2600 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
SPDT & SPST, NO or NC
Less than .005″ differential travel
Operating force 20 oz. max.
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 13/16″ x 41/64″ x 41/64″
Standard Terminals
Spade Terminals .250″ x .032″

2700 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 21/64″ x 1-13/16″ x 43/64″
Spade Terminals .250″ x .032″

MINIATURE SNAP-ACTION SWITCHES

McGill® 4775 Series Rolling Cam* SNAP-ACTION SWITCHES. An engineering breakthrough that provides 150,000,000 cycle reliability, less contact bounce (1.5 millsec), LIGHT OPERATING FORCE—75gm. Max.



4777 Series available rated:
15 Amp 125-250V AC, 1/2 HP 125-250V AC
25 Amp 125-250V AC, 1 HP 125V AC
2 HP 250V AC, 85°C. Max. Ambient Temp.

10 Amp
125-250V AC
1/2 HP 125-250V AC
4 Amp "L" 125V AC

Underwriters' Laboratories, Inc. Listed;
CSA Approved
Optional UL 100,000 cycle listing and 20.1 Amp
Case Dimensions: 1 3/32″ x 5/8″ x 13/32″

	CATALOG NUMBERS			OPERATING CHARACTERISTICS					
	SPADE TERMINALS			Operating Force Max. gm.	Release Force Min. gm.	Movement Diff. Max. In.	Pre-travel Max. In.	Total Over-travel Min. In.	Actuator Length
ACTUATOR	SPDT	SPST NO	SPST NC						
Basic plunger	4775-1100	4775-1200	4775-1300	75	10	.016	.047	.050	
Short rigid lever	4775-1120	4775-1220	4775-1320	75	9	.018	.052	.050	$^{27}/_{32}$
Long rigid lever	4775-1130	4775-1230	4775-1330	37	4	.037	.108	.090	$1^{13}/_{32}$
Short rigid lever w/roller	4775-1140	4775-1240	4775-1340	75	9	.018	.052	.050	$^{25}/_{32}$
Long rigid lever w/roller	4775-1150	4775-1250	4775-1350	37	4	.037	.108	.090	$1^{11}/_{32}$
Simulated roller	4775-1160	4775-1260	4775-1360	37	5	.033	.096	.090	$1^{9}/_{32}$

NOTE: Operating characteristics are given for levers mounted in the support farthest from the plunger. When the levers are mounted in the support closest to the plunger, multiply the given force values by .57 and the travel values by 1.76 to obtain the correct values.

4600 Series 15 Amp switches with berylium copper mechanism also available.

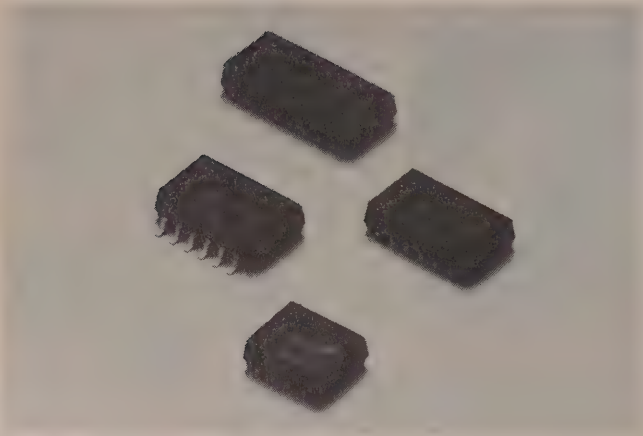
FAX (219) 465-2456; PHONE (219) 465-2200

MEPCOPAL

Trimmers and Switches.

SURFACE MOUNT SWITCHES

Call 800-JIT1SMD (548-1763) for additional information or technical catalog.



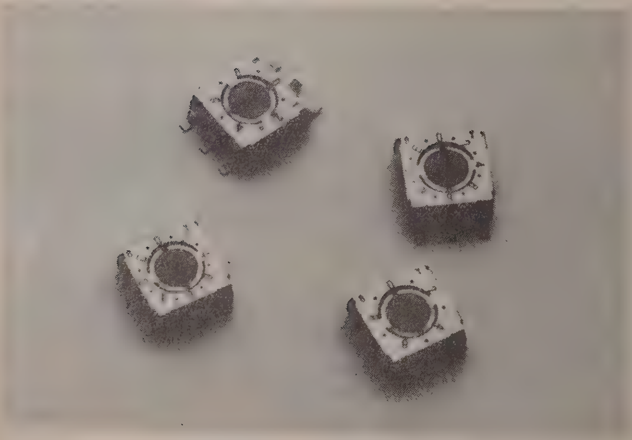
NEW PRODUCT!

CHS Series -
Dip Slide Switch

.050" lead pitch, SPST with 4, 6, or 8 positions. Tape sealed to allow for automatic processing. Gull wing & J lead styles available in bulk or tape & reel packaging.

CS-4 Series -
4 mm Square Selector Switch

Available with 1 pole - 2 positions, 2 pole - 2 positions, or 1 pole - 3 positions in bulk or tape & reel packaging. Sealed to allow for automatic processing in gull wing, J lead or through hole styles.



NEW STYLE!
SIDE ADJUST

S-7000 Series -
7mm Binary Coded Rotary Switch

10 (BCD) OR 16 (BCH) positions in real or complementary code. Sealed to allow for automatic processing. Available in top and side adjust, J lead, gull wing or through hole style. Bulk or tape & reel packaging.

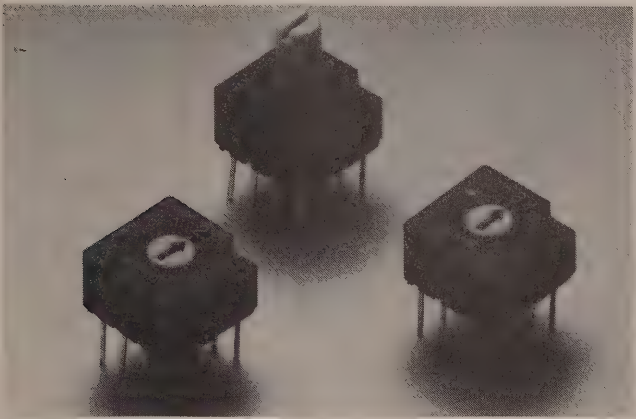
Mepcopal Company, 11525 Sorrento Valley Rd., San Diego, California 92121-1307 • 619/481-0210 • FAX: 619/481-1123

MEPCOPAL

Trimmers and Switches.

Selector, binary coded dip and key switches

Call 800-JIT1SMD (548-1763)
for additional information
or technical catalog.



SS-10 Series -
10mm dip rotary selector switch.

Sealed to allow for automatic processing. Rotary action for easy setting & stability. Precious metal contacts with self cleaning action. Available in 2 pole - 3 positions or 1 pole - 4 or 6 positions.

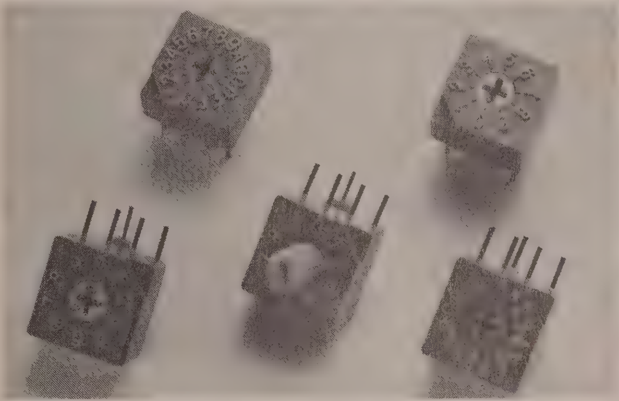
700/720 Series - Compact size keyswitches.

Model 700: 12mm low profile switch offers high reliability & contact rating plus tactile feedback. Surface mount style and assorted keycap types are available.

Model 720: 7mm microminiature switch offers high reliability in a rugged design with excellent solderability. Life span to 1 million operations

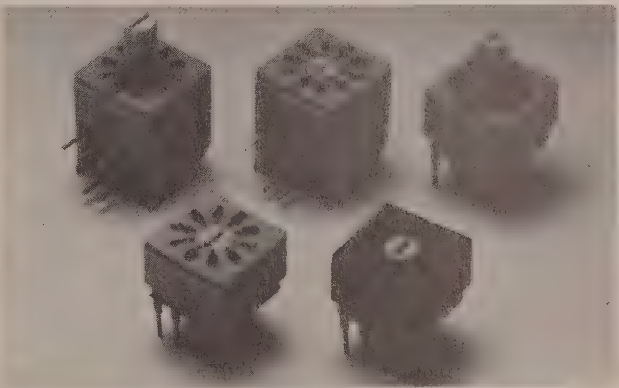
S-8000 Series -
7mm coded dip rotary switch.

8 (BCO) position, octal to binary, real or complementary code, top & side adjust available. Built with precious metal contacts and o-ring sealed for automatic processing. Pin compatible with conventional dip switches.



S-1000/2000 Series -
10mm coded dip rotary switch.

10 (BCD) or 16 (BCH) positions in real or complementary code. Sealed to allow for automatic processing. Built with precious metal contacts. Top or side adjust and knob style available. Pin spacing identical to piano key type dip switches.



S5000 Series - 11mm coded dip switch.

This unique switch is available with built in resistors and/or diode array. 10 (BCD) or 16 (BCH) positions in real or complementary code with precious metal contacts. Top or side adjust and knob style available. The S5000 series simplifies your circuit design.

Mepcopal Company, 11525 Sorrento Valley Rd., San Diego, California 92121-1307 • 619/481-0210 • FAX: 619/481-1123

MICRO SWITCH
a Honeywell Division

SUBMINIATURE/MINIATURE BASIC SWITCHES

UX/UM are our newest lower cost subminiature switches. SM subminiature basic switches are a versatile collection of small size and ample electrical capacities. SX subminiature basic switches provide up to 7 amp power load capacity. V3 miniature basic switches put a 25 amp power load capacity and a choice of 11 other electrical ratings into a relatively small package. V7 miniature basic switches have electrical ratings up to 15 amp power load capacity, and offer two versions—commercial and European designed to meet all leading European approval agency requirements.

MINIATURE AND SUBMINIATURE BASIC SWITCHES

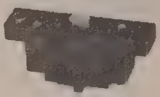
Listing	UX40E30A01	UM40D10A01	11SX21-T	11SM1-T	V3-101-D8	V7-1B11E9
PHYSICAL DESCRIPTION						
Package Size (inches)	.197H .236W .50L	.43H .25W .78L	.35H .20W .50L	.49H .25W .78L	.63H .40W 1.09L	.63H .40W 1.14L
Actuator	Pin plunger	Pin plunger	Pin plunger	Pin plunger	Pin plunger	Pin plunger
Terminals	Quick-connect	Solder	T solder	T solder	D8 QC	E9 QC
Mounting Centers	.256	.38	.19	.38	.88	.88
CHARACTERISTICS						
UL/CSA Rating	3a 125VAC	3a 250VAC	5a 250VAC	5a 250VAC	11a ⅓ HP 277 VAC	11a ⅓ HP 277 VAC
Circuitry	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT
Operating Force	5.3 oz.	3.5 oz.	2.5 to 5 oz.	3 to 5 oz.	8 oz.	5.3 oz.
Differential Travel (inches)	.005	.004	.002	.004	.006-.016	.002-.010
ENVIRONMENT						
Temperature Range (°F) Upper	185°	185°	250°	180°	180°	185°
Lower	–13°	–13°	–65°	–65°	–65°	–40°
Sealing				Elastomer sealed plunger avail.		
Housing Material	Thermo-plastic	Thermo-plastic	General purpose phenolic	General purpose phenolic	General purpose phenolic	Polyester
OTHER OPTIONS Request Catalog 10	Pin, flat, simulated roller levers.	Short, med., long flat levers. Simulated roller and roller levers.	Pin, integral or auxiliary leaf and lever, overtravel plunger actuators. Many terminal variations. SPST NO or NC ctry.			Pin, integral or auxiliary leaf and lever actuators. Meets European and UK standards.
	Low energy .1a rating. Solder Term.	.1a and 3a versions. VDE and SEMKO. PC and Quick-connect terminals. Choice of operating force.	400° temp. 7a rating. Gold contacts. Low force/low DT versions. MIL-S-8805 listings.	400° temp. 11a rating. Gold contacts. Low force/low DT versions MIL-S-8805 listings. BEAB, TV-2 listings.	600° temp. 25a rating. Gold alloy contacts. Low force/high force versions MIL-S-8805 listings. TV-3, 4, 5 listings.	

MICRO SWITCH
a Honeywell Division

STANDARD BASIC SWITCHES

Power load switching and motor handling capacity are among the attractions of thumb-size BZ/BA standard basic switches. Double-pole double-throw switching is added by DT switches.

Where there's a need for reliable switching of high capacity systems involving DC motors and solenoids, MT magnetic blowout switches do the job. The 3MN has double-break switching.



Listing	BZ-2R-A2	BA-2RV22-A2	DT-2R-A7	MT4R-A28	3MN1
PHYSICAL DESCRIPTION					
Package Size (inches)	.95H .69W 1.94L	.95H .69W 1.94L	1.28H .69W 1.94L	1.30H .69W 1.94L	1.20H .68W 2.50L
Actuator	Pin	Short roller lever	Pin	Pin	Plunger
Terminals	Screw	Screw	Screw	Screw	Screw
Mounting Centers	1	1	1	1	2.13
CHARACTERISTICS					
UL/CSA Rating	15A 480VAC	20A-480VAC	10A-250VAC	10A-125VAC or VDC	15A-600VAC 1 Hp at 240 VAC
Circuitry	SPDT	SPDT	DPDT	SPDT	2 CKT DB
Operating Force	9-13 oz.	14-22 oz.	20 oz.	12-18 oz.	12-20 oz.
Differential Travel (inches)	.0004-.002	.002-.0075	.005	.005	.015-.025
ENVIRONMENT					
Temperature Range (°F) Upper	180°	180°	180°	180°	180°
Lower	–65°	–65°	—	—	—
Sealing	Neoprene or Elastomer sealed plunger avail.				
Housing Material	General purpose phenolic	General purpose phenolic	General purpose phenolic	Arc resistant melamine	General purpose phenolic
OTHER OPTIONS **Request Catalog 10**	Pin, integral or auxiliary leaf and lever, overtravel plunger actuators. Many terminal variations. Manual reset versions. Special ctry. available.		Pin, integral or auxiliary leaf actuators.	Pin, integral or auxiliary leaf or lever actuators. SPST ctry.	
	22a rating 250° and 400° temperature Alloy contacts Low force/low DT versions MIL-S-8805 listings.	25a rating. 250° temp.			

SALES AND SERVICE

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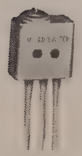
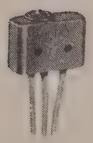
MICRO SWITCH
11 W. Spring St.
Freeport, Illinois 61032
Tel. 1-800-532-2235

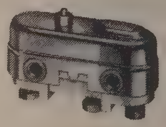
MICRO SWITCH
a Honeywell Division

SEALED AND HIGH TEMPERATURE BASIC SWITCHES

Specially adapted basic switches include: SE/XE environment-proof switches which protect subminiature SM/SX basic switches within a sealed housing; HM hermetically sealed switches are interchangeable in operating point with the SM switches; HS hermetically sealed switches which parallel the size and mounting scheme of the standard basic switches; and HT high temperature switches for use up to +1000°F.







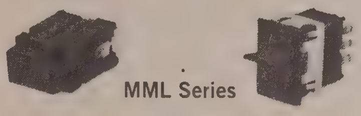
Listing	1XE1	1SE1	1HM1	1HS1	2HT1
PHYSICAL DESCRIPTION					
Package Size (inches)	.75H .32W .62L	.75H .34W .88L	.72H .25W .79L	1.18H .67W 1.96L	1.25H .70W 1.96L
Actuator	Pin	Pin	Integral lever	Integral lever	Pin
Terminals	Leadwire 1'	Leadwire 1'	Solder	Screw	Screw
Mounting Centers (inches)	.19	.38	.37	1	1
CHARACTERISTICS					
Electrical Data	7A-28 VDC, 115, 250 VAC	5A-28 VDC, 125, 250 VAC	4A-28 VDC, 115, 400 Hz	25A-28 VDC	3A-125, 250 VAC
Circuitry	SPDT	SPDT	SPDT	SPDT	SPDT
Operating Force	5-17 oz.	5-17 oz.	7 oz.	10-22 oz.	10-20 oz.
Differential Travel (inches)	.005	.004	.006	.020	
ENVIRONMENT					
Temperature Range (°F) **Upper**	221°	221°	250°	180°	1000°
Lower	–65°	–65°	–85°	–67°	—
Sealing	Environment	Environment	Hermetic	Hermetic	NO
	MIL-S-8805	MIL-S-8805		MIL-S-8805	
Housing Material	Aluminum	Aluminum	Stainless steel	Monel	Stainless Steel
OTHER OPTIONS **Request Catalog 10**	Aux. leaf actuators. SPST ctry. 300° temp. longer leads. Solder term. UL/CSA listing.	Aux. leaf or lever actuator, SPST ctry. 500° temp. UL/CSA listing.	Aux. leaf or lever actuator. MIL-S-8805 listing. 300° & 500° temp. Leadwire termination.	Leadwire termination. Roller lever actuators. 250° & 300° temp. UL/CSA listing.	Overtravel plungers. Panel mount. UL recognized.

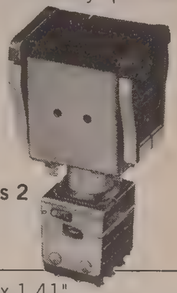
MICRO SWITCH
a Honeywell Division

MANUAL SWITCHES

Many options in colors, legending, shapes, sizes, and mounting available as well as power, electronic or solid state switching. AML's comprehensive line blends with other panel components for total display harmony. MML provides a full line of manuals in an economical miniature package. Series 2 provides modular assembly with 1 to 4 section display. Many other pushbutton lines are available. Request Catalog 30 or Catalog 80 for military qualified products.

AML Series


MML Series


Series 2

Because of the many variations of these products a listing is not being given.

PHYSICAL DESCRIPTION **Panel Area**	Pushbuttons: .80" (20,5 mm) square. PB's, paddles, and rockers: .80 x 1.20" (20,5 x 30,5 mm).	PWB mount: .40" (10,2 mm) square and .60 x .40" (15,2 x 10,2 mm), except 2-pole power duty paddles and rockers.	1.0 x 1.41" (2,5 x 35,8 mm) .86 x 1.35" (21,8 x 34,3 mm)
Display	Pushbuttons: .59" (15,0 mm) square and .59 x .99" (15,0 x 25,0 mm). Transmitted, projected, and dead front full and split color. Rockers: Full and split color rockers, with lens. Paddles: Full and split color covers, with lens.	Pushbuttons: 26" (6,6 mm) square and .46 x .26" (11,7 x 6,6 mm). Transmitted color. Rockers: Optional lenses for transmitted color.	.85 x 1.08" (21,6 x 27,4 mm) buttons. 1-4 section display. Transmitted and projected color.
Illumination	Incandescent T-1-3/4 lamps—6, 14, 28 v LEDs—2.4, 5, 10, 15 V Neon lamps—125, 250 V	LEDs—1.7, 2.1, 2.2, 2.3 V Incandescent T-1 lamps—5 V (other voltage avail.) Neon lamps—125, 250 V	Incandescent T-1-3/4 lamps—6, 14, and 28 V.
Behind Panel Depth (max.)	1.7" (43,1 mm)	.67" (17,0 mm)	3.28" (83,3 mm)
Mounting	Snap-in individual, strip, matrix, sub-panel PC board mounting	Printed wiring board, snap-in strip, matrix.	Snap-in flange mount and units with mounting barriers for individual or strip mount.
Termination	Solder, quick-connect, PC board, push-on	Printed wiring board, solder, quick-connect.	Solder, quick-connect and screw terminals.
Sealing	Optional panel seal for pushbuttons.	—	Optional panel seal.
SPECIAL FEATURES	Keylock switches available for controlled access applications.	Mechanically interlocked switches provide latching functions.	Coil equipped units for remote operation (pull-in and hold-in)
CHARACTERISTICS **Electrical Data**	Solid State: 5 or 6-16 VDC Electronic Control: Up to 3 a., 125 VAC Power Duty Push buttons: Up to 10 a., 125/250 VAC Power Duty Rockers, Paddles: Up to 15 a., 125/250 VAC	Solid State: 5-24 VDC Electronic Control: Up to 1a., 125 VAC res. Power Duty Push buttons: Up to 6 a., 250 VAC res. Power Duty Paddles: Up to 6 a., 250 VAC res.	1-20 a., 125, 250, 480 VAC, depending on switch module specified.
Circuitry	Current Sinking 1, 2, or 4 Form C 2 Form X 1 or 2 Form A	Current Sinking 1 or 2 Form C 1 or 2 Form X 1 or 2 Form C	1-4 Form C.
AGENCY LISTINGS	UL, CSA, CEE (European approvals being obtained as needed, from individual countries), MIL-S-22885	UL and CSA	UL, CSA. For MIL-S-22885 versions, refer to Catalog 80.

SALES AND SERVICE

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Freeport, Illinois 61032
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MICRO SWITCH
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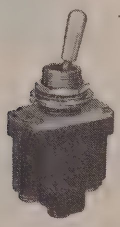
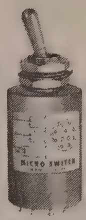
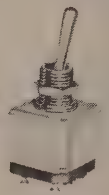
TOGGLE SWITCHES

We offer a wide selection of size, circuitry, capacity, sealing and toggle action. Plus a great array of levers, paddles and rockers that offer positive tactile feedback in a variety of colors. Request Catalog 30. ET toggles feature magnetically held on action. Request Catalog 80.



	TL Series	NT Series	TS Series
Panel Area	2-pole: 1.32 x .89 in.	2-pole: 1.32 x .89 in.	2-pole: 1.31 x .75 in.
Mounting	15/32 in. bushing	15/32 in. bushing	15/32 in. bushing
Sealing	Bushing and cover-to-case	Bushing and cover-to-case	Bushing
Electrical Data	Up to 15 a., 125 or 250 VAC. Also 28/115/250 VDC and 115/230 VAC MIL-S-3950 ratings. 1 or 2-pole, 2 or 3 positions mom. and maint. action.	Up to 15 a., 125, 250 or 277 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.	Up to 15 a., 125 or 250 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.
Termination	Screw, solder, IWTS	Screw, solder, quick-connect	Solder, screw, quick-connect
Temperature Upper **Lower**	160°F (71°C) –85°F (–65°C)	160°F (71°C) –85°F (–65°C)	160°F (71°C) –65°F (–54°C)
Agency Listings	UL CSA MIL-S-3950	ЯU	UL CSA





	AT Series	ET Series	TW Series
Panel Area	Depends on basic switches	1.0 in. dia.	2-pole: .57 x .53 in.
Mounting	¼ or 15/32 in. bushing	15/32 or ⅝ in. bushing	¼ to 15/32 in. bushing
Sealing	Bushing	Environment	Bushing
Electrical Data	Up to 15 a., 125 or 250 VAC. 1-10 poles, 2 or 3 positions mom. and maint. action.	Up to 7 a. res., 28 VDC. 1 or 2-pole, 2 or 3 position magnetically maintained toggle/action.	5 a. res., 30 VDC, 115/125 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.
Termination	Solder, screw, quick-connect	Solder, leadwire	Solder or IWTS
Temperature Upper **Lower**	Depends on basics	160°F (71°C) –85°F (–65°C)	160°F (71°C) –85°F (–65°C)
Agency Listings	UL CSA MIL-S-8805/26&/98	MIL-S-5594	MIL-S-83731

MICRO SWITCH
a Honeywell Division

ROCKER SWITCHES

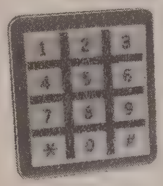
TYPICAL APPLICATIONS

- On control panels of road graders, pavers, cranes, earthmovers, buses, emergency and farm vehicles, and other heavy duty equipment.
- Refrigeration units on over-the-road trucks.
- Food and beverage processing control panels and other industrial equipment.
- Paper/wood processing equipment.

Request Catalog 30.

PUSHBUTTON PANELS

- Computer/Business Applications—
  Copiers, fax machines, printers, telephone equipment, typewriters, computer terminals, and adding machines.
- Medical Applications—
  Diagnostic and physical therapy equipment.
- Commercial Applications—
  Electrical test equipment, process control instruments, and other On/Off applications.



	TP Series	NR Series	SLP1 Series
Panel Area	2-pole: 2.17 x .89 in.	2-pole: 2.17 x .89 in.	.5 x .62 on center
Mounting	3-hole flush or above panel	3-hole flush or above panel	Custom layout
Sealing	Bushing and cover-to-case	Bushing and cover-to-case	—
Electrical Data	Up to 15 a., 125 or 250 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action. mom. or maint. action.	Up to 15 a., 125, 250 or 277 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.	30mA at 12 VDC X-Y or common bus wiring
Termination	Screw	Screw, solder, quick-connect	Pin-connector
Temperature Upper Lower	160°F (71°C) –65°F (–54°C)	160°F (71°C) –40°F (–40°C)	150°F (65°C) –40°F (–40°C)
Agency Listings	UL CSA	ЯU	—

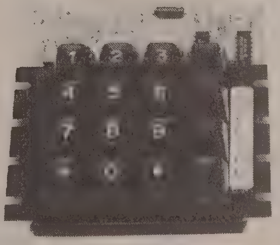
Hall Effect Keyboards

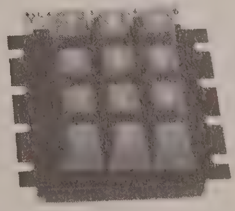
Back in 1968, we revolutionized the keyboard industry by introducing the Hall Effect Series—the first entirely solid state keyboard, and the first to feature such innovations as true N-key roll-over to reduce operator error in high performance applications.

Today, the Hall effect keyboard remains unparalleled in keyboard performance. We offer the Hall Effect Series as completely modular systems, with a choice of output type. So we can configure a keyboard that fits your requirements precisely, in very short order.

If you plan to build your own keyboard—or modify a standard design—you can buy solid state keyswitch modules separately for your special needs. And you can choose from a virtually endless combination of legends, shapes, and colors in sloped, stepped, or sculptured versions.

Request SD Series literature.





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Freeport, Illinois 61032
Tel. 1-800-532-2235

MORS ASC

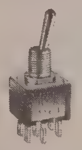
MORS COMPONENTS INC

A World of Switching Capabilities

The partial listings below contain some popular switch models. Consult factory for extensive product offerings and catalog data. Photos below show a representative selection for each switch grouping. Parenthesis in 'Action' tables below indicates momentary action.

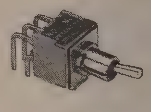
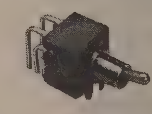
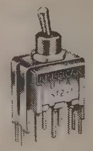
Miniature toggle switches - Power circuit

Contact rating 6 amps at 120 VAC or 3 amps at 250 VAC or 7 amps at 30 VDC. Operating temperature range -30° C to+85° C. Chrome plated brass toggle. Nickel plated brass bushing. Coin silver contacts. Silver plated brass terminals. Phenolic case. Epoxy terminal seal. Nuts, anti-rotate ring and lockwasher included. S.P. body size .290"w x .500"h x.420"d. D.P. body size .500"w x .500"h x .420"d.

MODEL NO.	CIRCUIT	ACTION	
ST1-1KMZQE	SPDT	On-None-On	 STANDARD ROUND HANDLE SOLDER LUG TERMINALS
ST1-2KMZQE		On-Off-On	
ST1-3KMZQE		(On)-Off-(On)	
ST1-4KMZQE		On-Off-(On)	
ST1-5KMZQE		On-None-(On)	
ST2-1KMZQE	DPDT	On-None-On	
ST2-2KMZQE		On-Off-On	
ST2-3KMZQE		(On)-Off-(On)	
ST2-4KMZQE		On-Off-(On)	
ST2-5KMZQE		On-None-(On)	
ST2-6KMZQE		On-On-On	
ST1-1KMCQE	SPDT	On-None-On	STANDARD ROUND HANDLE STRAIGHT P.C. TERMINALS
ST1-2KMCQE		On-Off-On	
ST1-3KMCQE		(On)-Off-(On)	
ST1-4KMCQE		On-Off-(On)	
ST1-5KMCQE		On-None-(On)	
ST2-1KMCQE	DPDT	On-None-On	
ST2-2KMCQE		On-Off-On	
ST2-3KMCQE		(On)-Off-(On)	
ST2-4KMCQE		On-Off-(On)	
ST2-5KMCQE		On-None-(On)	
ST2-6KMCQE		On-On-On	
ST1-1F1MZQE	SPDT	On-None-On	FLATTED TOGGLE HANDLE SOLDER LUG TERMINALS
ST1-2F1MZQE		On-Off-On	
ST1-3F1MZQE		(On)-Off-(On)	
ST1-4F1MZQE		On-Off-(On)	
ST1-5F1MZQE		On-None-(On)	
ST2-1F1MZQE	DPDT	On-None-On	
ST2-2F1MZQE		On-Off-On	
ST2-3F1MZQE		(On)-Off-(On)	
ST2-4F1MZQE		On-Off-(On)	
ST2-5F1MZQE		On-None-(On)	
ST2-6F1MZQE		On-On-On	
ST1-1KHZQE	SPDT	On-None-On	SPLASHPROOF SOLDER LUG TERMINALS
ST1-2KHZQE		On-Off-On	
ST1-3KHZQE		(On)-Off-(On)	
ST1-4KHZQE		On-Off-(On)	
ST1-5KHZQE		On-None-(On)	
ST2-1KHZQE	DPDT	On-None-On	
ST2-2KHZQE		On-Off-On	
ST2-3KHZQE		(On)-Off-(On)	
ST2-4KHZQE		On-Off-(On)	
ST2-5KHZQE		On-None-(On)	
ST2-6KHZQE		On-On-On	
ST1-1T1M4ZQE	SPDT	On-None-On	LARGE HANDLE, 15/32 BUSHING SOLDER LUG TERMINALS
ST1-2T1M4ZQE		On-Off-On	
ST1-3T1M4ZQE		(On)-Off-(On)	
ST1-4T1M4ZQE		On-Off-(On)	
ST1-5T1M4ZQE		On-None-(On)	
ST2-1T1M4ZQE	DPDT	On-None-On	
ST2-2T1M4ZQE		On-Off-On	
ST2-3T1M4ZQE		(On)-Off-(On)	
ST2-4T1M4ZQE		On-Off-(On)	
ST2-5T1M4ZQE		On-None-(On)	
ST2-6T1M4ZQE		On-On-On	

Miniature toggle switches - Dry circuit

Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Operating temperature range -30° C to+85° C. Chrome plated brass toggle. Nickel plated brass bushing. Gold over nickel plated brass contacts and terminals. Phenolic case. Epoxy terminal seal. Nuts, anti-rotate ring and lockwasher included. S.P. body size .290"w x .500"h x .420"d. D.P. body size .500"w x .500"h x .420"d.

MODEL NO.	CIRCUIT	ACTION	
ST1-1KMZBE	SPDT	On-None-On	STANDARD ROUND HANDLE SOLDER LUG TERMINALS
ST1-2KMZBE		On-Off-On	
ST1-3KMZBE		(On)-Off-(On)	
ST1-4KMZBE		On-Off-(On)	
ST1-5KMZBE		On-None-(On)	
ST2-1KMZBE	DPDT	On-None-On	
ST2-2KMZBE		On-Off-On	
ST2-3KMZBE		(On)-Off-(On)	
ST2-4KMZBE		On-Off-(On)	
ST2-5KMZBE		On-None-(On)	
ST2-6KMZBE		On-On-On	
ST1-1KMCBE	SPDT	On-None-On	STANDARD ROUND HANDLE STRAIGHT P.C. TERMINALS
ST1-2KMCBE		On-Off-On	
ST1-3KMCBE		(On)-Off-(On)	
ST1-4KMCBE		On-Off-(On)	
ST1-5KMCBE		On-None-(On)	
ST2-1KMCBE	DPDT	On-None-On	
ST2-2KMCBE		On-Off-On	
ST2-3KMCBE		(On)-Off-(On)	
ST2-4KMCBE		On-Off-(On)	
ST2-5KMCBE		On-None-(On)	
ST2-6KMCBE		On-On-On	
ST1-1L3S3A-1BE	SPDT	On-None-On	 SHORT ROUND HANDLE RT. ANGLE HORIZ. P.C. TERMS.
ST1-2L3S3A-1BE		On-Off-On	
ST1-3L3S3A-1BE		(On)-Off-(On)	
ST1-4L3S3A-1BE		On-Off-(On)	
ST1-5L3S3A-1BE		On-None-(On)	
ST2-1L3S3A-1BE	DPDT	On-None-On	
ST2-2L3S3A-1BE		On-Off-On	
ST2-3L3S3A-1BE		(On)-Off-(On)	
ST2-4L3S3A-1BE		On-Off-(On)	
ST2-5L3S3A-1BE		On-None-(On)	
ST2-6L3S3A-1BE		On-On-On	
ST1-1L3S3V-1BE	SPDT	On-None-On	 SHORT ROUND HANDLE RT. ANGLE VERT. P.C. TERMS.
ST1-2L3S3V-1BE		On-Off-On	
ST1-3L3S3V-1BE		(On)-Off-(On)	
ST1-4L3S3V-1BE		On-Off-(On)	
ST1-5L3S3V-1BE		On-None-(On)	
ST2-1L3S3V-1BE	DPDT	On-None-On	
ST2-2L3S3V-1BE		On-Off-On	
ST2-3L3S3V-1BE		(On)-Off-(On)	
ST2-4L3S3V-1BE		On-Off-(On)	
ST2-5L3S3V-1BE		On-None-(On)	
ST2-6L3S3V-1BE		On-On-On	
ST1-1L3S3V30BE	SPDT	On-None-On	 SHORT ROUND HANDLE STRAIGHT P.C. TERMINALS
ST1-2L3S3V30BE		On-Off-On	
ST1-3L3S3V30BE		(On)-Off-(On)	
ST1-4L3S3V30BE		On-Off-(On)	
ST1-5L3S3V30BE		On-None-(On)	
ST2-1L3S3V30BE	DPDT	On-None-On	
ST2-2L3S3V30BE		On-Off-On	
ST2-3L3S3V30BE		(On)-Off-(On)	
ST2-4L3S3V30BE		On-Off-(On)	
ST2-5L3S3V30BE		On-None-(On)	
ST2-6L3S3V30BE		On-On-On	

Subminiature pushbutton switches - Power circuit

FIG. A
SOLDER LUG
TERMINALS

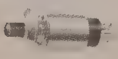


FIG. B
P.C.
TERMINALS

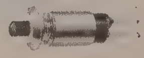
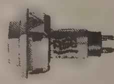


FIG. C
BEZEL MOUNT
SOLDER LUG TERMS.



Contact rating 3 amp at 120 VAC or 28 VDC or 1.5 amp at 250 VAC. Operating temperature range -30° C to+85° C. White nylon actuator. Nickel plated brass bushing. Coin silver contacts. Silver plated brass terminals. Epoxy terminal seal. Panel dress nut and lockwasher included except bezel unit which requires no mounting hardware. Body size .370" dia. x .640" long. Bezel and cap color - black for J81 models.

MODEL NO.	CIRCUIT	ACTION	FIG.
401ZQE	SPST	On-Off	A
401CQE	SPST	On-Off	B
401SZQEJ81	SPST	On-Off	C
402ZQE	SPST	Off-(On)	A
402CQE	SPST	Off-(On)	B
402SZQEJ81	SPST	Off-(On)	C

Subminiature pushbutton switches - Dry circuit

Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Operating temperature range -30° C to+85° C. White nylon actuator. Nickel plated brass bushing. Gold over nickel plated brass contacts and terminals. Epoxy terminal seal. Panel dress nut and lockwasher included except bezel unit which requires no mounting hardware. Body size .370" dia. x .640" long. Bezel and cap color - black for J81 models.

MODEL NO.	CIRCUIT	ACTION	FIG.
401ZBE	SPST	On-Off	A
401CBE	SPST	On-Off	B
401SZBEJ81	SPST	On-Off	C
402ZBE	SPST	Off-(On)	A
402CBE	SPST	Off-(On)	B
402SZBEJ81	SPST	Off-(On)	C

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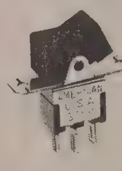
A World of Switching Capabilities

The partial listings below contain some popular switch models. Consult factory for extensive product offerings and catalog data. Photos below show a representative selection for each switch grouping. Parenthesis in 'Action' tables below indicates momentary action.

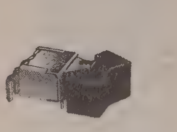
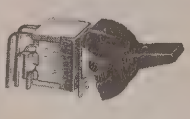
Miniature rocker & lever switches - Power circuit

Contact rating 6 amps at 120 VAC or 3 amps at 250 VAC or 7 amps at 30 VDC. Operating temp. range -30° C to+85° C. Black nylon actuator. Coin silver contacts.Silver plated brass terminals.Phenolic case. Epoxy terminal seal. Mtg. hardware supplied for panel mounting models. S.P. body size .290"w x.500"h x.420"d. D.P. body size .500"w x .500"h x .420"d. Rocker (J1) .531"l. x .365"w.. Lever (J2) .365"w. x .737"h..

MODEL NO.	CKT.	ACTION	
ST1-1L4S4ZQEJ1	SPDT	On-None-On	 **ROCKER ACTUATOR PANEL MOUNTING**
ST1-2L4S4ZQEJ1		On-Off-On	
ST1-3L4S4ZQEJ1		(On)-Off-(On)	
ST1-4L4S4ZQEJ1		On-Off-(On)	
ST1-5L4S4ZQEJ1		On-None-(On)	
ST2-1L4S4ZQEJ1	DPDT	On-None-On	
ST2-2L4S4ZQEJ1		On-Off-On	
ST2-3L4S4ZQEJ1		(On)-Off-(On)	
ST2-4L4S4ZQEJ1		On-Off-(On)	
ST2-5L4S4ZQEJ1		On-None-(On)	
ST2-6L4S4ZQEJ1		On-On-On	
ST1-1L4S4V30QEJ2	SPDT	On-None-On	**LEVER ACTUATOR STRAIGHT P.C. TERMINALS**
ST1-2L4S4V30QEJ2		On-Off-On	
ST1-3L4S4V30QEJ2		(On)-Off-(On)	
ST1-4L4S4V30QEJ2		On-Off-(On)	
ST1-5L4S4V30QEJ2		On-None-(On)	
ST2-1L4S4V30QEJ2	DPDT	On-None-On	
ST2-2L4S4V30QEJ2		On-Off-On	
ST2-3L4S4V30QEJ2		(On)-Off-(On)	
ST2-4L4S4V30QEJ2		On-Off-(On)	
ST2-5L4S4V30QEJ2		On-None-(On)	
ST2-6L4S4V30QEJ2		On-On-On	

Miniature rocker & lever switches - Dry circuit

Contact rating 0.4 volt- amps (VA) max. at 20 volts max. (AC or DC). Operating temp. range -30° C to+85° C. Black nylon actuator. Gold over nickel plated brass contacts and terminals.Phenolic case. Epoxy terminal seal. S.P. body size .290"w x.500"h x.420"d. D.P. body size .500"w x .500"h x .420"d. Rocker (J1) .531"l. x .365"w.. Lever (J2) .365"w. x .737"h..

MODEL NO.	CKT.	ACTION	
ST1-1L4S4A-1BEJ1	SPDT	On-None-On	 **ROCKER ACTUATOR RT. ANGLE HORIZ. P.C. TERMS.**
ST1-2L4S4A-1BEJ1		On-Off-On	
ST1-3L4S4A-1BEJ1		(On)-Off-(On)	
ST1-4L4S4A-1BEJ1		On-Off-(On)	
ST1-5L4S4A-1BEJ1		On-None-(On)	
ST2-1L4S4A-1BEJ1	DPDT	On-None-On	
ST2-2L4S4A-1BEJ1		On-Off-On	
ST2-3L4S4A-1BEJ1		(On)-Off-(On)	
ST2-4L4S4A-1BEJ1		On-Off-(On)	
ST2-5L4S4A-1BEJ1		On-None-(On)	
ST2-6L4S4A-1BEJ1		On-On-On	
ST1-1L4S4V-1BEJ2	SPDT	On-None-On	 **LEVER ACTUATOR RT. ANGLE VERT. P.C. TERMS.**
ST1-2L4S4V-1BEJ2		On-Off-On	
ST1-3L4S4V-1BEJ2		(On)-Off-(On)	
ST1-4L4S4V-1BEJ2		On-Off-(On)	
ST1-5L4S4V-1BEJ2		On-None-(On)	
ST2-1L4S4V-1BEJ2	DPDT	On-None-On	
ST2-2L4S4V-1BEJ2		On-Off-On	
ST2-3L4S4V-1BEJ2		(On)-Off-(On)	
ST2-4L4S4V-1BEJ2		On-Off-(On)	
ST2-5L4S4V-1BEJ2		On-None-(On)	
ST2-6L4S4V-1BEJ2		On-On-On	

Miniature pushbutton switches - Power circuit

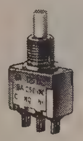


FIG.A
SOLDER LUG TERMS.

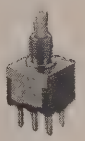


FIG. B
P.C. TERMS.

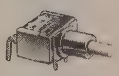


FIG. C
HOR. RT. ANGLE P.C.

Contact rating 6 amps at 120 VAC or 3 amps at 250 VAC or 7 amps at 30 VDC. Operating temp. range -30° C to +85° C. White glass polyester actuator. Coin silver contacts.Silver plated brass terminals.Phenolic case. Epoxy terminal seal. Mtg. hardware supplied for panel mounting models. S.P. body size .290"w x.500"h x.420"d. D.P. body size .500"w x .500"h x .420"d. Bezel and cap color - black for J81 models.

MODEL NO.	CIRCUIT	ACTION	FIG.
810KMZQ	SPDT	On-(On)	A
820KMZQ	DPDT	On-(On)	A
810KMCQ	SPDT	On-(On)	B
820KMCQ	DPDT	On-(On)	B
810KSA-1Q	SPDT	On-(On)	C
820KSA-1Q	DPDT	On-(On)	C
810KSV-1Q	SPDT	On-(On)	D
820KSV-1Q	DPDT	On-(On)	D
810KSV30Q	SPDT	On-(On)	E
820KSV30Q	DPDT	On-(On)	E
810K2M1ZQJ81	SPDT	On-(On)	F
820K2M1ZQJ81	DPDT	On-(On)	F

Miniature pushbutton switches - Dry circuit

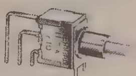


FIG. D
VERT. RT. ANGLE P.C.

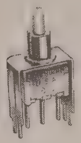


FIG. E
STRAIGHT P.C. TERMS.

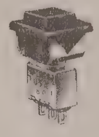


FIG. F
BEZEL MOUNTING

Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Operating temp. range -30° C to +85° C. White glass polyester actuator. Gold over nickel plated brass contacts and terminals.Phenolic case. Epoxy terminal seal. Mtg. hardware supplied for panel mounting models. S.P. body size .290"w x.500"h x.420"d. D.P. body size .500"w x .500"h x .420"d. Bezel and cap color - black for J81 models.

MODEL NO.	CIRCUIT	ACTION	FIG.
810KMZB	SPDT	On-(On)	A
820KMZB	DPDT	On-(On)	A
810KMCB	SPDT	On-(On)	B
820KMCB	DPDT	On-(On)	B
810KSA-1B	SPDT	On-(On)	C
820KSA-1B	DPDT	On-(On)	C
810KSV-1B	SPDT	On-(On)	D
820KSV-1B	DPDT	On-(On)	D
810KSV30B	SPDT	On-(On)	E
820KSV30B	DPDT	On-(On)	E
810K2M1ZBJ81	SPDT	On-(On)	F
820K2M1ZBJ81	DPDT	On-(On)	F

Subminiature pushbutton switches - Power circuit

FIG. G
SOLDER LUG
TERMINALS

FIG. H
P.C.
TERMINALS

Contact rating 3 amp at 120 VAC or 28 VDC or 1.5 amp at 250 VAC. Operating temp. range -30° C to+85° C. Black nylon actuator. Nickel plated brass bushing. Coin silver contacts. Silver plated brass terms. Epoxy term. seal. Hex. nut and lockwasher included except bezel unit which requires no mtg. hardware. Body size 301, 303 & 305 - .370" dia. x .427" long. .370" dia. x .315" long for 302 & 304. Bezel & cap color - black for J81 model.

MODEL NO.	CKT.	ACTION	TRAVEL	FIG.
301ZQE	SPST	Off-(On)	.110" total, .020" min. overtravel	G
301CQE	SPST	Off-(On)	.110" total, .020" min. overtravel	H
301SZQEJ81	SPST	Off-(On)	.110" total, .020" min. overtravel	I
302ZQE	SPST	Off-(On)	.060" total	J
303ZQE	SPST	On-(Off)	.055" total, .020" min. pretravel	G
304ZQE	SPST	On-(Off)	.040 total	J
305ZQE	SPST	Off-(On)	.110" total, .060" min. overtravel	G

Subminiature pushbutton switches - Dry circuit

FIG. I
BEZEL MOUNT
SOLDER LUG
TERMINALS

FIG. J
SOLDER LUG
TERMINALS

Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Op. temp. range -30° C to +85° C. Black nylon actuator. Nickel plated brass bushing. Gold over nickel plated brass contacts and terms. Epoxy term. seal. Hex. nut and lockwasher included except bezel unit which requires no mtg. hardware. Body size 301, 303 & 305 - .370" dia. x .427" long. .370" dia. x .315" long for 302 & 304. Bezel & cap color - black for J81 model.

MODEL NO.	CKT.	ACTION	TRAVEL	FIG.
301ZBE	SPST	Off-(On)	.110" total, .020" min. overtravel	G
301CBE	SPST	Off-(On)	.110" total, .020" min. overtravel	H
301SZBEJ81	SPST	Off-(On)	.110" total, .020" min. overtravel	I
302ZBE	SPST	Off-(On)	.060" total	J
303ZBE	SPST	On-(Off)	.055" total, .020" min. pretravel	G
304ZBE	SPST	On-(Off)	.040 total	J
305ZBE	SPST	Off-(On)	.110" total, .060" min. overtravel	G

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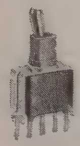
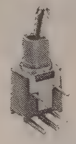
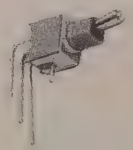
Sealed tiny toggle & rocker switches - Dry circuit

Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Operating temp. range -30° C to +85° C. Chrome plated brass toggle. Gold over nickel plated brass contacts & terminals. Blue glass filled PBT body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .200"w x.320"h x.320"d. D.P. body size .360"w x .320"h x .320"d. Process compatible. Rocker switches have black nylon actuator.

MODEL NO.	CIRCUIT	ACTION	
TL36POOOO	SPDT	On-None-On	 STRAIGHT P.C. TERMINALS
TL39POOOO		On-Off-On	
TL37POOOO		(On)-Off-(On)	
TL38POOOO		On-Off-(On)	
TL32POOOO		On-None-(On)	
TL46POOOO	DPDT	On-None-On	
TL49POOOO		On-Off-On	
TL47POOOO		(On)-Off-(On)	
TL48POOOO		On-Off-(On)	
TL42POOOO		On-None-(On)	
TL36YOOOO	SPDT	On-None-On	 STRAIGHT P.C. TERMINALS
TL39YOOOO		On-Off-On	
TL37YOOOO		(On)-Off-(On)	
TL38YOOOO		On-Off-(On)	
TL32YOOOO		On-None-(On)	
TL46YOOOO	DPDT	On-None-On	
TL49YOOOO		On-Off-On	
TL47YOOOO		(On)-Off-(On)	
TL48YOOOO		On-Off-(On)	
TL42YOOOO		On-None-(On)	
TL36WOOOO	SPDT	On-None-On	 RT. ANGLE HORIZ. P.C. TERMS.
TL39WOOOO		On-Off-On	
TL37WOOOO		(On)-Off-(On)	
TL38WOOOO		On-Off-(On)	
TL32WOOOO		On-None-(On)	
TL46WOOOO	DPDT	On-None-On	
TL49WOOOO		On-Off-On	
TL47WOOOO		(On)-Off-(On)	
TL48WOOOO		On-Off-(On)	
TL42WOOOO		On-None-(On)	
TL36WWOOO	SPDT	On-None-On	 RT. ANGLE VERT. P.C. TERMS.
TL39WWOOO		On-Off-On	
TL37WWOOO		(On)-Off-(On)	
TL38WWOOO		On-Off-(On)	
TL32WWOOO		On-None-(On)	
TL46WWOOO	DPDT	On-None-On	
TL49WWOOO		On-Off-On	
TL47WWOOO		(On)-Off-(On)	
TL48WWOOO		On-Off-(On)	
TL42WWOOO		On-None-(On)	
TR36YOO1O	SPDT	On-None-On	 STRAIGHT P.C. TERMINALS
TR39YOO1O		On-Off-On	
TR37YOO1O		(On)-Off-(On)	
TR38YOO1O		On-Off-(On)	
TR32YOO1O		On-None-(On)	
TR46YOO1O	DPDT	On-None-On	
TR49YOO1O		On-Off-On	
TR47YOO1O		(On)-Off-(On)	
TR48YOO1O		On-Off-(On)	
TR42YOO1O		On-None-(On)	

Sealed tiny pushbutton switches - Dry circuit

Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Operating temp. range -30° C to +85° C. Black glass polyester actuator. Gold over nickel plated brass contacts & terminals. Blue glass filled PBT body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .200"w x.320"h x.320"d. D.P. body size .360"w x .320"h x .320"d. Process compatible.

MODEL NO.	CKT.	ACTION	FIG.
TP32POO3O	SPDT	On-(On)	A
TP33POO3O	SPST	Off-(On)	A
TP42POO3O	DPDT	On-(On)	A
TP43POO3O	DPST	Off-(On)	A
TP32YOO3O	SPDT	On-(On)	B
TP33YOO3O	SPST	Off-(On)	B
TP42YOO3O	DPDT	On-(On)	B
TP43YOO3O	DPST	Off-(On)	B
TP32WOO3O	SPDT	On-(On)	C
TP33WOO3O	SPST	Off-(On)	C
TP42WOO3O	DPDT	On-(On)	C
TP43WOO3O	DPST	Off-(On)	C
TP32WWO3O	SPDT	On-(On)	D
TP33WWO3O	SPST	Off-(On)	D
TP42WWO3O	DPDT	On-(On)	D
TP43WWO3O	DPST	Off-(On)	D

FIG. A

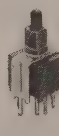


FIG. B

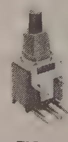


FIG. C

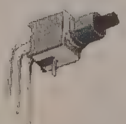
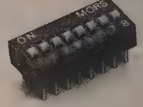


FIG. D

DIP switches

Contact rating : Carry - 100 mA max. at 50 VDC; Switching - 50 mA max. at 24 VDC. Op. temp. range -40° C to +70° C. Glass filled PBT case, color - red. Glass filled PBT actuators, color - white. Contacts & terms. gold over nickel over phosphor bronze. Epoxy sealed terms.. Std'd. DIP package term. spacing of .100" x .300" (.100" x .100" for DA models). Process compatible when optional tape seal is specified. SPST Off-On action.

ACTUATOR STYLE	MOD. NO. NO TAPE SEAL	MOD. NO. W/TAPE SEAL	NO. OF POS.
RAISED ACTUATOR	DS-02	DS-02T	2
	DS-03	DS-03T	3
	DS-04	DS-04T	4
	DS-05	DS-05T	5
	DS-06	DS-06T	6
	DS-07	DS-07T	7
	DS-08	DS-08T	8
	DS-09	DS-09T	9
	DS-10	DS-10T	10
	DS-12	DS-12T	12
RECESSED ACTUATOR	DSR-02	DSR-02T	2
	DSR-03	DSR-03T	3
	DSR-04	DSR-04T	4
	DSR-05	DSR-05T	5
	DSR-06	DSR-06T	6
	DSR-07	DSR-07T	7
	DSR-08	DSR-08T	8
	DSR-09	DSR-09T	9
	DSR-10	DSR-10T	10
	DSR-12	DSR-12T	12
RAISED ACTUATOR	DA-02	DA-02T	2
	DA-03	DA-03T	3
	DA-04	DA-04T	4
	DA-05	DA-05T	5
	DA-06	DA-06T	6
	DA-07	DA-07T	7
	DA-08	DA-08T	8
	DA-09	DA-09T	9
	DA-10	DA-10T	10
	DA-12	DA-12T	12
RECESSED ACT.	DP-02	DP-02T	2
	DP-03	DP-03T	3
	DP-04	DP-04T	4
	DP-05	DP-05T	5
	DP-06	DP-06T	6
	DP-08	DP-08T	8
	DP-10	DP-10T	10
	DP-12	DP-12T	12
EXTENDED ACT.	DPL-02	DPL-02T	2
	DPL-03	DPL-03T	3
	DPL-04	DPL-04T	4
	DPL-05	DPL-05T	5
	DPL-06	DPL-06T	6
	DPL-08	DPL-08T	8
	DPL-10	DPL-10T	10
	DPL-12	DPL-12T	12

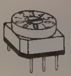


ON
MORS
1 2 3 4 5 6 7 8

DIP coded rotary switches

Contact rating : Carry - 400 mA max. at 24 VDC; Switching - 150 mA max. at 24 VDC. Op. temp. range -20° C to +70° C. Glass filled thermoplastic body, color - lt. gray. Glass filled thermoplastic actuator, color - dk. gray.Internal o-ring actuator seal. Contacts gold over nickel plated. Molded-in solder coated terms.. 10 & 16 position models. Body size .393" sq. x .256" high. Process compatible. **Code 1:** BCD (2 common terms.). **Code 2:** BCD complement. **Code 3:** Hexadecimal. **Code 4:** Hexadecimal complement

CODE	MODEL NO. BY TERMINAL STYLE		
	STRAIGHT .200"X.300"	RIGHT ANGLE AT PITCH = .100"	RIGHT ANGLE AT PITCH = .200"
1	P65101	P65101L254	P65101L508
2	P65102	P65102L254	P65102L508
3	P65103	P65103L254	P65103L508
4	P65106	P65106L254	P65106L508
1	P65301	P65301L254	P65301L508
2	P65302	P65302L254	P65302L508
3	P65303	P65303L254	P65303L508
4	P65306	P65306L254	P65306L508
1	P65401	P65401L254	P65401L508
2	P65402	P65402L254	P65402L508
3	P65403	P65403L254	P65403L508
4	P65406	P65406L254	P65406L508
1	P65501	P65501L254	P65501L508
2	P65502	P65502L254	P65502L508
3	P65503	P65503L254	P65503L508
4	P65506	P65506L254	P65506L508

P65101


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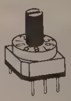

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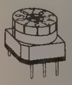

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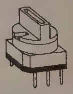

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MORS ASC

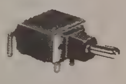
MORS COMPONENTS INC

A World of Switching Capabilities

The partial listings below contain some popular switch models. Consult factory for extensive product offerings and catalog data. Photos below show a representative selection for each switch grouping. Parenthesis in 'Action' tables below indicates momentary action.

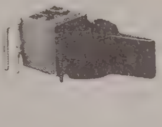
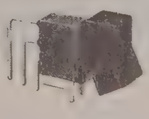
Process sealed miniature toggle switches

Contact rating 0.4 Volt-Amps max. at 20 V max. (AC or DC). Operating temperature range -30° C to+85° C. Chrome plated brass toggle. Gold over nickel over brass contacts and terminals. Glass filled nylon (UL94V-O) case and bushing, color red. Epoxy terminal seal. S.P. body size .265"w x.500"h x.420"d. D.P. body size .470"w x .500"h x .420"d. Power rating also available - 6 Amps at 125 VAC - Substitute Q for B in model no. below.

MODEL NO.	CIRCUIT	ACTION	
WT11L2SCBE	SPDT	On-None-On	 SHORT ROUND HANDLE STRAIGHT P.C. TERMINALS
WT12L2SCBE		On-Off-On	
WT13L2SCBE		(On)-Off-(On)	
WT14L2SCBE		On-Off-(On)	
WT15L2SCBE		On-None-(On)	
WT21L2SCBE	DPDT	On-None-On	
WT22L2SCBE		On-Off-On	
WT23L2SCBE		(On)-Off-(On)	
WT24L2SCBE		On-Off-(On)	
WT25L2SCBE		On-None-(On)	
WT26L2SCBE		On-On-On	
WT11L2SV30BE	SPDT	On-None-On	 SHORT ROUND HANDLE W/BRKT. STRAIGHT P.C. TERMINALS
WT12L2SV30BE		On-Off-On	
WT13L2SV30BE		(On)-Off-(On)	
WT14L2SV30BE		On-Off-(On)	
WT15L2SV30BE		On-None-(On)	
WT21L2SV30BE	DPDT	On-None-On	
WT22L2SV30BE		On-Off-On	
WT23L2SV30BE		(On)-Off-(On)	
WT24L2SV30BE		On-Off-(On)	
WT25L2SV30BE		On-None-(On)	
WT26L2SV30BE		On-On-On	
WT11L2SA-1BE	SPDT	On-None-On	 SHORT ROUND HANDLE RT. ANGLE HORIZ P.C. TERMS.
WT12L2SA-1BE		On-Off-On	
WT13L2SA-1BE		(On)-Off-(On)	
WT14L2SA-1BE		On-Off-(On)	
WT15L2SA-1BE		On-None-(On)	
WT21L2SA-1BE	DPDT	On-None-On	
WT22L2SA-1BE		On-Off-On	
WT23L2SA-1BE		(On)-Off-(On)	
WT24L2SA-1BE		On-Off-(On)	
WT25L2SA-1BE		On-None-(On)	
WT26L2SA-1BE		On-On-On	
WT11L2SV-1BE	SPDT	On-None-On	 SHORT ROUND HANDLE RT. ANGLE VERT. P.C. TERMS.
WT12L2SV-1BE		On-Off-On	
WT13L2SV-1BE		(On)-Off-(On)	
WT14L2SV-1BE		On-Off-(On)	
WT15L2SV-1BE		On-None-(On)	
WT21L2SV-1BE	DPDT	On-None-On	
WT22L2SV-1BE		On-Off-On	
WT23L2SV-1BE		(On)-Off-(On)	
WT24L2SV-1BE		On-Off-(On)	
WT25L2SV-1BE		On-None-(On)	
WT26L2SV-1BE		On-On-On	

Process sealed miniature rocker & lever switches

Contact rating 0.4 volt-amps max. at 20 volts max. (AC or DC). Op. temp. range -30° C to+85° C. Glass filled poly. , nylon or acetal actuator - color black std'd. Gold over nickel over brass conts. and terms. Glass filled nylon (UL94V-O) case and bush., color red. Epoxy term. seal. S.P. body size .265"w x .500"h x .420"d. D.P. body size .470"w x .500"h x .420"d. Pwr. rating also avail. - 6 Amps at 125 VAC - Substitute Q for B in model no. below.

MODEL NO.	CIRCUIT	ACTION	
WT11LSZBEJ2	SPDT	On-None-On	 PANEL MT., LEVER ACTUATOR SOLDER LUG TERMINALS
WT12LSZBEJ2		On-Off-On	
WT13LSZBEJ2		(On)-Off-(On)	
WT14LSZBEJ2		On-Off-(On)	
WT15LSZBEJ2		On-None-(On)	
WT21LSZBEJ2	DPDT	On-None-On	
WT22LSZBEJ2		On-Off-On	
WT23LSZBEJ2		(On)-Off-(On)	
WT24LSZBEJ2		On-Off-(On)	
WT25LSZBEJ2		On-None-(On)	
WT26LSZBEJ2		On-On-On	
WT11LSV30BEJ1	SPDT	On-None-On	 ROCKER ACTUATOR W/BRKT. STRAIGHT P.C. TERMS.
WT12LSV30BEJ1		On-Off-On	
WT13LSV30BEJ1		(On)-Off-(On)	
WT14LSV30BEJ1		On-Off-(On)	
WT15LSV30BEJ1		On-None-(On)	
WT21LSV30BEJ1	DPDT	On-None-On	
WT22LSV30BEJ1		On-Off-On	
WT23LSV30BEJ1		(On)-Off-(On)	
WT24LSV30BEJ1		On-Off-(On)	
WT25LSV30BEJ1		On-None-(On)	
WT26LSV30BEJ1		On-On-On	
WT11LSA-2BEJ2	SPDT	On-None-On	 LEVER ACTUATOR RT. ANGLE HORIZ. P.C. TERMS.
WT12LSA-2BEJ2		On-Off-On	
WT13LSA-2BEJ2		(On)-Off-(On)	
WT14LSA-2BEJ2		On-Off-(On)	
WT15LSA-2BEJ2		On-None-(On)	
WT21LSA-2BEJ2	DPDT	On-None-On	
WT22LSA-2BEJ2		On-Off-On	
WT23LSA-2BEJ2		(On)-Off-(On)	
WT24LSA-2BEJ2		On-Off-(On)	
WT25LSA-2BEJ2		On-None-(On)	
WT26LSA-2BEJ2		On-On-On	
WT11LSV-3BEJ1	SPDT	On-None-On	 ROCKER ACTUATOR RT. ANGLE VERT. P.C. TERMS.
WT12LSV-3BEJ1		On-Off-On	
WT13LSV-3BEJ1		(On)-Off-(On)	
WT14LSV-3BEJ1		On-Off-(On)	
WT15LSV-3BEJ1		On-None-(On)	
WT21LSV-3BEJ1	DPDT	On-None-On	
WT22LSV-3BEJ1		On-Off-On	
WT23LSV-3BEJ1		(On)-Off-(On)	
WT24LSV-3BEJ1		On-Off-(On)	
WT25LSV-3BEJ1		On-None-(On)	
WT26LSV-3BEJ1		On-On-On	

Ultraminiature tact switches

Single pole - single throw momentary action. Contact rating 50 milliamps at 12 VDC.. Operating temperature range -20° C to+70° C. PBT thermoplastic actuator and case.Phosphor bronze or stainless steel with silver clad shorting contact. Silver plated brass terminals. PET film, tin plated brass or stainless steel cover/bracket. Molded-in terminals. Body size (approx.) - MJTP1230, 1232 & 1234: .238" Sq. x .142" high. - MJTP1236: 291" w x .276" h x .157" d. - MJTP1237 & 1237E: .250" Sq. x .063" h. - MJTP1240: .250" Sq. x .283" h. - MJTP1243 & 1250: .138" w x .236" l x .138" h.

MODEL NUMBER	GROUND TAB	ACTUATOR HEIGHT
MJTP1230	No	.028"
MJTP1230A	No	.055"
MJTP1230B	No	.232"
MJTP1230C	No	.173"
MJTP1230D	No	.370"
MJTP1230E	No	.134"
MJTP1232	Yes	.028"
MJTP1232A	Yes	.055"
MJTP1232B	Yes	.232"
MJTP1232C	Yes	.173"
MJTP1232D	Yes	.370"
MJTP1232E	Yes	.134"

MODEL NUMBER	GROUND TAB	ACTUATOR L + W
MJTP1234	No	.094"
MJTP1234A	No	.110"

MODEL NUMBER	LED COLOR
MJTP1240R	Red
MJTP1240Y	Yellow
MJTP1240G	Green

MJTP1230

MJTP1232

MJTP1234

MJTP1240R

MODEL NUMBER	GROUND TAB	ACTUATOR HEIGHT
MJTP1236	Yes	.028"
MJTP1236A	Yes	.055"
MJTP1236B	Yes	.232"
MJTP1236E	Yes	.134
MJTP1237	No	Flush
MJTP1237E	Yes	Flush
MJTP1243	No	.031"
MJTP1250	No	.059"

MJTP1236

MJTP1250

MJTP1237

MJTP1237E

Ultraminiature slide switches

Single pole - double throw maintained action. Contact rating 300 milliamps at 50 VDC.. Operating temperature range -20° C to+70° C. Type 6/6 nylon actuator, black. Glass filled nylon case, black.Stainless steel cover. Silver plated phosphor bronze shorting contact. Silver plated brass terminals. Body size - .138" w x .335" l x .138" h.

MODEL NUMBER	ACTUATOR STYLE
MHSS1104	Vertical
MHSS1105	Right angle

MHSS1104

MHSS1105

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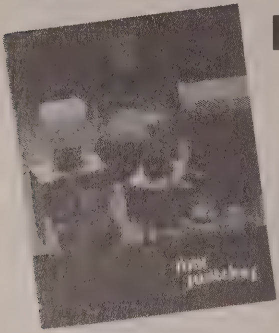

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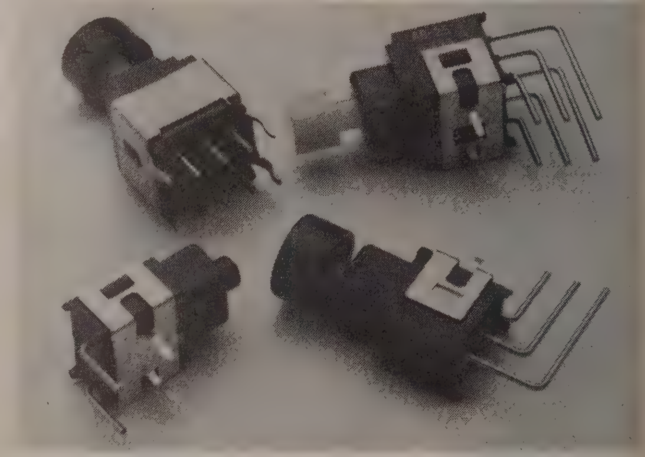
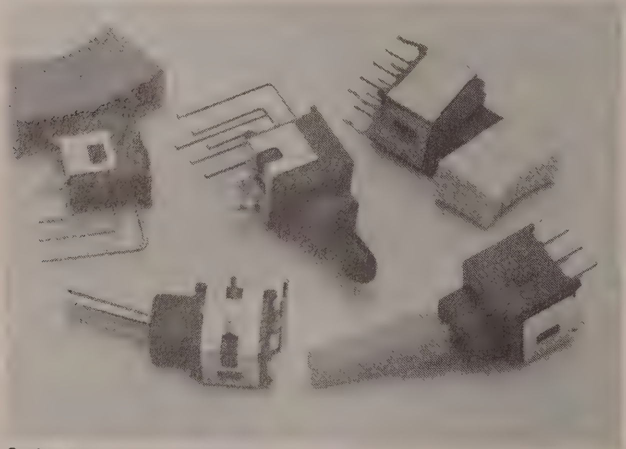
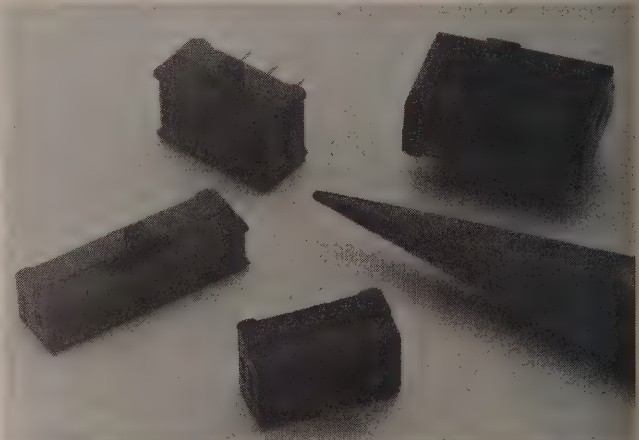


Series AB. Super-subminiature PCB washable pushbuttons. Sealed for automated washing/cleaning. High-rel contacts. SPST, SPDT & DPDT in ON-OFF & ON-ON momentary circuits. 0.4VA max @ 28V AC/DC max. Bracketed/unbracketed straight, right angle, vertical terminals. .213"/.183"/0.80" long plungers. Two cap sizes in red, white or black. **Call 602/991-0942. Ask for EEM Extension.**



Series A. Super-subminiature PCB washable toggles/rockers. Time & money saving automated washing/cleaning, plus ultra-reliable STC contacts. 0.4VA max @ 28V AC/DC max. SPST, SPDT & SP3T in all circuits. Bracketed/unbracketed straight, right angle & vertical .100" x .100" spaced terminations. Numerous toggles, paddles, rockers. **Call 602/991-0942. Ask for EEM Extension.**



Series SS. Unique! Micro-subminiature LED PCB slides. Slide switches as small as .257" x .402". Lighted or non-lighted. SPDT, SP3T &DPDT. 0.1A@30V DC. Top or side-actuated & .100" x .100" terminal spacing for maximum design flexibility. ON-NONE-ON & ON-ON-ON circuits. **Call 602/991-0942. Ask for EEM Extension.**

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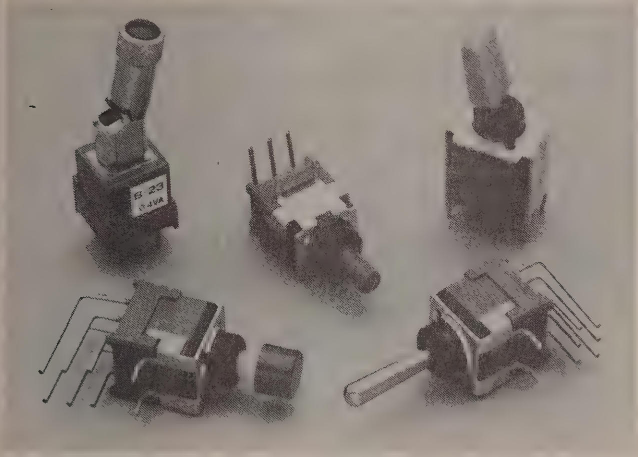
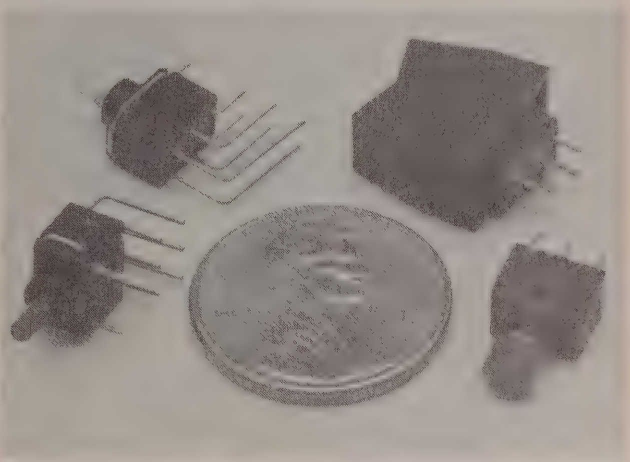


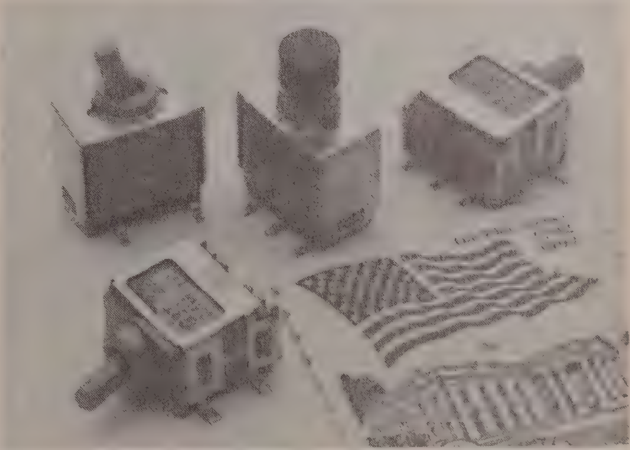
Series B. Antistatic super-subminiature PCB washables.
Antistatic-electricity toggles and pushbuttons. Rating: 0.4VA max @ 28V AC/DC max. SPDT, DPDT & SP3T in 6 circuits. Bracketed or unbracketed straight, right angle & vertical terminations with .100" x .100" spacing. Patented STC contacts. Unique locking lever versions.
Call 602/991-0942. Ask for EEM Extension.

Series SK. Compact bushing & panel mount keylocks.
Crisp detent, self-cleaning contacts, dust resistant interior. UL/CSA recognition, bushing mounted 3A rated SPDT with 1500V dielectric strength. Short .945" length behind panel. Washable types available with straight or right angle PC terminals.
Call 602/991-0942. Ask for EEM Extension.

Series AS. Super-subminiature, high reliability PCB slide switches.
Guaranteed minimum of 50,000 actuations. Rated at 0.4VA max @ 28V AC/DC. Single & double pole with numerous circuit options. Straight, right angle & vertical terminals — all with support brackets. Various actuator lengths available.
Call 602/991-0942. Ask for EEM Extension.



Series G. World's smallest washable PCB switches.
Toggles, rockers, pushbuttons & indicator lights one-third size of super-subminiatures. 0.4VA max @ 28V AC/DC max. Patented hi-rel STC contacts. .100" x .100" straight, right & vertical terminations. SPDT & DPDT. Sealed for automated cleaning. Weighs .25 grams.
Call 602/991-0942. Ask for EEM Extension.



Series G3. Micro-subminiature washable surface mount.
World's smallest & most reliable surface mount toggles & pushbuttons. Patented STC contacts. Straight or right angle gull-winged mounting. Vapor phase reflow solderable. SPDT & DPDT in numerous circuits. 500-device tape reel or 500-piece stick tube.
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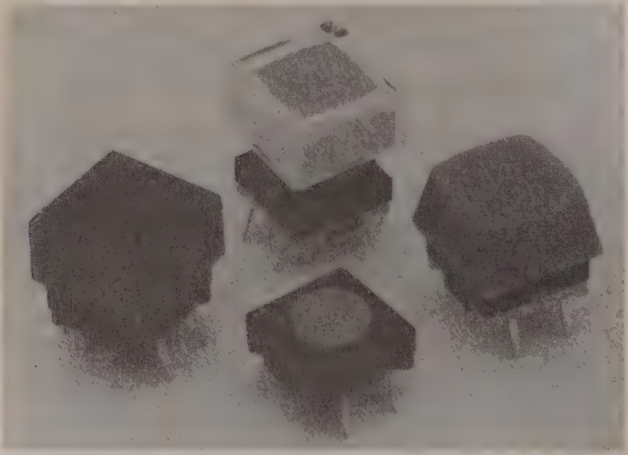
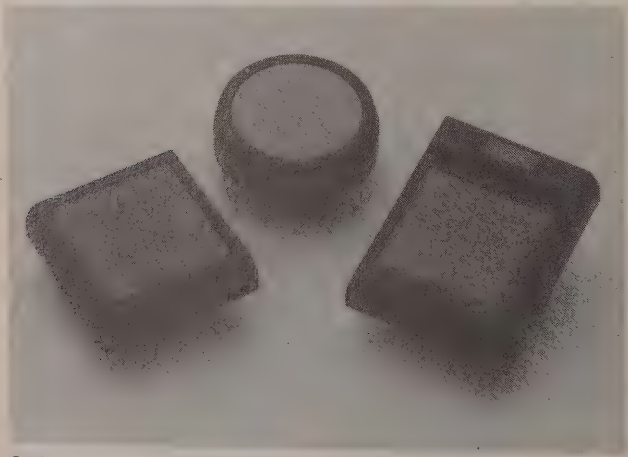
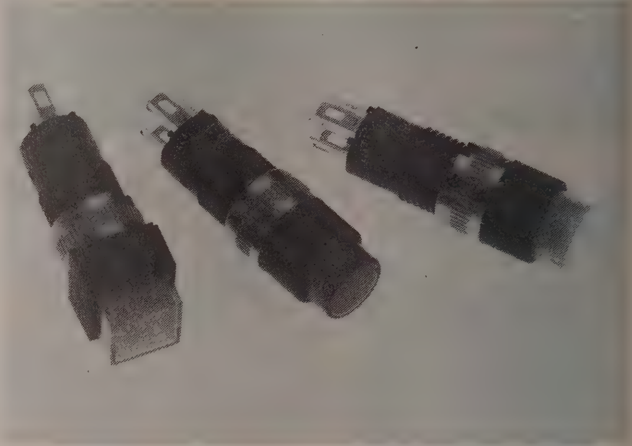


Series JB. 5 million-actuation low-profile keypads.
Low profile, short stroke dome contact, SPST, OFF/momentary circuit. Short actuator 50mA or extended 125mA, both @ 24V DC max. Illuminated or non-illuminated types plus model for mounting under overlay. Numerous color and clear snap-on cap options.
Call 602/991-0942. Ask for EEM Extension.

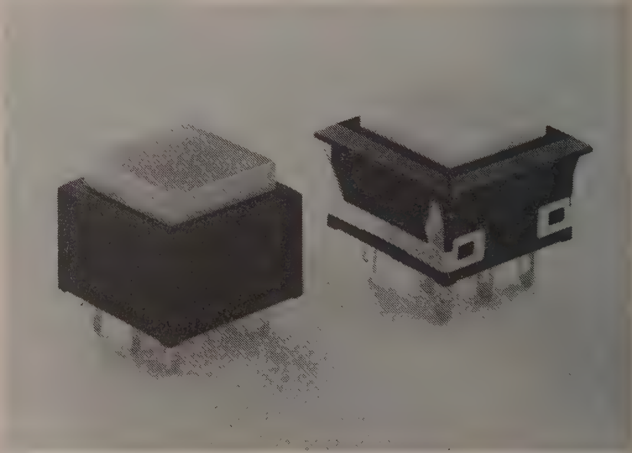


Series JF. Washable lighted/non-lighted designer keypads.
Space-saving decorative styles with or without LEDs. SPST OFF/momentary ON. Rated 50mA @ 24V DC. Round, square & sculpted actuators with choice of several colors. Contacts sealed & protected against splashes for exceptional long-life reliability.
Call 602/991-0942. Ask for EEM Extension.



Series HB. Ultra-small LED panel mount pushbuttons.
One-fourth size of std. lighted devices. Tiny .315" dia. body takes up less than 1" behind panel. Hi-visibility full-face or spot-illuminated caps relamp from panel. Self-cleaning contacts. SPDT with 0.1A max. @ 30V AC/DC max. rating. UL recognized.
Call 602/991-0942. Ask for EEM Extension.

Series KB. 1 amp & logic level lighted pushbuttons.
Miniature KBs allow front panel, bushing or snap-in mounting, plus optional adapters for straight or right angle PCB mounting. Several hi-visibility lamp choices, all relampable from front panel. SPDT, DPDT in maintained or mom. circuits. Hi-rel snap-action contacts.
Call 602/991-0942. Ask for EEM Extension.



Series UB. Space-saving lighted panel mount/PCB pushbuttons.
Half-inch body saves space behind panel or on PC board. Momentary or alt. action. Quick-break contact mechanism. 5A 125/250V AC, 5A/30V DC or logic level. SPDT and DPDT. Switch features special latchdown mechanism.
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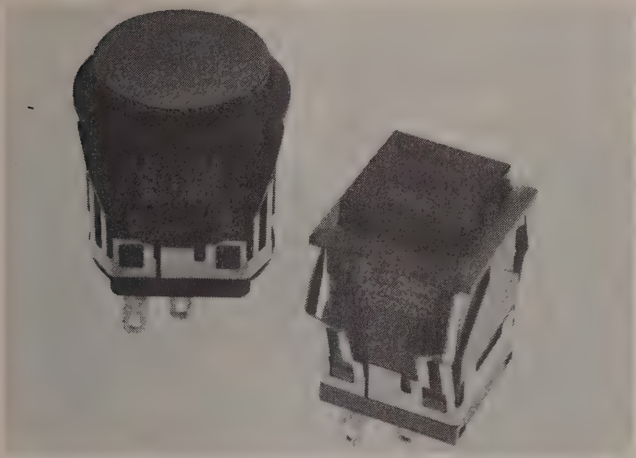
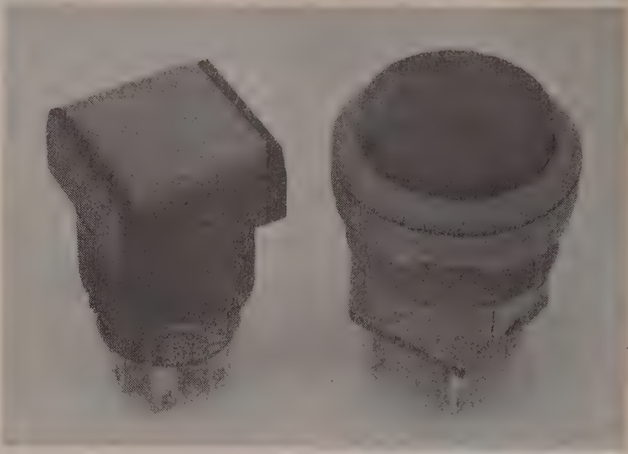
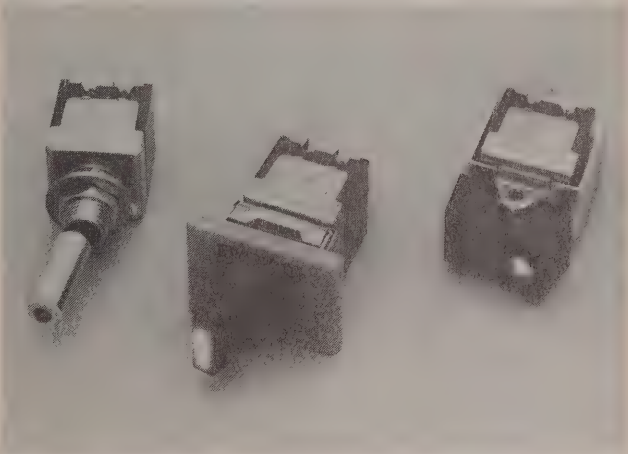


Series LB. 3 amp, million-actuation lighted pushbuttons.
SPDT, DPDT 3 amp with UL/CSA recognition or logic level. Maintained or momentary circuits. Single or bicolor LEDs. One million guaranteed actuations. Round, rectangular, spot-LED caps. Optional PC adaptor, splash/dust covers, barriers, etc.
Call 602/991-0942. Ask for EEM Extension.

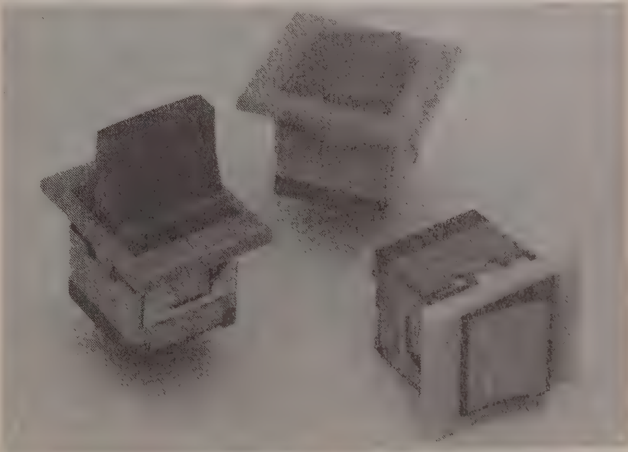
Series YB. Lighted panel mount pushbuttons with twin seal.
1 million mechanical actuations. Exceptional reliability ensured by double-seal design that protects contacts from dust, water, etc. Snap-in or bushing mount. 3A 125/250V AC, 3A 30V DC & logic level. Wide choice of lamps. Round, square & rectangular caps in several colors.
Call 602/991-0942. Ask for EEM Extension.



Series LB & YB. 3 amp panel-sealed lighted pushbuttons.
Extremely reliable one-million actuation switch features oil, dust, and watertight panel seal that meets IP65 of IEC 529 standards. SPDT, DPDT with UL/CSA recognition, or logic level. Maintained or momentary circuits. Numerous caps and other options.
Call 602/991-0942. Ask for EEM Extension.



Series M2100. Unique! Tip changes color with actuation.
Toggles, rockers/paddles with high-visibility LED that changes color with position of actuator. 6A/125V AC, 3A/30V DC & logic level ratings. LED circuit synchronous or isolated. Single color LED also available. Bushing, snap-in or flat frame mounting.
Call 602/991-0942. Ask for EEM Extension.



Series MLW. Power rated miniature snap-in lighted rockers.
5 amp industry first. 3 lamp choices with easy front panel relamping. Conserves space behind panel. Solid, designer and spot illuminated caps. 2 bezel sizes. Built-in protective cover, epoxy sealed solder lug terminals and anti-jamming interlocking actuator.
Call 602/991-0942. Ask for EEM Extension.

nkk switches

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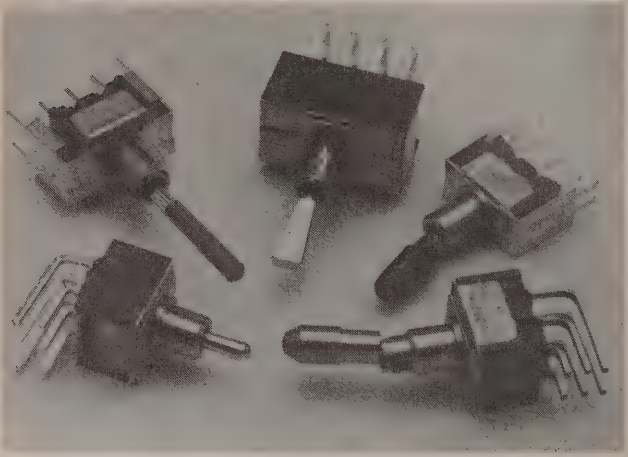
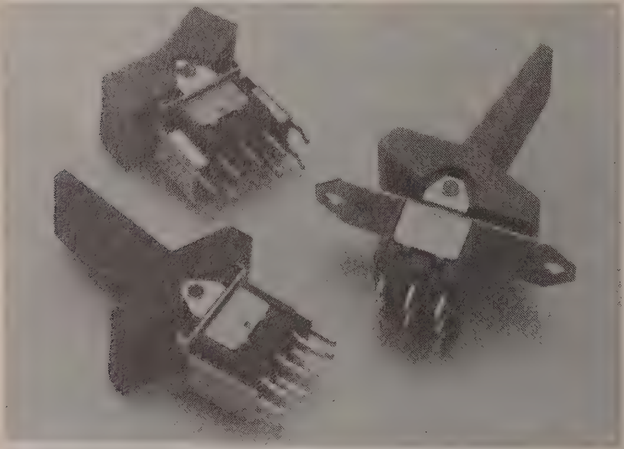
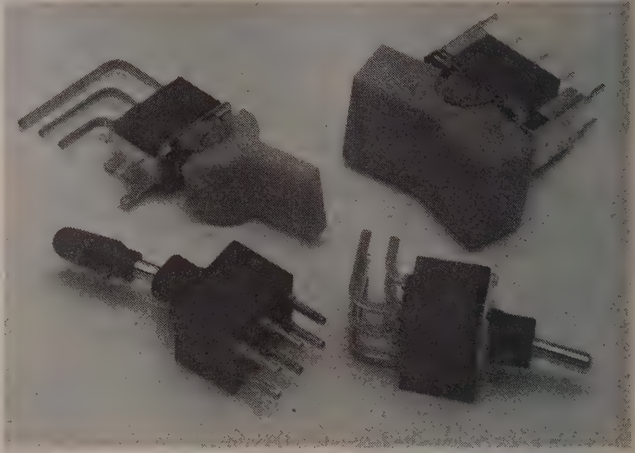


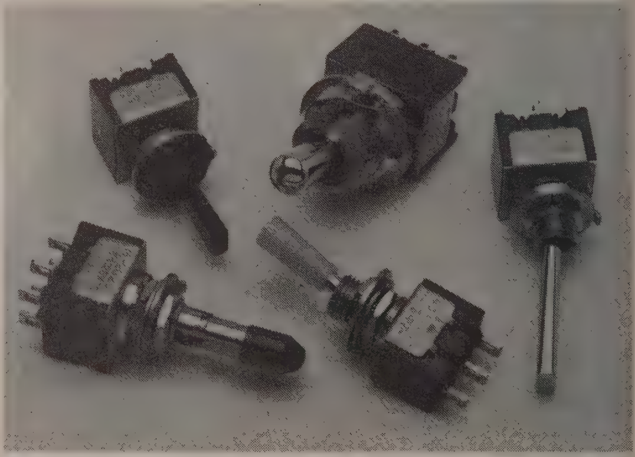
Series M. Bracketed PC mount subminiature toggles.
Sturdy, bracketed PC board switches with bushings offer exceptional reliability and flexibility. Choose 6 amp or logic-level rating. SPDT to 4PDT types in numerous circuits with straight, right angle or vertical terminations. UL/CSA recognition. Full range of toggle configurations.
Call 602/991-0942. Ask for EEM Extension.



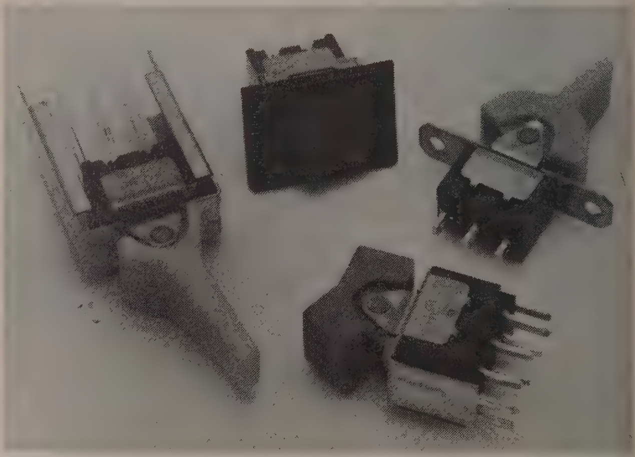
Series M. Large rocker/paddle subminiature switches.
6 amp & logic level, bracketed PC or flat frame mount. SPDT to 4PDT in all circuits. Terminals include straight (bracket or reinforced bracketed), PC, solder lug and quick connect. UL/CSA recognition. Large rockers & paddles in several shapes & colors. Easily legended.
Call 602/991-0942. Ask for EEM Extension.



Series M2T. Washable 6 amp subminiature toggles & rockers.
Huge selection for max. design-in flexibility. 6A/125V AC to logic level. UL/CSA recognition. Totally sealed for automated washing/cleaning. Anti-jamming feature for max. reliability. All popular terminations.
Various toggle/rocker/paddle choices. SP & DP in several circuits.
Call 602/991-0942. Ask for EEM Extension.



Series M. Subminiature hi-reliability panel mount toggles.
Extremely versatile, hi-rel UL/CSA recognized 6 amp or logic level switches fill thousands of application needs. SP through 4P in all circuit configurations. 1/4" 40 and 12mm bushings and seven terminal types. Various lengths of bat, flatted, locking and many other toggles.
Call 602/991-0942. Ask for EEM Extension.



Series M. Small rocker/paddle subminiature switches.
Flat frame, snap-in or PC mount for increased application potential. 6 amp & logic level, SPDT to 4PDT & 3T in numerous circuits and terminations, including right angle and vertical with supports. UL/CSA recognition. Paddles and rockers in several shapes, sizes and colors.
Call 602/991-0942. Ask for EEM Extension.

nkk® switches

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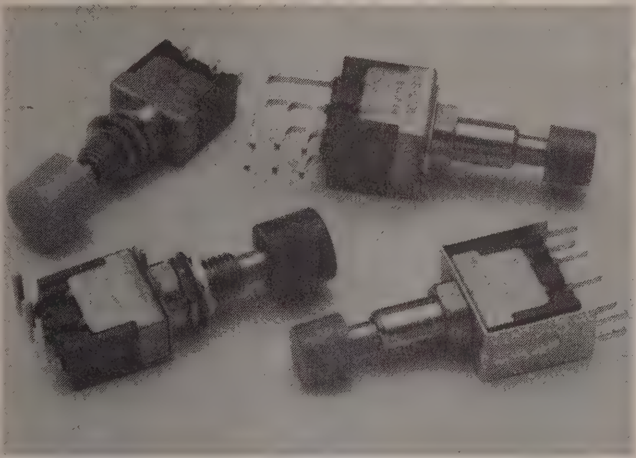
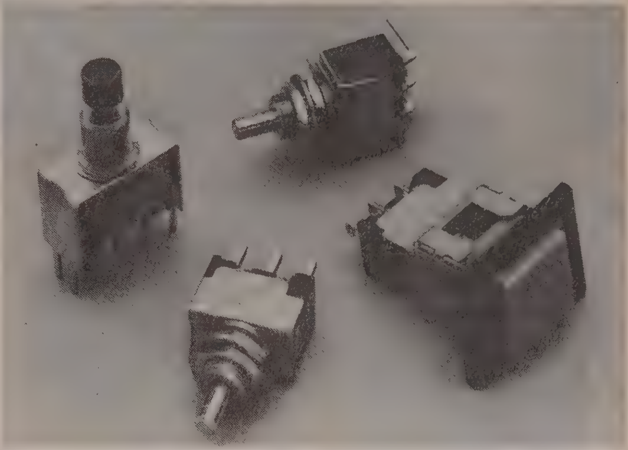


Series MB2000. Versatile 6 amp subminiature pushbuttons.
SP to 4P, momentary or alt. action. 6 amp to logic level. UL/CSA recognition. 1/4" 40 panel mount versions. Solder lug, quick connect, straight, right angle and vertical PC & wirewrap terminations. 7 cap colors. Optional mounting collars & splashproof boots.
Call 602/991-0942. Ask for EEM Extension.

Series MB2000. Lg. bushing panel mount subminiature pushbuttons.
Tremendous selection. SP to 4P in momentary or alt. action. 6A to logic level. UL/CSA recognition. 4 round, screw-on cap diameters. Splashproof boot. Round snap-in mounter. Round or rectangular shroud. Straight PC, solder lug, quick connect & wirewrap terminals.
Call 602/991-0942. Ask for EEM Extension.



Series MB2400. Subminiature 3 amp momentary pushbuttons.
Hi-rel, light-touch, snap acting contacts with high torque bushings, external insulating barriers, 1500V dielectric strength. SPDT, DPDT. 3A or logic level. Solder lug, right angle, vertical and straight PC with various bracket lengths & types. UL/CSA recognition.
Call 602/991-0942. Ask for EEM Extension.

Series M2B. Washable 1 amp PCB subminiature pushbuttons.
Hi-rel, light-touch, momentary snap acting contacts featuring totally sealed construction for automated washing/cleaning. 1A/125V to logic level. SPDT & DPDT with UL/CSA recognition. Vertical, right angle & straight PC with bracket. Snap-on caps in several colors & sizes.
Call 602/991-0942. Ask for EEM Extension.

Series MS. Unique! 6 amp compact subminiature slides.
Hi-rel contact & compact .500" x .469" dimensions for high-density, side-by-side mounting. SPDT & DPDT with 6A/125V to logic level. Epoxy sealed, solder lug, straight, right angle & vertical PC terminals. Two actuator sizes. Plus SP ON-ON-ON circuit. Lighted models.
Call 602/991-0942. Ask for EEM Extension.

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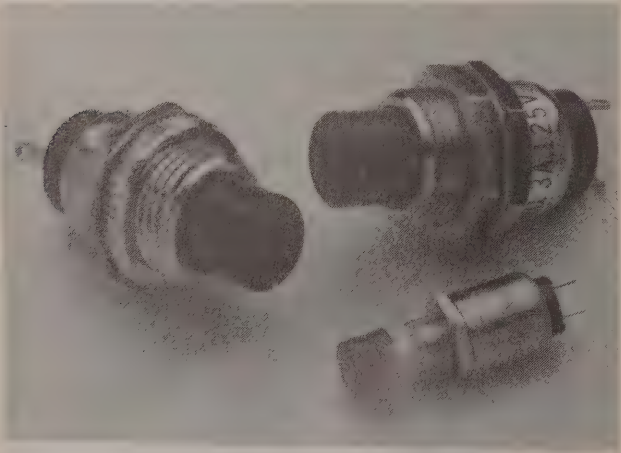
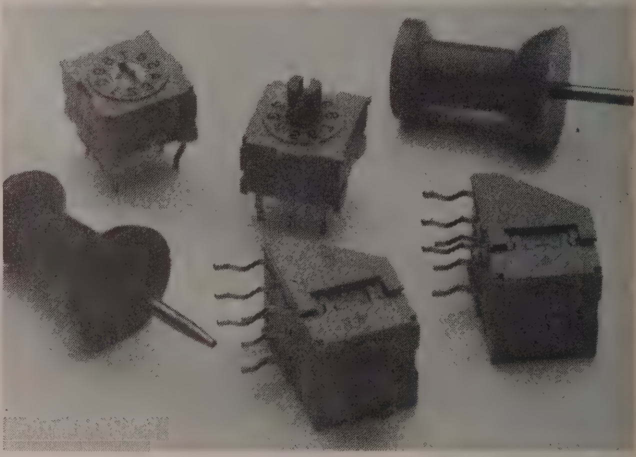
Series MR. Half-inch diameter miniature rotaries.
From logic level to 10 amp. PCB or panel mounting. Panel depths from .323" to .681". Single, double & four poles. 30°, 45°, 120° indexing and adjustable stop settings or continuous rotation. Washable and splash-proof models available. Knobs supplied.
Call 602/991-0942. Ask for EEM Extension.

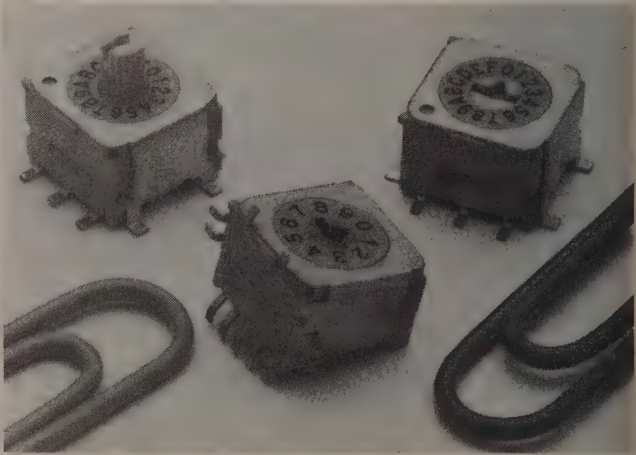


Series FB & SB. Momentary panel mount pushbuttons.
Tiny, hi-rel FB rated at 500mA @ 125V AC (UL) & 0.4VA max @ 28V AC/DC max. SPST in OFF/momentary ON with 3 cap colors. 3 amp SB UL/CSA recognized. Durable one-piece bushing/housing. Black or red plungers. SPST in N/C or N/O circuits. Solder lug termination.
Call 602/991-0942. Ask for EEM Extension.

Series DR. Washable binary coded DIP rotaries.
Screwdriver, shaft or dial actuated with high-visibility legends for PCB. Shaft actuated for panel mounting. Real or complement code. Decimal or hexadecimal. Self-cleaning contacts. Switching rating: 100mA/5V DC, non-switching: 100mA/50V DC.
Call 602/991-0942. Ask for EEM Extension.

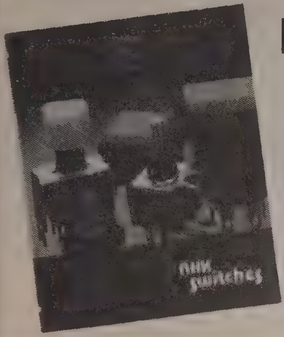


Series ND. World's smallest binary coded DIP rotaries.
Washable thru-hole PCB in straight or right angle mount. Real or complement-coded with 10 positions decimal or 16 hexadecimal. Screwdriver or shaft-actuated with hi-visibility legends for easy code setting. 100mA/5V DC switching rating.
Call 602/991-0942. Ask for EEM Extension.



Series ND3. Tiny surface mount binary coded DIP rotaries.
Compact size for high-density side-by-side mounting. 100mA/5V DC. Gull-winged, vapor phase solderable terminals for greater stability during soldering. Screwdriver or shaft-actuated. Real or complement coded, decimal or hexadecimal. Packaged 500 devices per tape reel.
Call 602/991-0942. Ask for EEM Extension.

nkk® switches



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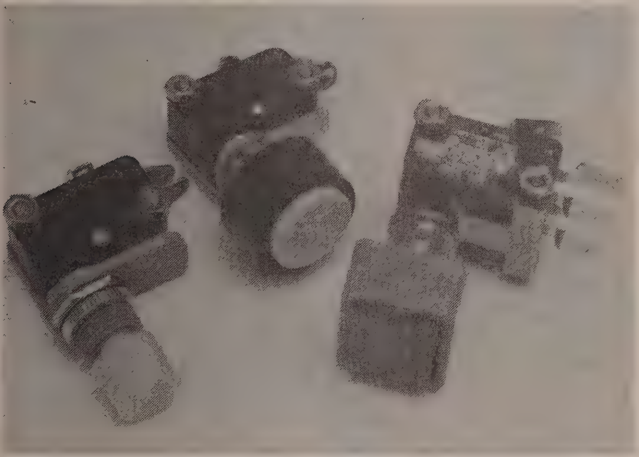
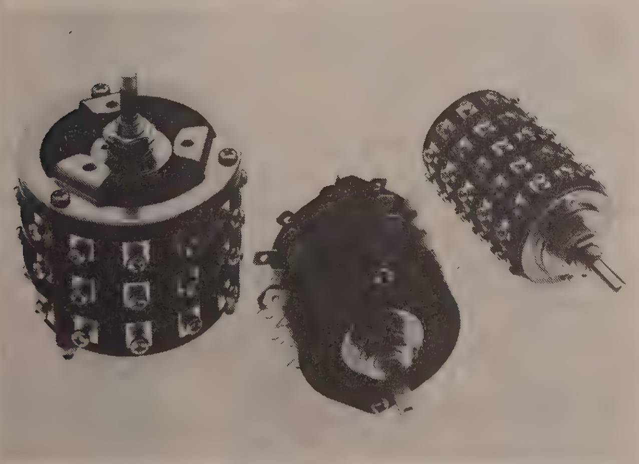
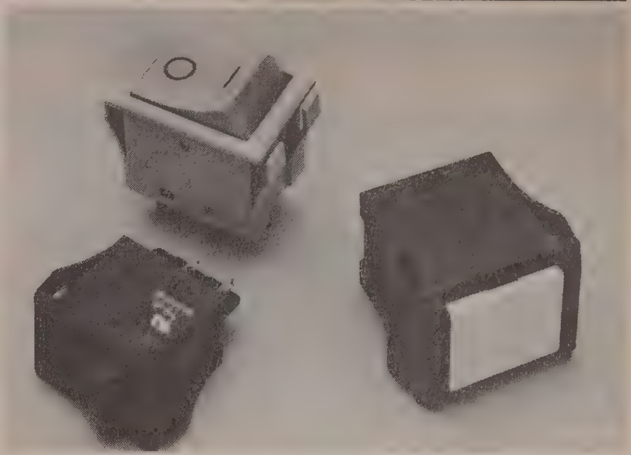


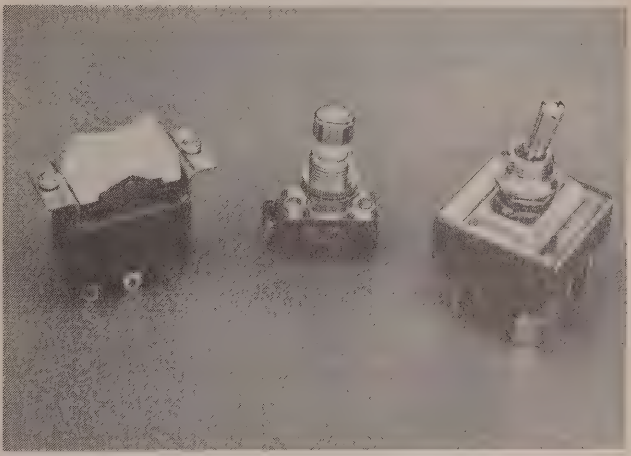
Series SCB. 5,000,000-operation panel mount pushbuttons. Snap-acting contact provides unrivaled lifespan. 5 million actuations for 10A, 1/3HP model, 1 million for hi-cap. 15A 1/2HP type. UL/CSA recognition. SP & DP. Momentary or alternate action. Numerous cap and shroud combinations available in various colors.
Call 602/991-0942. Ask for EEM Extension.



Series HS/PS/TS. Standard size to hi-cap 30 amp rotaries. Nonshorting TS: 1 through 5 poles, 2 through 11 positions, 6A (res. load) rating. Shorting or nonshorting HS: 1 through 6 poles, 2 through 11 pos., 6A & 12A ratings. Nonshorting PS: 1 through 5 poles, 2 through 11 pos., 30A (res. load), 10A (inductive load).
Call 602/991-0942. Ask for EEM Extension.



Series JW/JP. Snap-in mount TV rated rockers & pushbuttons. JW rockers & JP pushbuttons provide high inrush current capability to prevent contact welding. SP & DP maintained circuits. Model "L" has UL/CSA TV-8 rating; 16A 125/250V AC (res. load). Model "M" has UL/CSA TV-5 rating; 10A 125/250V AC (res. load).
Call 602/991-0942. Ask for EEM Extension.

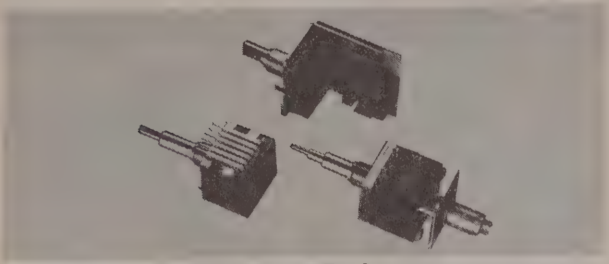


Series S/SB/SW Std. size toggles, rockers & pushbuttons. S Series: bushing mounted toggles with 1 through 4 poles, 6 circuits and 3A to 20A rating (res. load). Optional splashproof bushing. SB: 3A to 15A, 1 & 2 pole momentary or alt. action, bushing mounted pushbuttons. SW: 3A to 20A (with res. load) rockers. Flush panel mount.
Call 602/991-0942. Ask for EEM Extension.

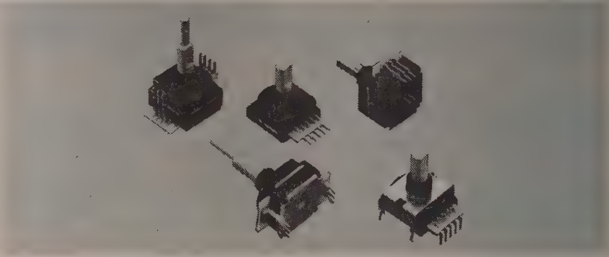
Series S/SW. High capacity AC/DC toggles & rockers to 50 amps. Series S toggles rated 30A/125V AC (res. load) & 50A/125V AC. 2 & 3 poles with maintained circuits. Bushing mounted, screw terminals. SW rockers rated at 30A/125V AC. Plus, 15A/125V DC (res. load) & 5A/125V (inductive load) models for hi-capacity DC applications.
Call 602/991-0942. Ask for EEM Extension.

Rotary Encoder Switches

OAK GRIGSBY™



MMP-Rel



LCE Encoder

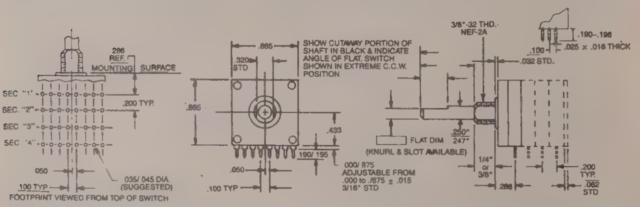
Electrical Characteristics

Current Carrying Capacity	Resistive load. 250 MA at 28 VDC.
Shock Humidity	MIL-STD 202E.
Code Program	Shorting or non-shorting (non-shorting versions, up to 16 positions only).
Dielectric Strength	From pole to shaft 1,000 volts min.
Contact Resistance	75 milliohms max, over lifetime.
Contacts	Phosphor-bronze with silver inlay at interface with program disc. Gold inlays available upon request. External terminals are solder (60-40) plate except on die cut edges.
Codes	Hexidecimal, B,C,D, Gray and others on special order.
Switching Loads	1.5 MA at 115 VAC. 150 MA at 14 VDC.

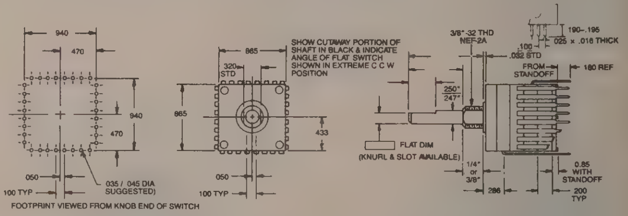
Mechanical Specifications

Operating Forces	(torque over detents): 7 to 20 in./oz. ±25%.
Life	50,000 minimum cycles at rated load (250,000 cycles available)
Rotational position Stops	Per requirement.
Stop Strength	15 in./lb. min.
Operating Temperature Range	−55°C to +85°C (105°C optional).
Sealing	Terminals are insert molded into housing. Front and rear molded sections of module are interlock construction. Ideally suited for wave soldering.
Shafts and Hardware	Shafts and hardware are steel, cadmium plated and chromate treated, detent parts, including stops, are stainless steel.
Anti-Rotation Device	Flatted mounting bushing. .375" dia. × .320," double "D."
Concentric Shafts	Available.
Detent Angles	90°, 60°, 45°, 36°, 30°, 22.5°, 20°. 18°, 15°, 12.8°, 11.25°, 10°.
Molded Construction	Molded parts are Ryton R4 and Polyester PBT, chosen for heat resistance and electrical characteristics. Rated 94 V-O or better.
Disc. Construction	Program disc. is glass epoxy, copper clad with silver plating standard. Gold upon request.

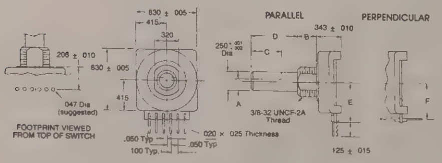
Parallel Shaft Mounting (relative to PC Board)


.286 REF.
MOUNTING SURFACE
SEC "1"
SEC "2"
SEC "3"
SEC "4"
.200 TYP.
.050
.100 TYP
.035/.045 DIA (SUGGESTED)
FOOTPRINT VIEWED FROM TOP OF SWITCH
.865
.320 STD
SHOW CUTAWAY PORTION OF SHAFT IN BLACK & INDICATE ANGLE OF FLAT SWITCH SHOWN IN EXTREME C.C.W. POSITION
.865
.433
.190/.195
.050
.100 TYP
.000/.875 ADJUSTABLE FROM .000 to .875 ± .015 3/16" STD
3/8"-32 THD. NEF-2A
.100
.190-.198
.025 x .018 THICK
.032 STD.
.250" .247"
FLAT DIM (KNURL & SLOT AVAILABLE)
1/4" or 3/8"
.286
.200 TYP.
.062 STD

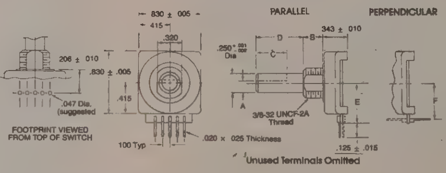
Perpendicular Shaft Mounting (relative to PC Board)


.940
.470
.940
.470
.050
.100 TYP
.035/.045 DIA SUGGESTED)
FOOTPRINT VIEWED FROM KNOB END OF SWITCH
.865
.320 STD
SHOW CUTAWAY PORTION OF SHAFT IN BLACK & INDICATE ANGLE OF FLAT SWITCH SHOWN IN EXTREME C C W POSITION
.865
.433
.050
.100 TYP
3/8"-32 THD NEF-2A
.100
.032 STD
.190-.195
.025 x .018 THICK
FROM STANDOFF
.180 REF
.250" .247"
FLAT DIM (KNURL & SLOT AVAILABLE)
1/4" or 3/8"
.286
0.85 WITH STANDOFF
.200 TYP

LCE-1 PARALLEL OR PERPENDICULAR MOUNTING (relative to PC Board)


.830 ± .005
.415
.320
.206 ± .010
.830 ± .005
.415
.047 Dia (suggested)
FOOTPRINT VIEWED FROM TOP OF SWITCH
.050 Typ
.100 Typ.
.050 Typ
.020 × .025 Thickness
PARALLEL
PERPENDICULAR
.343 ± .010
.250 Dia
D
B
C
A
E
F
3/8-32 UNCF-2A Thread
.125 ± .015

LCE-2 PARALLEL OR PERPENDICULAR MOUNTING (relative to PC Board)


.830 ± .005
.415
.320
.206 ± .010
.830 ± .005
.415
.047 Dia. (suggested
FOOTPRINT VIEWED FROM TOP OF SWITCH
.100 Typ
.020 × .025 Thickness
PARALLEL
PERPENDICULAR
.343 ± .010
.250 Dia
D
B
C
A
E
F
3/8-32 UNCF-2A Thread
.125 ± .015
Unused Terminals Omitted

Unless otherwise specified, standard dimensions are:

A. Thickness of flat—.218 ± .003 standard
B. Length of bushing—.250 ± .010 standard. Also available in .000 ± .010 and .375 ± .010.
C. Length of flat—.375 ± .010 standard. Others upon request.
D. Length of shaft—.500 ± .015 standard. Others upon request.
E. Centerline of switch to standoff—.615 ± .005.
F. Centerline of switch to centerline of terminal—.470 ± .007, or .625 ± .007 extending to rear, .500 ± .007 extending to front.

SWITCH POSITION	OUTPUTS A	OUTPUTS B
1		
2	●	
3	●	●
4		●
5		
6	●	
7	●	●
8		●
9		
10	●	
11	●	●
12		●
13		
14	●	
15	●	●
16		●
30	●	
31	●	●
32		●
33		
34	●	
35	●	●
36		●

SWITCH POSITION	OUTPUTS A	OUTPUTS B
1		
2	●	
3		●
4		
5	●	
6		●
7		
8	●	
9		●
10		
11	●	
12		●
13		
14	●	
15		●
16		
17	●	
18		●
19		
20	●	
21		●
22		
23	●	
24		●

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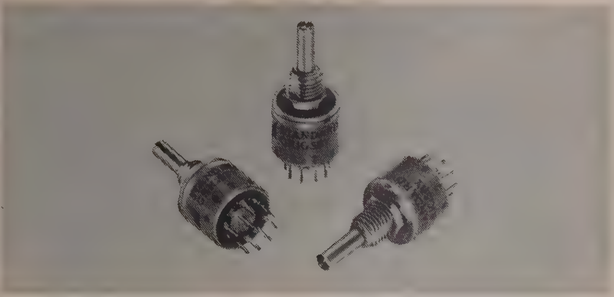
Rotary Switches

1/2" Single Deck (Sealed and Unsealed)

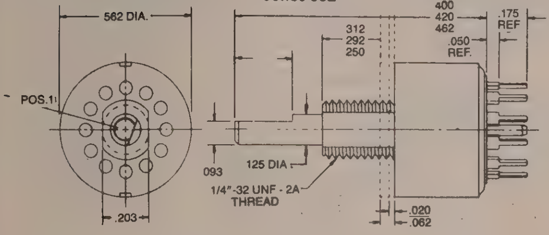
OAK◆GRIGSBY



Series SD/SDS

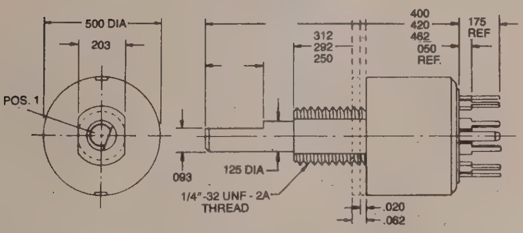
(unsealed)

SD-12 POSITION
Series 562



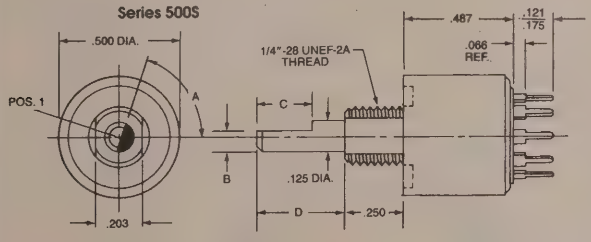
562 DIA.
POS.1
.203
093
125 DIA.
1/4"-32 UNF - 2A THREAD
312
292
250
400
420
462
.175 REF
.050 REF.
.020
.062

SD-10 POSITION, 8-POSITION, 6 POSITION
Series 500



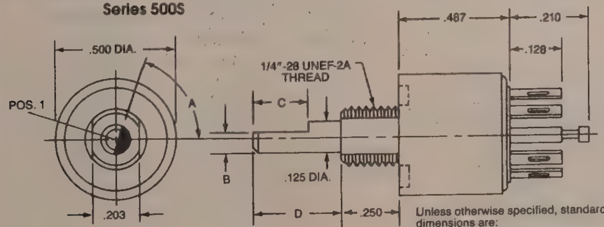
500 DIA
203
POS. 1
093
125 DIA
1/4"-32 UNF - 2A THREAD
312
292
250
400
420
462
175 REF
050 REF.
.020
.062

SDS-10 POSITION — PRINTED CIRCUIT
Series 500S



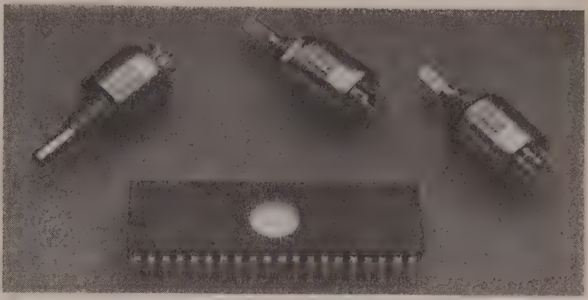
.500 DIA.
POS. 1
A
.203
1/4"-28 UNEF-2A THREAD
C
B
.125 DIA.
D
.250
.487
.121
.175
.066 REF.

SDS-10 POSITION — SOLDER LUG
Series 500S



.500 DIA.
POS. 1
A
.203
1/4"-28 UNEF-2A THREAD
C
B
.125 DIA.
D
.250
.487
.210
.128

Unless otherwise specified, standard dimensions are:
A. Angle of flat – 72° ±3°.
B. Thickness of flat – .093" ±.003".
C. Length of flat – .250" ±.015".
D. Length of shaft – .375" ±.020".



Series 500

(sealed)

Electrical Characteristics

Current and Voltage Ratings	200 MA at 30 VDC resistive. 150 MA at 115 VAC resistive.
Current Carrying Capacity	6 amps
Dielectric Strength	600 VAC min.
Insulation Resistance	10,000 megohms min., 50,000 megohms initial
Contact Resistance	Typical: 25 milliohms

Mechanical Specifications

Life	25,000 cycles
Rotational Torque	8 to 24 oz./in. at ambient conditions
Stop Strength	8.0 lb./in. min.
Shaft Orientation	Flat is opposite pole number one contacting position-standard
Detent Angles	Series 562-30° Series 500 - 36°, 45° and 60°

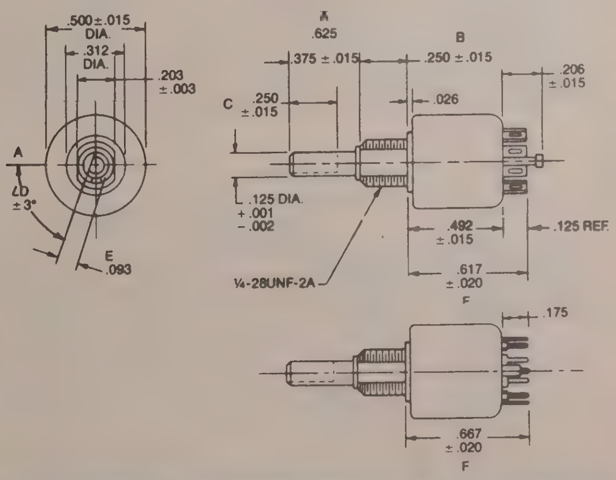
Material and Finishes

Switch Base	Diallyl Phthalate per MIL-M-14
Shaft & Stop Plate	Stainless steel passivated
Index Housing	Zamak with chromate finish
Terminals and Contacts	Brass with gold plate
Mounting Hardware	Mounting nut and lockwasher supplied unassembled

Military Type Switches - Series QPL

The Type 500 switches are provided in sealed or unsealed versions, with fixed stops and solder lug or PC terminals, to meet the requirements of MIL-S-3786/20.

Fixed Stops

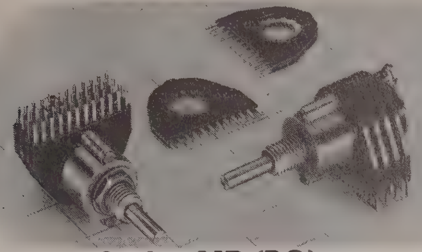


.500±.015 DIA.
.312 DIA.
.203 ±.003
A
∠D ±3°
E .093
A .625
.375 ± .015
B .250 ± .015
C .250 ±.015
.026
.206 ±.015
.125 DIA. +.001 -.002
.492 ±.015
.125 REF.
.617 ±.020 F
¼-28UNF-2A
.175
.667 ±.020 F

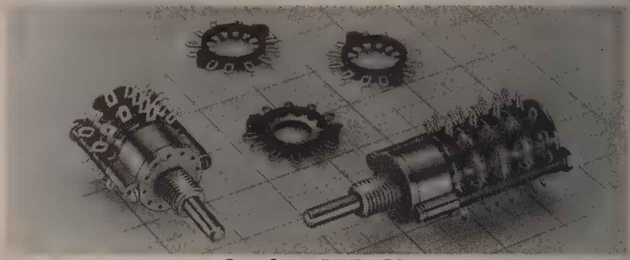
Rotary Switches

1/2" Multi Deck

OAK GRIGSBY



Series MD (PC)



Series MD SL

Electrical Characteristics

Current and Voltage Ratings	150 MA. at 28 VDC resistive. 100 MA. at 115 VAC resistive.
Current Carrying Capacity	3 amps.
Dielectric Strength	600 VAC min.
Insulation Resistance	50,000 megohms.
Contact Resistance	25 milliohms max. at initial contact.

Mechanical Specifications

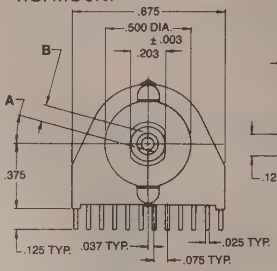
Life	25,000 cycles.
Rotational Torque	6 to 32 oz./in. depending on number of poles.
Stop Strength	10.0 pound-inches min.
Stops	Fixed or adjustable available.
Shaft Orientation	Flat is opposite pole number one contacting position.

Material and Finishes

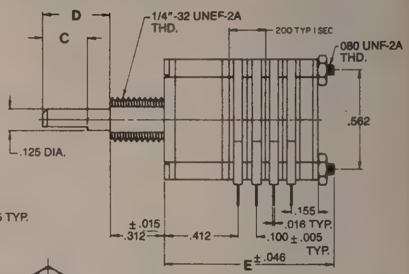
Decks	Ryton R-4 for PC mount/thermoset for SL.
Shaft	Stainless steel passivated.
Index Housing	Zamak with chromate finish.
Rotor Contacts	Silver alloy. Gold plate optional.
Stationary Contacts and Terminals	Brass silver plate. Gold plate optional.
Mounting Hardware	Mounting nut and lockwasher supplied unassembled.

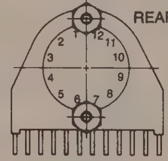
250 diameter shafts available upon request.

P.C. MOUNT

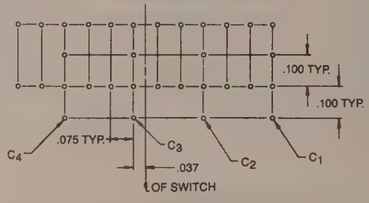

.875
.500 DIA.
± .003
.203
B
A
.375
.125 TYP.
.037 TYP.
.025 TYP.
.075 TYP.

12 POSITION (30° INDEX)


D
C
1/4"-32 UNEF-2A THD.
.200 TYP 1 SEC.
.080 UNF-2A THD.
.562
.125 DIA.
±.015
.312
.412
.155
.016 TYP.
.100 ± .005 TYP.
E ±.046


REAR VIEW
1
2
3
4
5
6
7
8
9
10
11
12

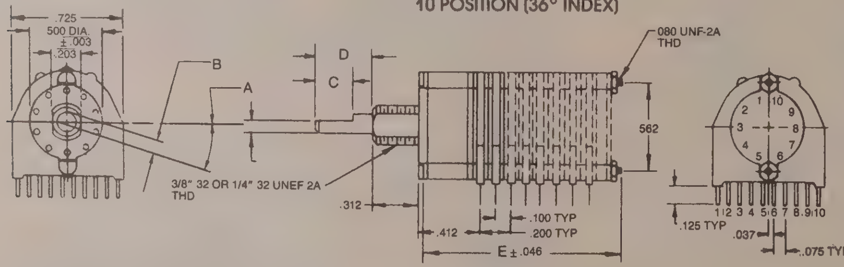
P.C. BOARD MOUNTING PATTERN
Viewed from components side of board.


.100 TYP.
.100 TYP.
.075 TYP.
C4
C3
C2
C1
.037
℄ OF SWITCH

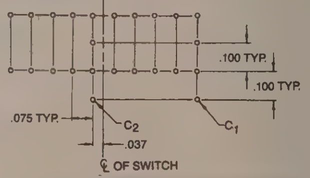
SHAFT END OF SWITCH

P.C. MOUNT

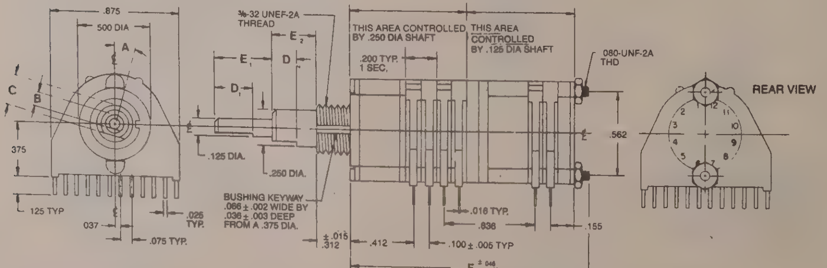
10 POSITION (36° INDEX)


.725
.500 DIA.
± .003
.203
B
A
D
C
.080 UNF-2A THD
.562
3/8" 32 OR 1/4" 32 UNEF 2A THD
.312
.412
.100 TYP
.200 TYP
E ± .046
1 2 3 4 5 6 7 8 9 10
.125 TYP
.037
.075 TYP

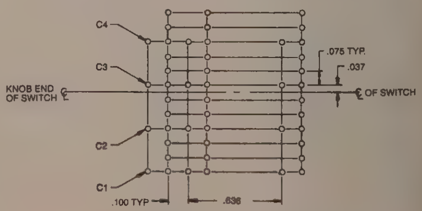
P.C. BOARD MOUNTING PATTERN
Viewed from components side of board.


.100 TYP.
.100 TYP.
.075 TYP.
C2
C1
.037
℄ OF SWITCH

Unless otherwise specified, standard dimensions are:
A. Angle of flat—15° ±3°.
B. Thickness of flat—.093" ±.003".
C. Length of flat—.250" ±.015".
D. Length of shaft—.375" ±.020".
E. .780" for one section. Add .200" ± for each additional section.


.875
.500 DIA
A
C
B
.375
.125 TYP
.037
.025 TYP.
.075 TYP.
3/8-32 UNEF-2A THREAD
E
E₁
D
D₁
.125 DIA.
.250 DIA.
BUSHING KEYWAY .066 ± .002 WIDE BY .036 ± .003 DEEP FROM A .375 DIA.
THIS AREA CONTROLLED BY .250 DIA SHAFT
THIS AREA CONTROLLED BY .125 DIA SHAFT
.200 TYP. 1 SEC.
.080-UNF-2A THD
.562
±.015
.312
.412
.016 TYP.
.836
.155
.100 ± .005 TYP
F ±.046
REAR VIEW

P.C. BOARD MOUNTING PATTERN
Viewed from components side of board.


C4
C3
C2
C1
KNOB END OF SWITCH ℄
.075 TYP.
.037
℄ OF SWITCH
.100 TYP
.636

Unless otherwise specified, standard dimensions are: A. Angle of flat-15°±3° B. Thickness of flat-.093"±.003" C. Thickness of flat-.219"±.003". D. Length of flat-.250"±.015". E. Length of shaft-.375"±.020". F. 1.416" for one section. Add .200" for each additional section.

OAKGRIGSBY INC. 88 N. Dugan Rd., Sugar Grove, Il 60554 • Phone 708/556-4200 • FAX 1-800/432-9625

Lighted Pushbutton Switches

OAKGRIGSBY

OakGrigsby lighted pushbutton switches come in a choice of styles, colors, and mounting options. By choosing the base, pushbutton cap, mounting hardware, and lamp, the engineer is able to custom design the switch.

Bases

A wide range of electrical rating and contact configurations is available in both alternate (push-on push-off) and momentary action. Materials are as follows:

Contacts: coin silver (gold plate for low level)
Solder Terminals: coin silver or plated brass
Housing: anodized aluminum or thermoplastic

Type	Contact Rating	Switch Action	Circuit	Length (inches)	UL Approved	Low Level
830 860	.5 amp	Momentary	SPST Form A	2.312		
543 546	3 amp at 30 VDC	Momentary	SPDT-DB Form Z	1.594	X	 X
516 518	5 amp at 28 VDC	Alternate Momentary	SPDT Form C	2.188	X X	
520 521	5 amp at 28 VDC	Alternate Momentary	DPDT Form C	2.188	X X	
5710 5810	10.1 amp at 125/250 VAC	Alternate Momentary	SPDT Form C	2.25	X X	
5720 5820	10.1 amp at 125/250 VAC	Alternate Momentary	DPDT Form C	2.25	X X	
517 519	15 amp at 28VDC	Alternate Momentary	SPDT Form C	2.25		

Pushbuttons

All pushbuttons are high impact resistant plastic, and can be custom engraved.

Colors: red, white, orange, blue, green, and lunar.
Round: 1/2, 5/8, and 3/4 inch.
Square: 1/2, 5/8, and 3/4 inch.
Rectangular: 3/4 x 1 inch.

Hardware

The selection of mounting hardware includes recess mounting configurations with flush or barrier mounts, and low cost snap in styles. Also available are hardware kits which are splashproof, oiltight, and E.M.I. suppressed.

Lamps

All switches use T-1 3/4 midget flange base lamps. Some bases provide for neon lamp operation.

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Indicators

Because of the wide variety of items in the OakGrigsby indictor light line, it is possible to select a standard unit to meet a precise requirement. These panel indicators embody the best of military and commercial materials and performance features. Materials, finishes, and workmanship are more than adequate for conformance to military, federal, or industry specifications. Caps are available in numerous styles and functions, and in the following colors: clear, white, red, green, amber, blue, yellow, orange, and lunar. The availability of indicator bases is summarized below.

Sub-Miniature (T-1 sub-midget flange base lamp)

Series	Rear Projection	Max. Panel Thickness	Gen. Pur-pose	Water-tight	E.M.I. Sup-pressed	Military Designation
99-33180	.66	.31	X			
98-36980	.56-.58*				X	LHC82/2, LHC83/2, LHC84/2
99-36980	.56-.58*		X			LHC82/1, LHC83/1, LHC84/1
95-33180	.64			X		

*Does not include length of wire leads.

Standard (T-3 1/4 miniature bayonet base lamp)

Series	Rear Projection	Max. Panel Thickness	Gen. Pur-pose	Press To-Test	Water-tight	Military Designation
02-91180	1.50	.37		X		MS25331
06-91182	1.34	.31		X	X	

Miniature (T-1 3/4 midget flange base lamp)

Series	Rear Projection	Max. Panel Thickness	Gen. Pur-pose	Water-tight	E.M.I. Sup-pressed	Military Designation
14-30080	.79	.18	X			
59-52380	.88	.25	X			
59-52480	.73	.19	X			
11-33480	.73	.19	X			MS25256, LH73/1
15-30083	.73	.16		X		
11-35182	.66	.19		X		LH89/1
18-36880	.74	.16			X	
18-36680	.90	.34		X	X	

Neon (T-2 midget flange base lamp)

Series	Rear Projection	Max. Panel Thickness	Gen. Pur-pose	Water-tight	E.M.I. Sup-pressed	Internal Resistor 68k	Internal Resistor 27k	Military Designation
31-36180	.95	.44	X			X		MS25257, LH74/1
31-36280	.95	.44	X				X	MS25257, LH74/2
31-36680	.90	.34		X		X		LH88/1
31-36681	.90	.34		X			X	LH88/2
38-36180	.95	.44			X	X		LH74/3
38-36280	.95	.44			X		X	LH74/4
38-36680	.90	.34		X	X	X		
38-36681	.90	.34		X	X		X	

Miniature Press-To-Test (T-1 3/4 midget flange base lamp)

Series	Rear Projection	Max. Panel Thickness	Gen. Pur-pose	Water-tight	E.M.I. Sup-pressed	Military Designation
59-52280	.88	.25	X			MS25041*
03-91080	.94	.31	X			
01-91180	.90	.37	X			
05-91182	.85	.25		X		
05-90880	.96	.31		X		
08-83283	.97	.25		X	X	

*Caps available with NVG Green compatibility.

Keylocks

OAKGRIGSBY

Electrical Characteristics

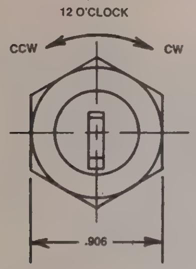
	KL Series	KL (UL/CSA) Series
Current and Voltage Ratings	200 MA at 28 VDC resistive, 150 MA at 115 VAC resistive	4 amps at 120 VAC, 2 amps at 240 VAC (UL/CSA listed)
Current Carrying Capacity	6 amps	6 amps, continuous, with max. temperature rise of 20°C
Contact Resistance	25 milliohms initially, 100 milliohms max. after life	10 milliohms
Dielectric Resistance	200 VAC min. (36° indexing, 1000 VAC min. (45° & 90° indexing)	600 VAC min.
Insulation Resistance	50,000 megohms initially, 10,000 megohms after life	
Static Protection	20,000 VDC min.	

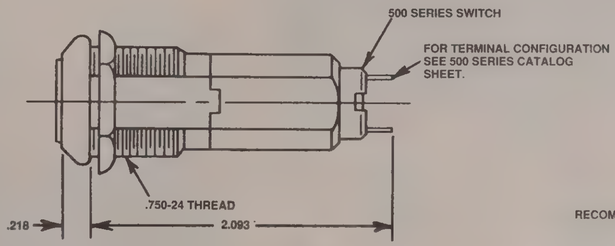
Mechanical Specifications

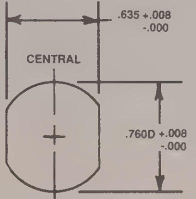
	KL Series	KL (UL/CSA) Series
Life	25,000 cycles	10,000 cycles
Rotational Torque	6 to 24 oz./in. at ambient conditions	7 to 24 oz./in. at ambient conditions
Stops	Fixed	Fixed
Indexing Angles	90°, 45° and 36°	90° and 45° std.

Material and Finishes

	KL Series	KL (UL/CSA) Series
Locks	Barrel: Zinc alloy. Key: Brass	
Finishes	Bright nickel, satin nickel, bright chrome, satin chrome and black. KL (UL/CSA) Series bezel: polished stainless steel	
Switch Housing	Molded Zytel 94 V-2	
Terminal and Contacts	Gold plated	Copper alloy, silver-plated

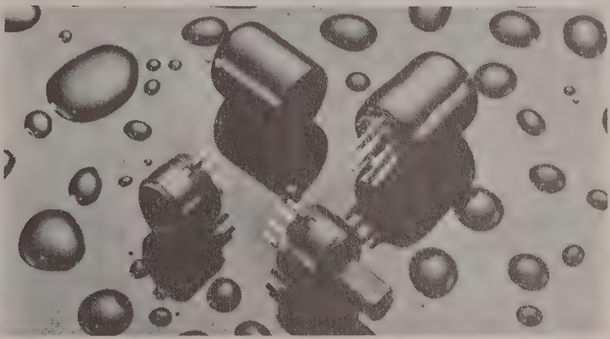

12 O'CLOCK
CCW
CW
.906


500 SERIES SWITCH
FOR TERMINAL CONFIGURATION SEE 500 SERIES CATALOG SHEET.
.750-24 THREAD
.218
2.093


.635 +.008 -.000
CENTRAL
.760D +.008 -.000

RECOMMENDED OPENING PANEL MTG.

TO-5 Rotary Switch



Electrical Characteristics

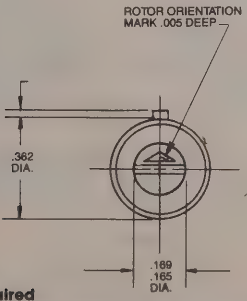
Current and Voltage Ratings	10 MA 1 volt. 500 MA 125VAC resistive load.
Current Carrying Capacity	.5 amps.
Contact Resistance	50 milliohms max. initial. 100 milliohms max. after operating life.
Breakdown Voltage	500 V 60 Hz. 850-1900 VAC.
Temperature Range (Operating)	−30°C to +65° C.
Insulation Resistance	50,000 megohms min. at 100 Volts.

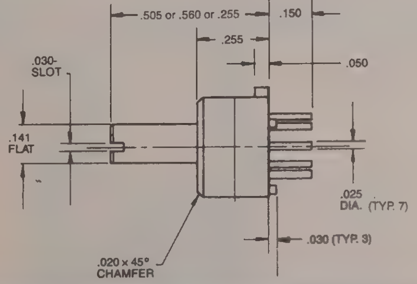
Mechanical Specifications

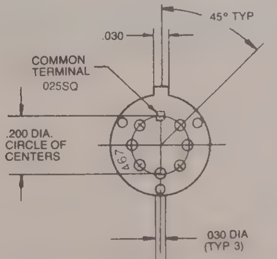
Life	2500 cycles.
Rotational Torque	2 in./oz. to 4 in./oz. initial room ambient.
Stops	Available as required from 2 to 8 positions.
Angle of Throw	45°/position–8 position max.

Material and Finishes

Switch Base/Index	Polyester, Glass Filled.
Shaft	Acetal, Homopolymer.
Shaft Seal	Ethylene Propylene.
Rotor Contact	Brass, hard gold plate over nickel plate.
Common Ring Terminal	Phosphor Bronze, hard gold plate over nickel plate.
Selected Terminals	Copper Alloy, hard gold plate over nickel plate.

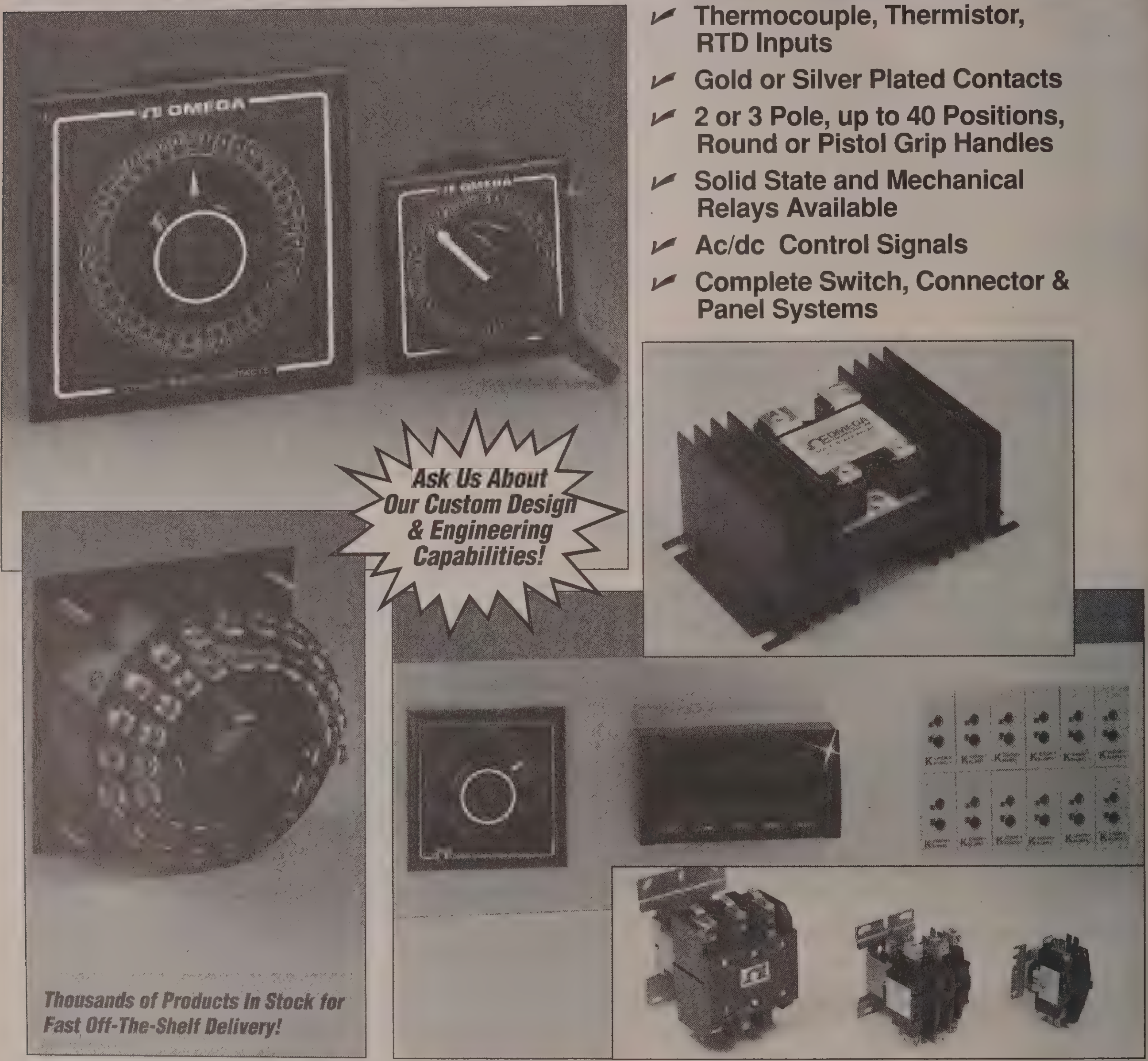

ROTOR ORIENTATION MARK .005 DEEP
.362 DIA.
.169 .165 DIA.


.505 or .560 or .255
.150
.255
.050
.030- SLOT
.141 FLAT
.025 DIA. (TYP. 7)
.030 (TYP. 3)
.020 x 45° CHAMFER


45° TYP
.030
COMMON TERMINAL 025SQ
.200 DIA. CIRCLE OF CENTERS
.467
030 DIA (TYP 3)

Part #91002
***Indicate if stops are required**

OMEGA... SWITCHES AND RELAYS



- Thermocouple, Thermistor, RTD Inputs
- Gold or Silver Plated Contacts
- 2 or 3 Pole, up to 40 Positions, Round or Pistol Grip Handles
- Solid State and Mechanical Relays Available
- Ac/dc Control Signals
- Complete Switch, Connector & Panel Systems

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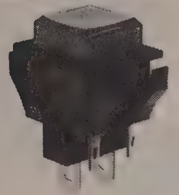
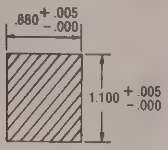
OSLO CONTROLS

TYPE S Lighted & Non-lighted Pushbutton Switches



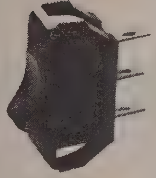
ALL DIMENSIONS IN INCHES



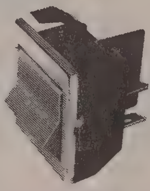
PANEL CUT OUT
PANEL THICKNESS 1/32" – 3/16"

FEATURES
- Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- LED, incandescent or neon lamps
- Single pole and double pole circuit arrangements
- Momentary or alternating actions
- 10 amps 125/250VAC 1/4 HP, UL, CSA, VDE
- Mechanical life 100,000 operations

TYPE R and CR Lighted & Non-lighted Rocker Switches



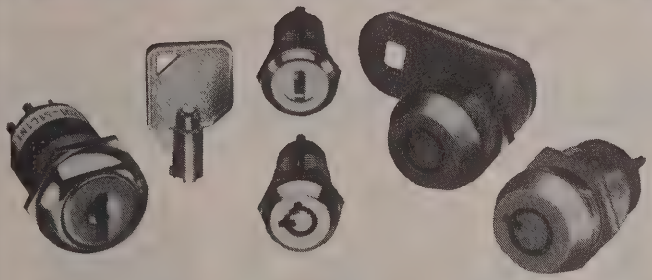
**TYPE CRS
SINGLE-POLE**



**TYPE RT
DOUBLE-POLE**

FEATURES
- Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- LED, incandescent or neon lamps
- Single pole and double pole circuit arrangements
- Maintained or momentary actions, 2 or 3 position
- 20 amps 125/250VAC 3/4 HP, 125/250VAC UL, CSA
- High inrush capability
- Mechanical life: 100,000 operations

TYPE K and TYPE J Keylock Switches



FEATURES
- Flat keys or tubular keys
- Single pole and double pole
- Various key operate and removal positions
- PC mount, solder or quick connect terminals
- Maintained or momentary contacts
- 4 amp 125 VAC or 28 VDC UL, CSA
- Miniature to full size available (12mm diameter to 19mm diameter)

Q SERIES Lighted Pushbutton Switches

FEATURES
- Snap-in panel mounting
- Standard 3/4" cut-out
- Momentary or alternate action
- Led, incandescent or neon lamps
- 10 amp 125/250 VAC UL
- Custom marking available

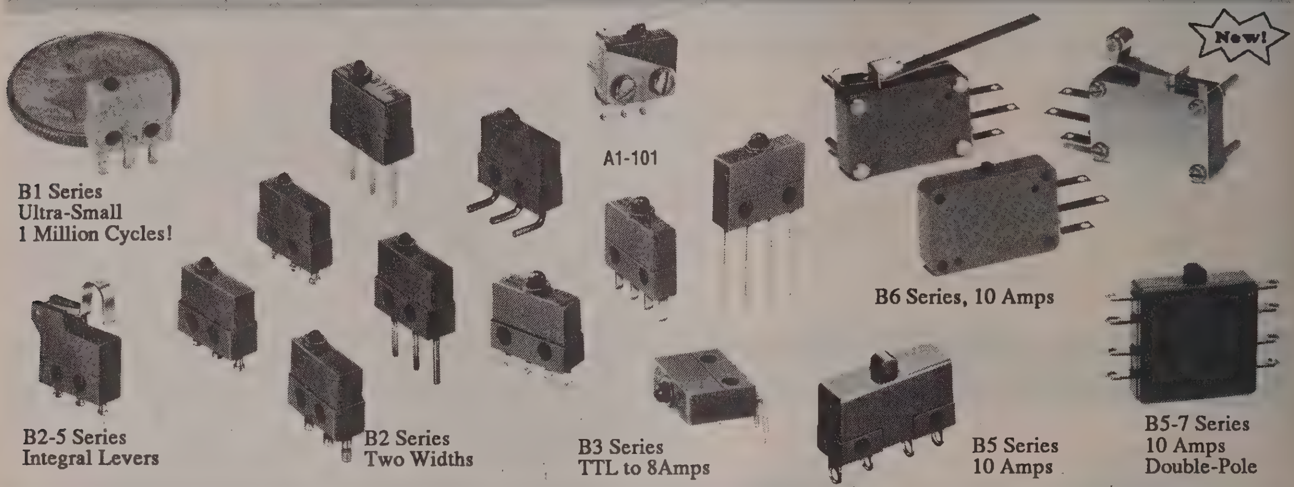
OSLO CONTROLS

**328 Industrial Avenue, Cheshire, Connecticut 06410
Tel.: (203) 272-2794 • FAX (203) 272-3492**

OTTO CONTROLS

More than just the Switch! Because

Sub-Miniature Basic Switches



B1 Series
Ultra-Small
1 Million Cycles!

A1-101

B6 Series, 10 Amps

B2-5 Series
Integral Levers

B2 Series
Two Widths

B3 Series
TTL to 8Amps

B5 Series
10 Amps

B5-7 Series
10 Amps
Double-Pole

Series		B1 Sub-Subminiature	B2 Subminiature	B2-5 Integral Lever	B3 Subminiature	B5 Miniature	B5-7 Two Pole	B6 Miniature
Circuitry		SPDT	SPDT	SPDT	SPDT-DB	SPDT-DB	DPDT-DB	SPDT
Rating①	Resistive	1A	7A	7A	8A	10A	10A	10A
	Inductive	.5A	4A	4A	5A	7.5A	7.5	10A
Actuation		Cam	Cam	Lever	Cam	Cam	Cam	Cam/Lever
Operating Force		4 oz. max	3-8 ounces	1.76 oz. max	3-8 ounces	3-8 ounces	3-8 ounces	15 ounces, max.
Size:	Length	.300	.510	.580	.510	.790	.790	1.200
	Height	.280	.350	.450	.445	.530	.868	.975
	Depth	.100	.156/.200	.200	.200	.260	.260	.280
Mounting Centers		.150	.188	.188	.281	.500	.500	1.000
Terminal Styles②		1, 2	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6	1,3,6,7	1,3,6,7	6, 7
Approvals		---	M8805/4,/106,/109 UL/CSA	--- UL/CSA	M8805/101 UL/CSA	M8805/7 UL/CSA	--- ---	--- ---

①120/250VAC, 28VDC, silver contacts . ② 1. PC pins, 2. Turret, 1/8", 3. Turret 3/16", 4. Wire Wrap, 5. Right Angle PC, 6. Solder, 7. QC Tabs

Environment-free Sealed

OTTO
OTTO
OTTO
OTTO

P6-3 Series
Sub-Miniature
Up to 10 Amps!

P5 Series
Pin & Roller Plunger, 2 & 4 pole
M8805/39, /40, /43, /100, /104

T6 Series
Solenoid-Held Toggle,
30% lighter, 25% smaller
M5594/1, /2, /3, /6

R6 Series
Rotary Roller
Actuation

Miniature Toggles

New!

T3 Series

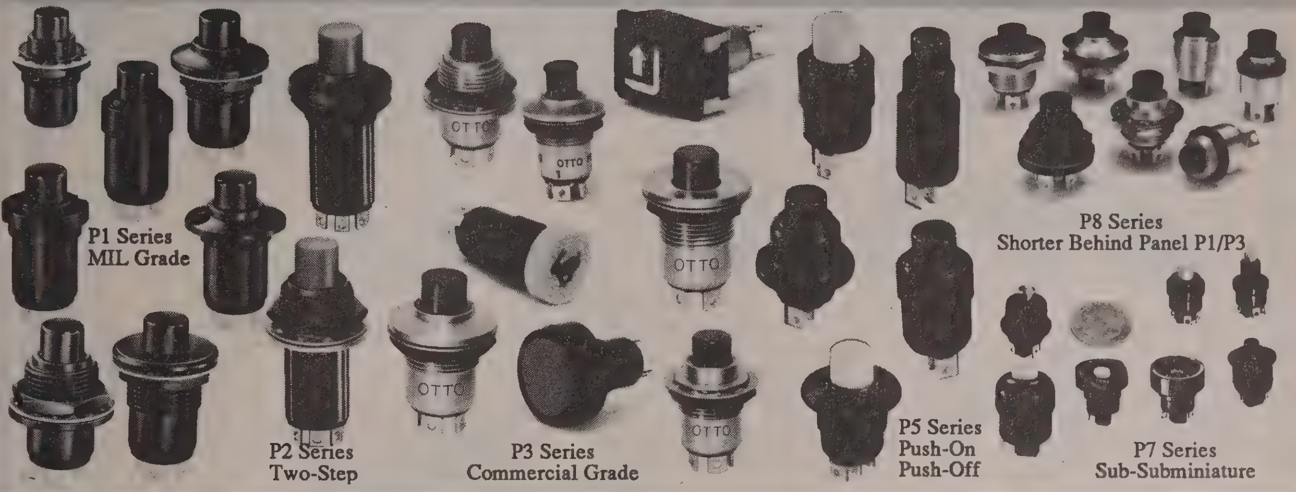
- Non-Teasible
- Shorter behind panel
- Weighs 25% less
- More plating choices
- More reliable. . . less parts
- Commercial
- MIL-S-83731
- 5 Amp., resistive
- 1 & 2 pole
- 15/32" bushing, sealed
- 1/4-40 bushing, unsealed
- Lever-Lock 15/32" bushing, sealed

OTTO Controls 2 East Main Street • Carpentersville, Illinois 60110 Phone: 708/428-7171 • Fax: 708/428-1956

we add value to your switch solution

OTTO
CONTROLS

Sealed Push Button Switches-Standard Designs

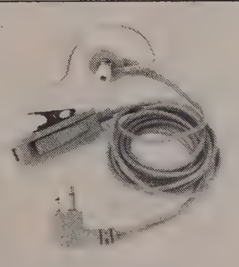

P1 Series
MIL Grade
P2 Series
Two-Step
P3 Series
Commercial Grade
P5 Series
Push-On
Push-Off
P8 Series
Shorter Behind Panel P1/P3
P7 Series
Sub-Subminiature
OTTO

Series. . .		P1 MIL Grade	P2 3-Position	P3 Commercial Grade	P5 Alternate Action	P7 Sub-Miniature	P8 Sub-Mini, Short Panel
Circuitry		SPDT-DB	2-SPDT	SPDT-DB	SPDT	SPDT-DB	SPDT-DB
Actuation		Mom./Push-Pull	2 Levels	Mom./Push-Pull	Push-On/Push-Off	Momentary	Momentary/Push-Pull
Rating①	Resistive	10A	5A	10A	5A	5A	10A
	Inductive	5A	3A	5A	3A	3A	5A
Mechanical Life		Up to 1 million	Up to 50,000	Up to 1 million	Up to 1 million	Up to 1 million	1 million, min.
Operating Force		3-5 lbs.	3.5/6.0 lbs.	3-5 lbs.	3-5 lbs.	1.2-2.2 lbs.	3.5 ±1 lbs.
Typical Behind Panel		.865	1.25	.865	.720	.510	.683
Terminal Styles②		1, 2	1	1, 2	1, 2	1, 2, 3	1, 2, 3
Approvals		M8805/3	- - -	- - -	- - -	M8805/110	M8805/20
		- - -	- - -	- - -	- - -	- - -	- - -
Materials	Case	Black Anodized	Black Anodized	Clear Anodized	Black Anodized	Black Anodized	Black/Clear Anodized
	Button	Nylon in 9 colors	Nylon in 9 colors	Nylon in 9 colors	Nylon in 9 colors	Nylon in 9 colors	Nylon in 9 colors

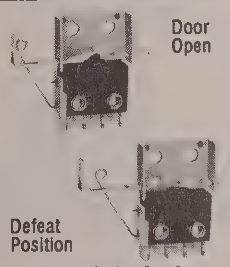
① Ratings based on 120/250VAC, 28VDC, silver contacts. ② Terminal Style Code: 1. Solder, 2. Screw, 3. PC Pin

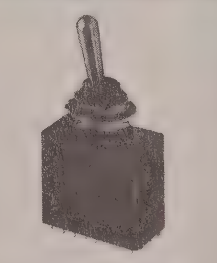
Some Examples of Special Purpose Designs

Vandal-Proof
Sealed, Survives abuse

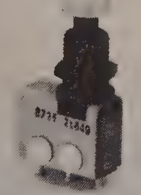

Custom Assembly
Switch, cable, connector

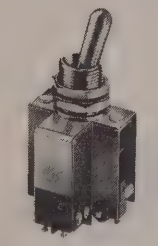
Pendent Switch
Remote Switch with cable

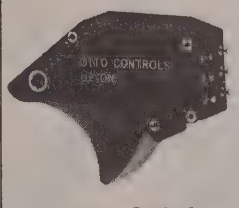

Door
Open
Defeat
Position
Door Interlock
Safety with service defeat


Sealed, Toggle
3-Position, 8 Poles

4-Way Toggle
Miniature Joy Stick


Offset Push Button
Clears back-of-panel interference


Open Frame Toggle
4-Position, 4 Pole


OTTO CONTROLS
Trigger Switch
Two level control U2-016

Shrouded Button
Guards against accidental operation

OTTO Controls 2 East Main Street • Carpentersville, Illinois 60110 Phone: 708/428-7171 • Fax: 708/428-1956

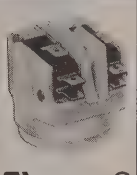
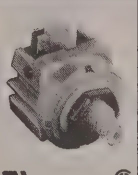
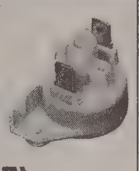
PRES:AIR:TROL®

PRES:AIR:TROL CORPORATION
1009 W. Boston Post Road, Mamaroneck, NY 10543
914•698-2026 FAX 914•698-9450 Telex 5106000212
800•431-2625 (OUTSIDE NY)

PRESSURE AND VACUUM SWITCHES • AND • SHOCK-PROOF SWITCHES

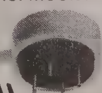
(Shock-Proof • Water-Proof • Explosion-Proof)

PRESSURE & VACUUM SWITCHES

			
FIGURE R RADIAL SPOUT	FIGURE C CENTER SPOUT	FIGURE M 1/8 NPT	FIGURE D DIFF. SWITCH
SIZE: 2¼"×2¼" MOUNT: USE #4 SELF TAP SCREWS	SIZE: 2¼"×2¼" MOUNT: USE #4 SELF TAP SCREWS	SIZE: 2¼"×2¼" MOUNT: USE 9/16-18 NUT	SIZE: 1⅝"×1⅛"×1" MOUNT: USE (2) 1/8 SCREWS

NOTE:
1. Above sizes Do Not Include Inlet.
2. Special Micros available on request. to 25 AMP
3. Fig. R, C & D Connect to 1/8" ID Tube.
4. Other Spout and Mounting Configurations Available.
5. Micro Switches Accept STD .250" Slide On Terminal.
6. Approx. Repeat Accuracy ±3% At Constant Temp.
7. Consult Factory For Special Requirements.
8. P.C. Switch Also Avail With Threaded Mount. Contacts are 1 N.O. or 2 N.O.

P.C. MOUNT



PRESSURE OR VACUUM

LOW COST PRESSURE SWITCHES

SPDT	DPDT	ADJUSTABLE RANGE	MAX 250VAC RATING	APPROVAL	FIG # STD	FIG # SPECIAL
PR10103A	—	1.5-7 INCH H_2O	3A	UL, CSA	R	M,C
PR10306A	—	5-35 INCH H_2O	5A	UL, CSA	R	M,C
PR10510A	PR20510A	20-50 INCH H_2O	10A	UL, CSA	R	M,C
PM11120A	PM21120A	1-5 PSI	21A	UL, CSA	M	R,C
PM11130A	PM21130A	2.5-6 PSI	21A	UL, CSA	M	R,C
PM11140A	PM21140A	4-11 PSI	21A	UL, CSA	M	R,C
PM11150A	PM21150A	9-18 PSI	21A	UL, CSA	M	R,C
PM11160A	PM21160A	15-28 PSI	21A	UL, CSA	M	R,C
PM11170A	PM21170A	25-40 PSI	21A	UL, CSA	M	R,C
PM11180A	PM21180A	35-65 PSI	21A	UL, CSA	M	R,C
PM11190A	PM21190A	50-100 PSI	21A	UL, CSA	M	R,C
PM11195A	PM21195A	75-125 PSI	21A	UL, CSA	M	R,C

LOW COST VACUUM SWITCHES

SPDT	DPDT	ADJUSTABLE RANGE	MAX 250VAC RATING	APPROVAL	FIG # STD	FIG # SPECIAL
VR10103A	—	2.5-7 INCH H_2O	5A	UL, CSA	R	M,C
VR10306A	—	6-16 INCH H_2O	21A	UL, CSA	R	M,C
VR10510A	VR20510A	13-25 INCH H_2O	21A	UL, CSA	R	M,C
VR10515A	VR20515A	20-40 INCH H_2O	21A	UL, CSA	R	M,C
VR11120A	VR21120A	35-80 INCH H_2O	21A	UL, CSA	R	M,C
VR11130A	VR21130A	75-150 INCH H_2O	21A	UL, CSA	R	M,C
VR11140A	VR21140A	135-250 INCH H_2O	21A	UL, CSA	R	M,C

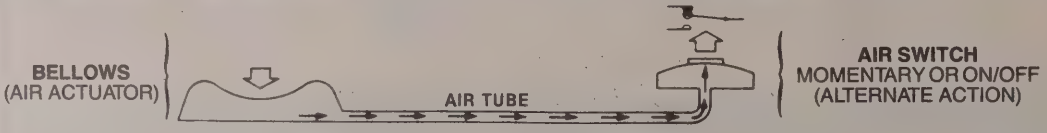
DIFFERENTIAL PRESSURE SWITCH (Pressure or Vacuum)

SPDT	DPDT	ADJUSTABLE RANGE	MAX 250VAC RATING	APPROVAL	FIG #
D1000A	—	.5-15 INCH H_2O	.5A	—	D
D1001A	—	5-30 INCH H_2O	1A	—	D

NOTE: Differential switch may be set for normally open or closed contacts for pressure or vacuum operation.

SHOCK PROOF, WATER PROOF, EXPLOSION PROOF SWITCH

INSTEAD OF A SWITCH CONNECTED BY CABLE TO THE EQUIPMENT OR APPLIANCE, AN AIR BELLOWS IS JOINED BY TUBING TO AN AIR SWITCH CONTAINED WITHIN THE EQUIPMENT OR APPLIANCE. **AIR SWITCHES ARE AVAILABLE IN MOMENTARY, ALTERNATE ACTION, OR SEQUENCING ACTIONS.**



Air Switches

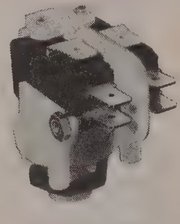
1. 2HP @ 240VAC
   1HP @ 120VAC
   21 AMP @ 240VAC
2. Other mounting choices.
3. Acetel plastic body and mechanism ensures high mechanical stability and minimum moisture absorption.
4. Other switch ratings available.

FILE #E80254 FILE #LR69099-1

ON/OFF TVA111A
Momentary TVM111A

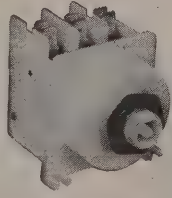
"Tinytrol™ Single"
SPDT

ON/OFF TVA211A
Momentary TVM211A



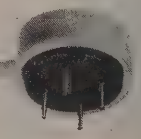
"Tinytrol Double"
DPDT
US PATENT 4,783,580

4-Function
MTG311A



"Magictrol™" Sequencing

P.C. Mount "C" Series Momentary



- Printed Circuit Board Mount Air Switch 1" DIA.
- SPST or DPST 1 Amp (typical)

Air Actuators (Bellows) And *Foot Switches (Bellows or Electric)

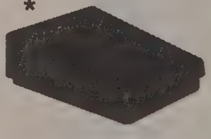
The air actuators in any of the various forms, are not affected by water, dirt, dust or flammable gases. Only a few of the many actuators available are shown here. Standard electrical footswitches are also available.

B225A

B318A

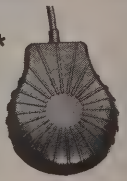
B643A

*



B621A

*



B721A

F800A

B145A

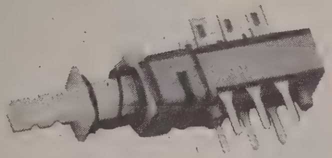
RDI ELECTRONICS INCORPORATED

The following information is excerpted from our catalog. Please contact us for your complete guide to the components available from RDI Electronics.

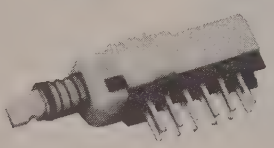
SWITCHES

RDI Electronics offers pushbutton and miniature pushbutton versions, as well as tact, rocker, and slide switches to suit most applications.

PUSHBUTTON TYPES

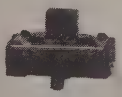


MINIATURE PUSHBUTTON TYPES

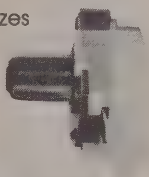


TACT TYPE

- Horizontal and vertical PC Mount
- Positive tactile feel
- 6.2mm and 12mm sizes



JTM-1101B



JTM-1105A3

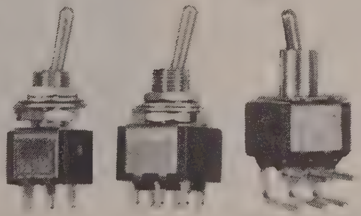
JTM-1102C

JTM-1105B

JTM-1108C

TOGGLE SWITCH TYPE

- PC and Solder Terminals
- Right angle and vertical mount



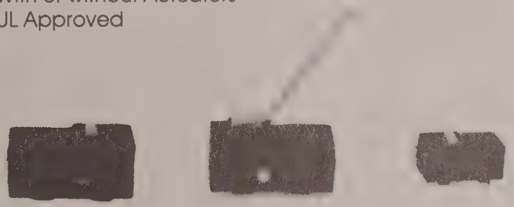
ELECTRICAL SPECIFICATIONS	
Contact Rating	3 amps with resistive load @ 120VAC or 28 VDC
Contact Resistance	20 milliohms max. initial @ 2-4VDC. 100 milliamps for both coin silver and gold plated contacts
Insulation Resistance	100 megohms minimum
Dielectric Strength	1,000 volts RMS @ sea level
DURABILITY SPECIFICATIONS	
Electrical Life	30,000 make-and-break cycles at full load
Operating Temperature	20°C to 65°C
MATERIALS	
Case	Diallyl Phthalate (DAP)
Toggle Handle	Brass, chrome palted
Bushing	Brass, nickel plated
Housing	Stainless Steel
Terminal/Switch Support	Brass electrotin plated
Contacts	Coin silver, silver plated
Center Contact & Terminal	Brass, silver plated

PUSH BUTTON SWITCH SPECIFICATIONS	
ELECTRICAL SPECIFICATIONS	
Rating Resistance	DC 30V, 0.3A Max.
Contact Resistance	20mΩ Max. under the DC 5V, 1A
Insulation Resistance	100MΩ Min. at DC 500V.
Withstanding Voltage	1 min. at AC 500V
Contact Timing	Non-shorting, Shorting.
MECHANICAL SPECIFICATIONS	
Terminal Strength	500g for 1 Min.
Operating Force	300 ± 200g
Control Strength	3 kg static force.
Function	Self-Lock, Inter-Lock, Non-Lock (Momentary)
DURABILITY SPECIFICATIONS	
Test Conditions	10,000 cycles at a rate of 15 ~ 20 cycles for 1 minute without load.
Operating Force	Within $^{+10}_{-40}$% of initial value.
Contact Resistance	40mΩ Min.

TACT SWITCH COMMON SPECIFICATION		
Specification Model	JTM-1101, 1102 Type	JTM-1105,1108 Type
ELECTRICAL SPECIFICATIONS		
Power Rating	DC 12V, 50 mA Max.	
Contact Resistance	100 mΩ Max. under DC 5V, 1A.	
Insulation Resistance	100 MΩ Min. at DC 100 V	
Withstanding Voltage	1 min. at AC 250 V	
Bounce	10 msec. Max.	
MECHANICAL SPECIFICATIONS		
Switch Action	S.P.S.T. momentary push on switch	
Operating Force	100±30 gf 200±50 gf	120±50 gf
Control Strength	1 Kgf static force	
DURABILITY SPECIFICATIONS		
Test Conditions	100,000 ~ 500,000 cycles at a rate of 15 ~ 20 cycles for 1 minute with a resistive load DC 12 V, 50 m A.	
Contact Resistance	200 mΩ Max.	
Bounce	20 msec. Max.	
Operating Force	Within $^{+10}_{-40}$% of initial value	

BASIC SUB-MINIATURE TYPE

- Solder, Faston or PC Terminals
- With or without Actuators
- UL Approved



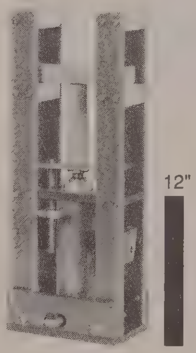
PUSH BUTTON SWITCH SPECIFICATIONS	
ELECTRICAL SPECIFICATIONS	
Rating Resistance	DC 30V, 0.3A Max.
Contact Resistance	20mΩ Max. under the DC 5V, 1A
Insulation Resistance	100MΩ Min. at DC 500V.
Withstanding Voltage	1 min. at AC 500V
Contact Timing	Non-shorting, Shorting.
Service Life	Mechanically: 300,000 operations min. Electrically: 50,000 operations min. (full load)

FROM PROTOTYPE TO PRODUCTION, SPECIFY RDI ELECTRONICS FOR QUALITY, SERVICE AND COMPETITIVE PRICING.

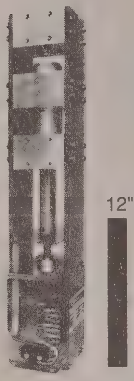
RDI Electronics, Inc.,/ Dept. E, 147 Palmer Ave., Mamaroneck, NY 10543 Tel: 914-777-7000/ Fax: 914-777-7070

HIGH CURRENT SWITCHES

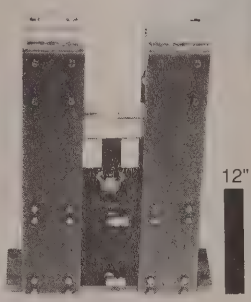
6V TO 350 KKV • TO 36,000A CONTINUOUS • TO OVER 1,000,000 A PULSE



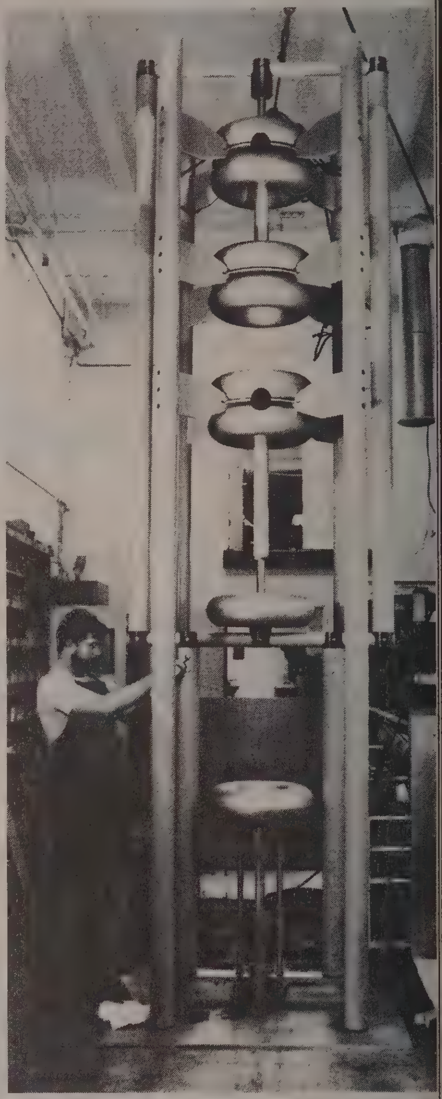
600 AMP
50KV PK TEST
GA50-NC-50
200-600 AMP AVAILABLE



400 AMP
27KV PK TEST
GD27-DT-60
400-36,000 AMP AVAILABLE



1200 AMP
27KV PK TEST
GB27-NCP-27
400-2,000 AMP AVAILABLE



6,000 AMP DC to 400Hz.
1500 AMP 30 KHz
350 KV PK TEST
GD350 DT-350

APPLICATION DATA

Ross Engineering's high current switches have very low contact resistance. They are used for power, RF, capacitor discharge, pulse, transfer and tap selection. They are used on low and high voltage power loads or with multiple capacitor banks for isolated no load selection, transfer or grounding.

By using non-conductive air or hydraulic lines, no electrical or mechanical ties to contact mechanism are required. Also, when specially built, the units can be used for high currrent RF applications. Units are built with G-10 epoxy glass laminate insulation for standard applications, and G-7 silicone glass insulation for RF applications. Heavy duty contacts, specially designed to minimize corona, are built of highly conductive but weld resistant alloys. Units are able to withstand high shock/vibration and severe environmental conditions. Simple mechanical design and conservative stress levels result in long life, trouble-free performance. Additionally, units are built of lightweight material and are of the smallest dimensions possible for full performance within power ranges. They are easily installed and used in the most compact compartments.

OPERATE VOLTAGE

The peak test rating of high current switches should be 1.2 to 5 times the normal circuit operating voltage, depending upon the application. For lower power systems where transients are unlikely or intermittent flashover is of no consequence, a safety factor of 1.2 to 1.5 may be suitable. For medium power systems or where moderate transients are likely, a safety factor of 1.5 to 3 is desirable, and 2 to 3 recommended. For higher power systems or where transient overvoltages are expected, a safety factor of 2.5 to 5 should be considered and the factor should be based on the maximum probable transient. The rated peak test voltage to ground should be selected in the same way as was the contact to contact value. If a value other than the published rating is required, it can normally be supplied as an extra cost option.

*See our additional products in **Volume B**, Fiber Optic Equipment & Accessories – Sect. 2475, Relays – Sect. 4500; and **Volume D,** Instruments, Test & Measuring – Sect. 2900.*

ROSS ENGINEERING CORP.

540 Westchester Drive, Campbell, CA 95008 • (408) 377-4621 • FAX (408) 377-5182 • TOLL FREE 1-800-654-3205

SCHURTER
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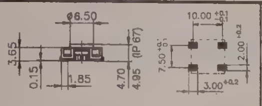
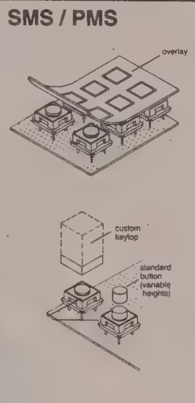
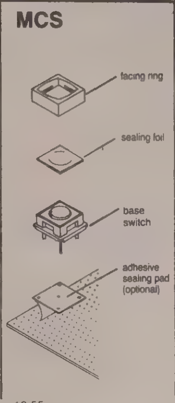
SWITCHES

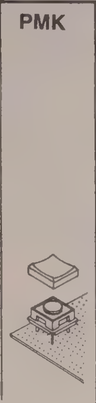
PUSHBUTTONS

SMS 1/2"
Surface mount switch designed for use under membrane overlay.


ø6.50
10.00
3.65
0.15
1.85
4.70
4.95
(IP 67)
7.50
2.00
3.00

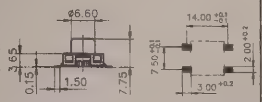

SMS / PMS
overlay
custom keytop
standard button (variable heights)


MCS
facing ring
sealing foil
base switch
adhesive sealing pad (optional)



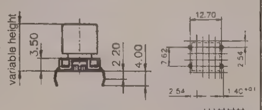
The snap dome is gold plated steel guaranteed for 10⁶ operations.

SMS 1/2"
Surface mount switch designed for use under membrane overlay.


ø6.60
14.00
3.65
0.15
1.50
7.75
7.50
2.00
3.00

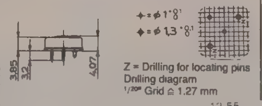
Has metal plate for ESD protection.

PMS 1/2"
Base switch with button.

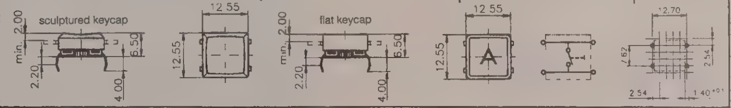

variable height
3.50
2.20
4.00
12.70
7.62
2.54
2.54
1.40

The actuating style, color and legend inscription can be selected from a number of basic components.

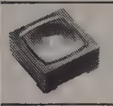
MCS 1/2"
Base switch with sealing foil and facing ring.


3.85
3.2
4.07
Z = Drilling for locating pins
Drilling diagram
1/20" Grid ≙ 1.27 mm

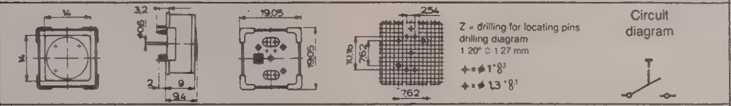
PMK 1/2"
Base switch with keycap


sculptured keycap
min. 2.00
2.20
6.50
4.00
12.55
12.55
flat keycap
min. 2.00
2.20
6.50
4.00
12.55
12.55
A
12.70
7.62
2.54
2.54
1.40

The switches can be supplied with an IEC rating of sealing protection class IP40 or IP65.

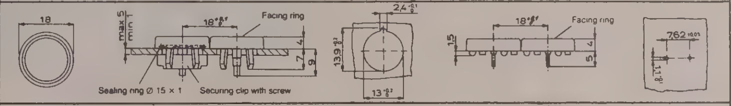


MTG, MCS, MTL 3/4"
Key switch unlighted or backlighted with two LED's. MTL is indicator only.

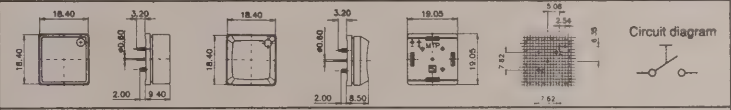

14
14
3.2
2
9
9.4
19.05
19.05
25.4
7.62
10.16
7.62
Z = drilling for locating pins
drilling diagram
1/20" ≙ 1.27 mm
Circuit diagram

The contacts are short travel and available with gold or silver plating.

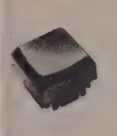
MCS 3/4"
Key switch unlighted with extreme low profile for panel or pcb mounting.


18
max 5
min 1
18
Facing ring
4
9
Sealing ring Ø 15 × 1
Securing clip with screw
24
13.9
13
18
Facing ring
1.5
5
4
7.62

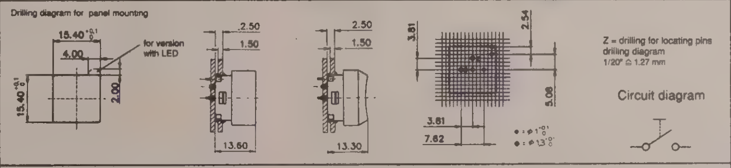
MTP 3/4"
Key switch with or without LED


18.40
18.40
3.20
2.00
9.40
18.40
18.40
3.20
2.00
8.50
19.05
19.05
7.62
5.08
2.54
7.62
Circuit diagram

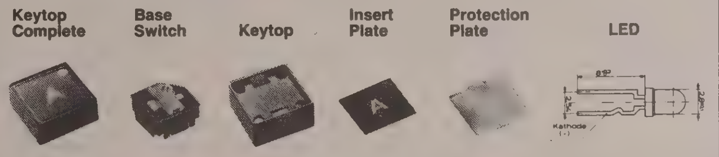
Adhesive sealing pads for wave-soldering and washing are available for most models.



MMT 3/4"
Key switch with momentary or alternate action for pcb or panel mounting. With or without LED

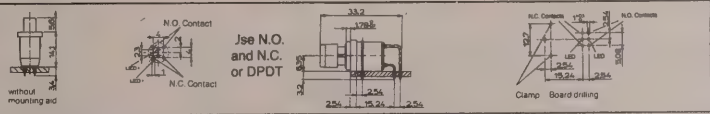

Drilling diagram for panel mounting
15.40
4.00
for version with LED
2.00
15.40
2.50
1.50
13.60
2.50
1.50
13.30
3.81
2.54
5.08
3.81
7.62
Z = drilling for locating pins
drilling diagram
1/20" ≙ 1.27 mm
Circuit diagram

MMT 3/4"
Optional keytop assembly

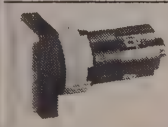

Keytop Complete
Base Switch
Keytop
Insert Plate
Protection Plate
LED
A
A
Kathode (-)

Medium stroke, low profile switches in momentary (MMT) or alternate (MMS) action for panel or pcb mounting. Self-cleaning contacts are silver, with a smooth gliding spring action. The MMT is guaranteed for 5 million operations. Available sealed or unsealed. Keytop assembly can be ordered separately for interchanging legends.

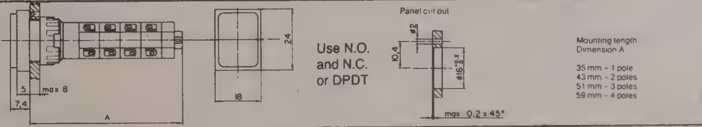
LDS/LDT


without mounting aid
N.O. Contact
N.C. Contact
Use N.O. and N.C. or DPDT
33.2
2.54
15.24
2.54
N.C. Contacts
N.O. Contacts
LED
2.54
15.24
Clamp
Board drilling

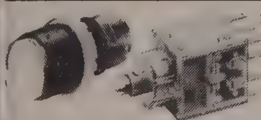
Miniature pushbutton with or without TI LED or mechanical indicator for panel or pcb mounting. Available with solder terminals and various button shapes and colors.



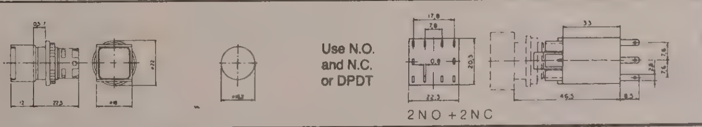
EMF


5
max 8
7.4
A
24
18
Use N.O. and N.C. or DPDT
Panel cut out
10.4
max 0.2 × 45°
Mounting length
Dimension A
35 mm - 1 pole
43 mm - 2 poles
51 mm - 3 poles
59 mm - 4 poles

Pushbutton accepts TI¾ LED neon or incandescent lamps. Available in round, square or rectangular. Also with gold contacts, various lense colors and legend inscriptions. AF is matching indicator.



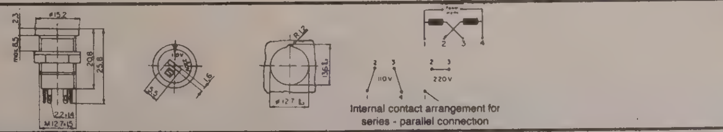
SBE


Use N.O. and N.C. or DPDT
17.8
20.5
22.5
2 N O + 2 N C
33
45.5

Heavy-duty push button with mechanical contact black accepts T5 LED, neon or incandescent lamps. Available in round, square, or rectangular. Various lense colors and legend inscriptions. AF is matching indicator.

ROTARY - Voltage Selector

SWA


ø15.2
2.3
max 8.5
20.8
23.8
22 × 14
M12.7 × 15
ø12.7
1 2 3 4
110 V
220 V
Internal contact arrangement for series - parallel connection

Selector switch for international voltages. Part number 033.4501 for panel mounting and 033.4601 for pcb mounting. Reference full-line catalog for 3 and 6 position models.

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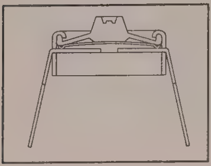
PCB mount switch modules

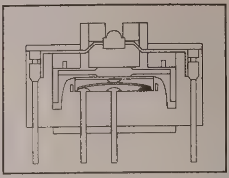


MICRO-COSMOS

"Tactile effect" switch
4 versions available:

- Thru-hole
- Right Angle
- SMT
- Manual Insertion

Micro COSMOS switch modules are packaged in ready to mount IC type standard tubes.



COSMOS

"Tactile effect" switch: The 12,3 x 12,3 mm square "COSMOS" series attractive button is fitted with a removable cover: various possible colors and symbols are available.

Illumination: total front area illumination of the Cosmos series button by means of a L.E.D. embedded in the centre of the module.

Sealed: Contact component fully sealed against dust, splashes, wave soldering flux and solvent cleaning pollution. Terminal pins are interference fitted to ensure a fully sealed base.

Modular: The Cosmos series buttons are building blocks on 2,54 mm matrix to provide a flexible layout solution using single or multiple modules.

SPECIFICATIONS

- CECC Standard
  - Micro COSMOS CECC 96401 - 004
  - COSMOS CECC 96401 - 003
- NATO listed (COSMOS)
- ISO 9002

		MICRO-COSMOS		COSMOS	
ELECTRICAL CHARACTERISTICS		Ag standard contacts	Tropicalised Au contacts	Ag standard contacts	Tropicalised Au contacts
Function		OFF-MOM	OFF-MOM	OFF-MOM	OFF-MOM
Nominal voltage:	V	24	24	24	24
Maximum voltage:	V	50	50	50	50
Minimum voltage:	mV	100	10	100	10
Nominal current:	mA	20	20	125	125
Minimum current:	mA	10 mA	500 µA	10 mA	500 µA
Nominal contact power rating:	W	0,5	0,5	3	3
Contact resistance:	mΩ	<47	<20	<20	<20
Dielectric strength:	V RMS 50 Hz	250	250	300	300
Insulation resistance at 100 V:	MΩ	>1000	>1000	>1000	>1000
Maximum bounce:		<5ms	<5ms	<100 µs	<100 µs
Guaranteed number of operations at nominal contact power rating:		10^6	10^6	10^6	10^6
MECHANICAL CHARACTERISTICS					
Dimensions: L x l x H	mm	see drawings		12,5 x 12,5 x 14,7	12,5 x 12,5 x 14,7
Distance between modules:	mm	7,62 x 10,16	7,62 x 10,16	12,7 x 12,7	12,7 x 12,7
Distance between terminals:	mm	5,08 x 7,62	5,08 x 7,62	2,54	2,54
Insulation: glass filled polyamide, self-extinguishing	4 V-O (UL-94)	•	•	•	•
Operating force:	N	3	3	3	3
Nominal operating travel:	mm	0,45	0,45	0,4	0,4
Maximum travel:	mm	0,80	0,80	0,65	0,65
Overtravel:	mm	0,35	0,35	0,25	0,25
Resistant to vibration of 1,5 mm amplitude (IEC 512-4):	Hz	500/10	500/10	2000/10	2000/10
Mechanical shock resistance (IEC 512-4 section 6c):		50G	50G	100G	100G
Mechanical shock resistance (IEC 512-4 section 6b):	Severity index 40 G/1000	•	•	•	•
Contact plating (mean value):	on Ni	2 µ Ag	0,5 µ Au	2 µ Ag	0,5 µ Au
Terminal plating (mean value):	on Ni	5 µ Sn Pb	0.5 µ Sn Pb	2 µ Ag	0,5 µ Au
L.E.D. terminal plating:	on Ni	—	—	8 µ Sn Pb	8 µ Sn Pb
Soldering time at 250°C: (IEC 512-4)		consult us	consult us	5	5
Soldering and cleaning process		consult us	consult us	consult us	consult us
ENVIRONMENTAL CHARACTERISTICS					
Operating temperature range:	°C	-40 +85	-40 +85	-25 +85	-25 +85
Storage temperature:	°C	-55 +85	-55 +85	-40 +85	-40 +85
Damp heat (IEC 512-6)	days	21	21	10	21
Saline mist (IEC 512-6)	hours	48	48	24	96
Sealing		Sealed for Immersion Cleaning in Solvents			

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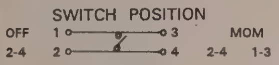
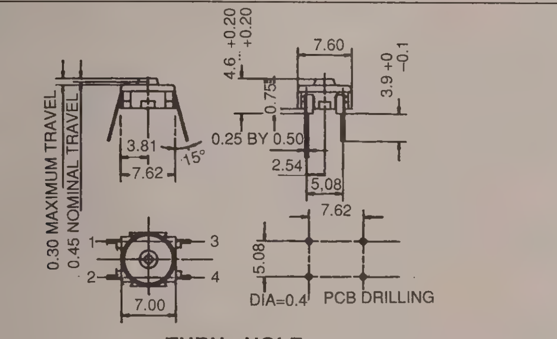
MICRO-COSMOS
Tactile Effect
Sealed

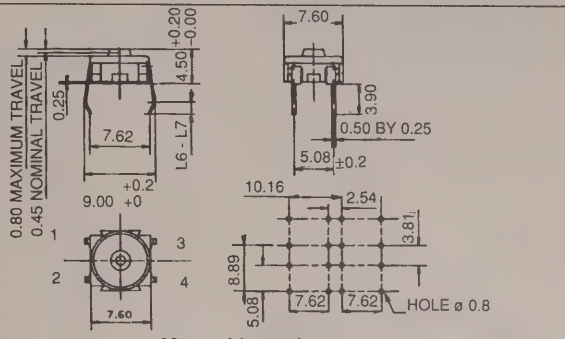
SWITCH POSITION	TYPE OF MODULE	PART NUMBER	TYPE OF MODULE	PART NUMBER
	**STANDARD SILVER CONTACT**		**TROPICALISED GOLD PLATED CONTACTS**	
	Thru-hole	MC 10333 00	THRU - HOLE	MC 12551 00
	Manual insertion	MC 10333 11	Manual insertion	MC 12551 11
	Right angle	MC 10355 00	Right angle	MC 12555 00
	SMT	MC 10311 91	SMT	MC 12511 91

SWITCH POSITION
OFF
2-4
1
3
2
4
MOM
2-4
1-3

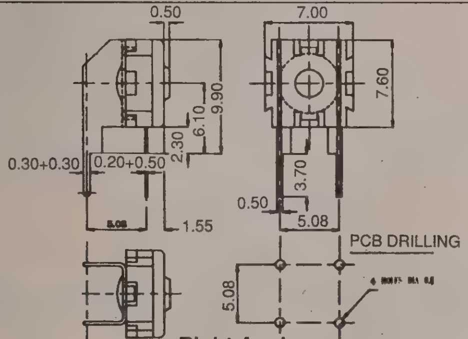
1-POLE / 2-POSITION


0.30 MAXIMUM TRAVEL
0.45 NOMINAL TRAVEL
3.81
7.62
15°
4.6 +0.20 +0.20
7.60
3.9 +0 −0.1
0.75
0.25 BY 0.50
2.54
5.08
7.62
5.08
1
2
3
4
7.00
DIA=0.4
PCB DRILLING

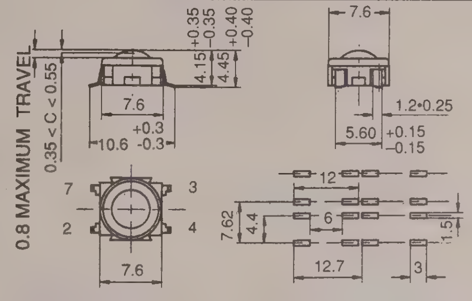
THRU - HOLE


0.80 MAXIMUM TRAVEL
0.45 NOMINAL TRAVEL
0.25
7.62
+0.20 −0.00
4.50
L6 - L7
9.00 +0.2 +0
7.60
3.90
0.50 BY 0.25
5.08 ±0.2
10.16
2.54
3.81
8.89
5.08
7.62
7.62
HOLE ø 0.8
1
2
3
4
7.60

Manual Insertion


0.50
7.00
9.90
6.10
2.30
7.60
0.30+0.30
0.20+0.50
5.08
1.55
3.70
0.50
5.08
PCB DRILLING
5.08

Right Angle


0.8 MAXIMUM TRAVEL
0.35 < C < 0.55
+0.35 −0.35
+0.40 −0.40
4.15
4.45
7.6
+0.3
10.6 -0.3
7.6
1.2•0.25
5.60 +0.15 −0.15
7
3
2
4
7.6
12
6
7.62
4.4
1.5
12.7
3

PITCH BETWEEN MODULES
7.62 MM 12.7

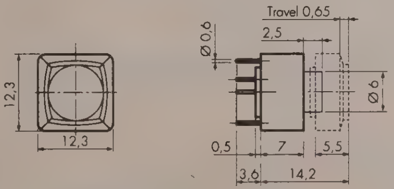
SMT

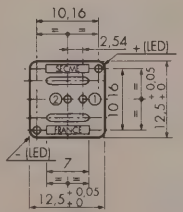
Micro-Cosmos Series
THRU - HOLE
Manual insertion
Right angle
SMT

PCB MOUNTING — PITCH in mm				
TYPE OF MODULE	BETWEEN TERMINALS	BETWEEN MODULES without button	with ⌀ 8 button	with ⌀ 10 button
THRU - HOLE	5.08 x 7.62	7.62 x 10.16	8.89 x 10.16	10.16 x 10.16
MANUAL INSERTION	5.08 x 7.62	7.62 x 10.16	8.89 x 10.16	10.16 x 10.16
RIGHT ANGLE	5.08 x 5.08	7.62	10.16	10:16
SMT	5.08 x 10.6	7.62 x 12.70	—	—

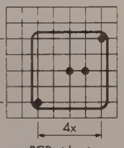
1-pole 2-position

COSMOS
Tactile Effect - Sealed Illuminated or Non-Illuminated


12,3
12,3
Travel 0,65
Ø 0,6
2,5
Ø 6
0,5
7
5,5
3,6
14,2

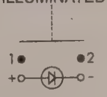

10,16
2,54
+ (LED)
SECME
FRANCE
10,16
12,5 +0,05 +0
- (LED)
7
12,5 +0,05 +0

Back view



PCB side view:
Pitch: x = 2,54 mm
0,8 mm diameter hole

SWITCH POSITION	STYLE	PART NUMBER
NON-ILLUMINATED 1• •2 OFF MOM - 1-2	**TROPICALISED GOLD PLATED CONTACTS**	
	Black body	81 12151 00
	Black body	81 12551 00*
	STANDARD SILVER CONTACTS	
	Black body	81 10101 00

SWITCH POSITION	STYLE	PART NUMBER
ILLUMINATED  1● ●2 OFF ON - 1-2	**TROPICALISED GOLD PLATED CONTACTS**	
	Black body	illuminated
	L.E.D. red	81 22151 02
	L.E.D. green	81 22151 03
	L.E.D. yellow	81 22151 04
	L.E.D. red	81 22551 02*
	L.E.D. green	81 22551 03*
	L.E.D. yellow	81 22551 04*
	STANDARD SILVER CONTACTS	
	Black body	illuminated
Independent L.E.D. circuit	L.E.D. red	81 20101 02
	L.E.D. green	81 20101 03
	L.E.D. yellow	81 20101 04

Operating force 3N
*Selected for 3 N ± 15%

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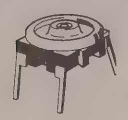
PCB mount switch modules

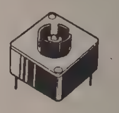
Micro-Cosmos/Cosmos Custom Built Keyboards

ASSEMBLY EXAMPLES

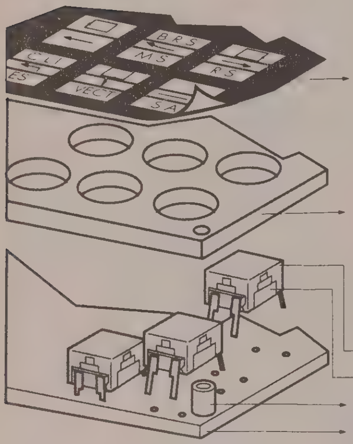
MICRO-COSMOS

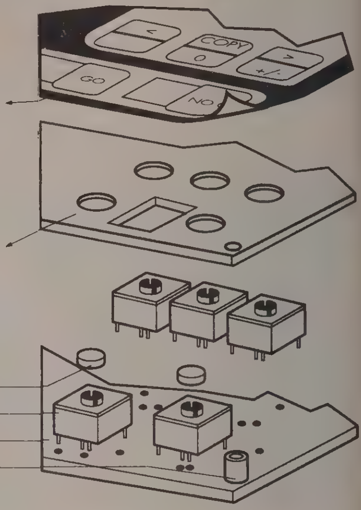


COSMOS



Electrical and mechanical characteristics of Micro-cosmos and Cosmos modules (see page B·1754)


BRS
MS
CLI
ES
VECT
SA
RS



Front panel film

Manufacture to specification in polycarbonate or polyester with silk-screening on back. Thickness: 0,175 to 0,250 mm. With or without thermoformed finger guide border.

Device front panel

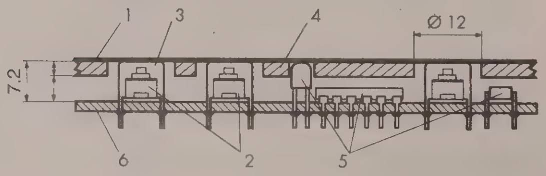
Front panel holes to accommodate module and other components, LED, switch, etc. Maximum thickness: 4 mm for Micro-cosmos, 3,5 mm for Cosmos.

Protective button
Switch module (illuminated or non-illuminated)
Spacer
PCB

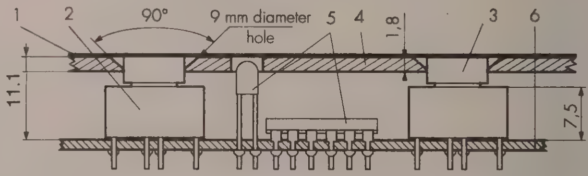
Protective lens
PCB
Spacer

To obtain a better film flexibility it is recommended that the modules are countersunk on top surface.

MICRO-COSMOS under film layout


1
3
4
Ø 12
7,2
6
2
5

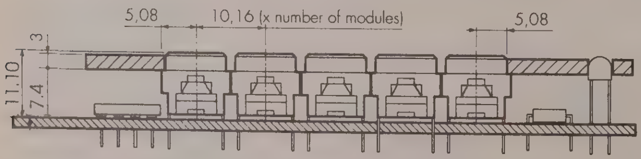
COSMOS under film layout


1
2
90°
9 mm diameter hole
5
4
1,8
3
6
11,1
7,5

① Front panel film: silk-screen printing
② MICRO-COSMOS or COSMOS module
③ Protective button
④ Device front panel
⑤ Components: (LED, resistors, ICs, etc)
⑥ PCB

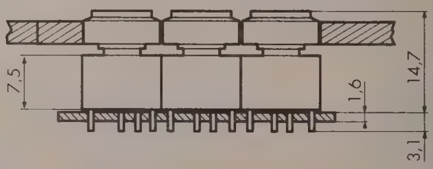
SMT Micro COSMOS can be mounted under an overlay without protective button

MICRO-COSMOS building blocks mounting

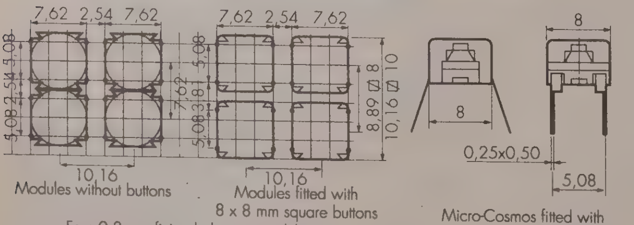

5,08
10,16 (x number of modules)
5,08
3
11,10
7,4

With buttons Ø 9 mm and square cases ◻ 10 x 10 mm

COSMOS building blocks mounting



MICRO-COSMOS building blocks module assembly


7,62
2,54
7,62
5,08
2,54
5,08
10,16
7,62
3,81
5,08
8,89 Ø 8
10,16 Ø 10
8
0,25x0,50
5,08

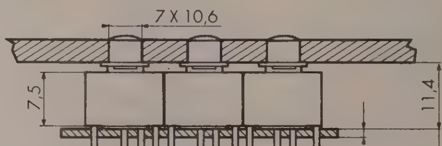
Modules without buttons

Modules fitted with 8 x 8 mm square buttons

Four 0,8 mm fixing holes per module

Micro-Cosmos fitted with 8 x 8 mm square button

COSMOS fitted with anti-pull off button

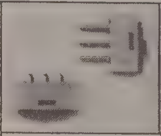
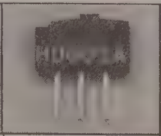

7 X 10,6
7,5
11,4

secma inc.
A MEMBER OF SECME GROUP

1K2 PCB Mount Switch
1K3 Rotary Changeover Switch

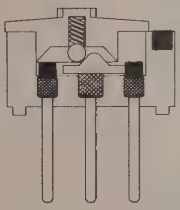
SPECIFICATIONS

- NATO listed (1K2)
- ISO 9002

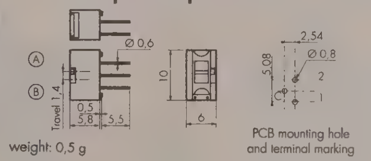



		1K2 Standard gold plated contacts	1K2 Tropicalised gold contacts	1K3 Silver contact
ELECTRICAL CHARACTERISTICS				
Function: changeover		ON-ON	ON-ON	ON-ON
Nominal voltage:	V	12	12	12
Maximum voltage:	V	24	24	50
Minimum voltage:	mV	10	10	20
Nominal current:	mA	500	500	50
Minimum current:	mA	1	1	5
Nominal contact rating:	W	6	6	0,6
Contact resistance:	mΩ	<22	<22	<200
Dielectric strength: Between terminals of the same pole:	V RMS 50 Hz	250	250	500
Between terminals of adjacent poles or switches:	V RMS 50 Hz	2000	2000	
Insulation resistance at 500 V DC:	MΩ	>10000	>10000	>50000
Switch capacitance between terminals of the same pole:	pF	<1,5	<1,5	<2
Switch capacitance between terminals of adjacent poles:	pF	<1,5	<1,5	—
Life at nominal rating:	operations	1000	1000	500
MECHANICAL CHARACTERISTICS				
Self-extinguishing insulation: Glass filled polyamide	94V-O(UL-94)	•	•	•
Nominal operating travel:	mm	1,60	1,60	—
Resistant to vibration of 1.5 mm amplitude (IEC 512-4):	Hz	500/10	500/10	55/10
Mechanical shock resistance (IEC 512-4):		50 G	50 G	—
Contact plating:	on 2µ Ni	0,5 µ Au	2 µ Au	Ag/Ni
Terminal plating	on 2µ Ni	0,5 µ Au	2 µ Au	SnPb/Ni
ENVIRONMENTAL CHARACTERISTICS				
Operating temperature range:	°C	-40 +85	-40 +85	-25 +85
Damp heat (IEC 512-6):	days	4	21	21
Saline mist (IEC 512-6)	hours	24	96	48

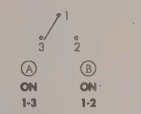
1K2



1-pole 2-position


Ⓐ
Ⓑ
Ø 0,6
Travel 1,4
0,5
5,8
5,5
10
6
2,54
Ø 0,8
5,08
2
1
C
weight: 0,5 g
PCB mounting hole and terminal marking

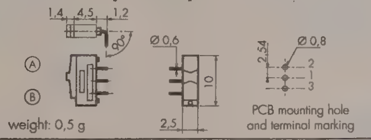
SWITCH POSITION


1
3
2
Ⓐ
ON
1-3
Ⓑ
ON
1-2

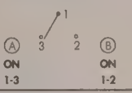
Cursor position A
1 visible position markings

STYLE	PART NUMBER
STANDARD GOLD PLATED CONTACTS	
1K2 Straight MTG, PCB Grey Cursor red	09 03201 02
TROPICALISED GOLD CONTACTS	
1K2 Straight MTG, PCB Black Slide knob red	19 03201 01

1-pole 2-position


1,4
4,5
1,2
90°
Ⓐ
Ⓑ
Ø 0,6
10
2,5
2,54
Ø 0,8
2
1
3
weight: 0,5 g
PCB mounting hole and terminal marking

SWITCH POSITION

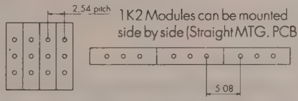

1
Ⓐ
3
2
Ⓑ
ON
1-3
ON
1-2

Cursor position A
1 visible position markings

STYLE	PART NUMBER
STANDARD GOLD PLATED CONTACTS	
1K2 Right Angle MTG, PCB Grey Cursor red	09 10201 02

Single-pole changeover switch
In line contacts at 2,54 mm pitch
Slide switch
Height above PCB: 6,4 mm

OPERATION


2,54 pitch
5.08

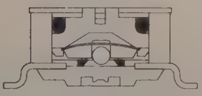
1K2 Modules can be mounted side by side (Straight MTG. PCB)

Instructions for wave soldering and cleaning

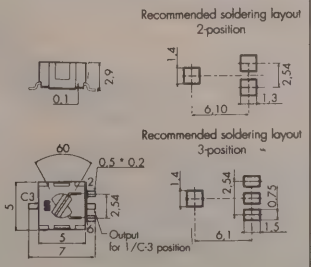
Wave Soldering			Cleaning			
Base sealed	Soldering time at 250°C (in seconds)	Trichlorethylene basic solvent	Cleaning solvents Freon TE-TF Forane 113ME/MA Arklone P Flugene 113MA	Cursor fully sealed	Immersion in an impure bath	Number of operations after cleaning with solvents
yes	5	yes	yes	no	forbidden	unchanged

Wave soldering not recommended for side-by-side switches — Ultrasonic cleaning forbidden.
Wave soldering forbidden for right angle terminal switches.

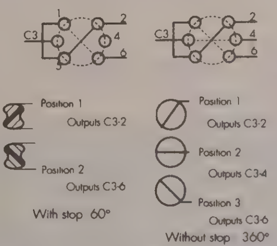
1K3



1-pole 2 and 3-position


Recommended soldering layout 2-position
2,9
0,1
1,4
2,54
1,3
6,10
Recommended soldering layout 3-position
60
0,5 * 0,2
C3
2
5
2,54
6
5
7
Output for 1/C-3 position
1,4
2,54
0,75
1,5
6,1

SWITCH POSITION


1
2
C3
4
5
6
C3
2
4
6
Position 1
Outputs C3-2
Position 2
Outputs C3-6
With stop 60°
Position 1
Outputs C3-2
Position 2
Outputs C3-4
Position 3
Outputs C3-6
Without stop 360°

09 55201 01 PART NUMBER 09 55300 01

- 2 or 3-position rotary changeover switch - Screwdriver operated
- On request, customised circuits
- Semi-snap action non shorting contacts
- Sealed for soldering and cleaning processes

ASSEMBLY AND CLEANING INSTRUCTIONS	
Polymerisation and adhesive bonding: Vapour phase soldering: Reflow or infrared soldering: Double wave soldering: Cleaning: By spraying/brushing - deionised water: By vapour: Recommended cleaning agents: Freon TE/TF, Flugene 113 MA, Forane 113 ME	Consult Us For Details

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LOW CURRENT & POWER

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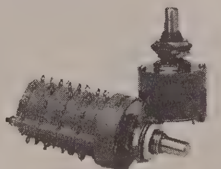
• SUBMINIATURE

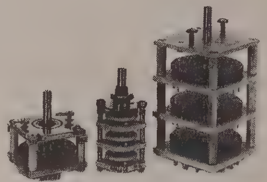
STD & BCD CODED

PCB ROTARY

• MINIATURE

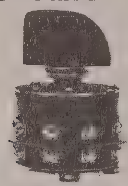


ENCLOSED

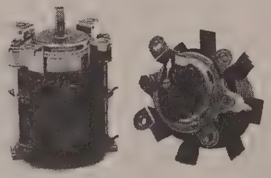


OPEN FRAME

• POWER



10 AMPERE

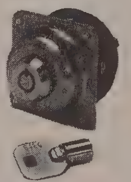


30 AMPERE

200 AMPERE

• CUSTOM

SPRING-RETURN



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- Toggle switches
- Power switches
- Push button switches
- Lever action switches
- Push-slide switches
- Leaf switches
- Rotary-slide switches

And featuring:

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- An extensive variety of sizes, pin types, pole and position quantities, ratings, contact and insulation resistances, and withstand voltages
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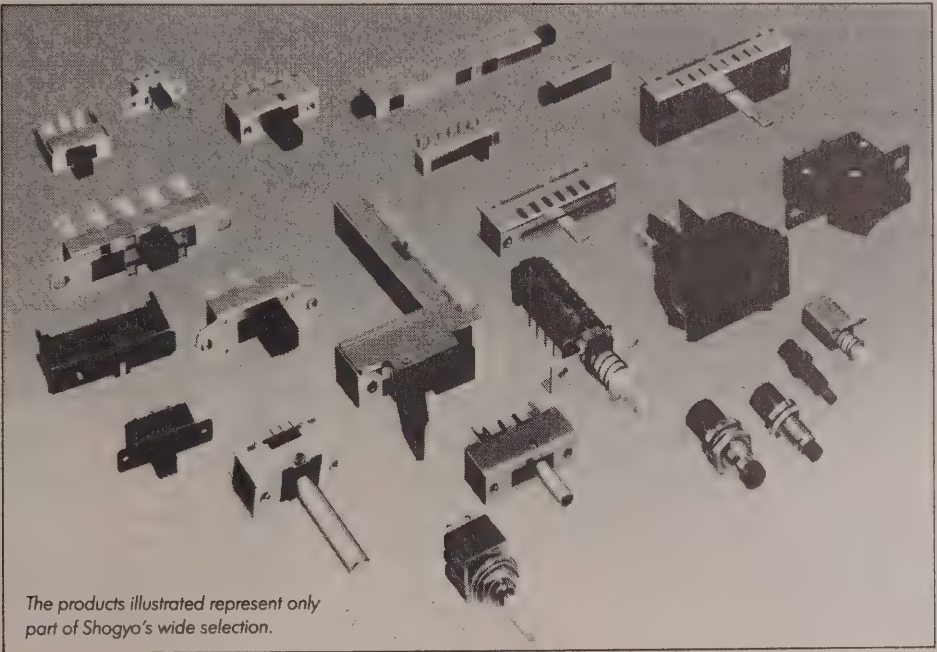
- Silver plated contacts



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SHOGYO

STANDEX REED SWITCHES

- Tested to 1 billion operations
- Totally automated production
- Highest quality, based on computerized SPC, yielding unmatched uniformity
- Custom cutting and forming for difficult applications
- Several standard contact materials for a broad range of applications and loads from dry circuit to power switching

SWITCH SPECIFICATIONS

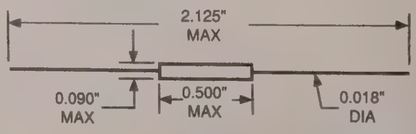
Part Number	GR500	GR501	GR560	GK560	GHG560	GR100	GK126	GHG126
Contact Form	1A	1A	1A	1A	1A	1A	1A	1A
Physical Characteristics	A	A	B	B	B	C	D	D
Contact Material	Rhodium	Rhodium	Rhodium	Gold Alloy	Amalgam	Rhodium	Gold Alloy	Amalgam
Electrical Ratings								
(1) Contact Rating VA-Max	10	10	10	10	10	10	50	50
Switching Current Amperes-Max.	0.5	0.5	1.0	1.0	1.0	1.0	1.5	1.5
Carry Current Amperes-Max.	1.0	1.0	1.5	1.5	1.5	1.5	2.5	2.5
Switching Voltage-DC VDC-Max.	100	100	100	100	100	200	200	200
Switching Voltage-AC VAC-RMS-Max.	100	100	125	125	125	250	250	250
(2) Breakdown Voltage VDC-Min.	200	200	250	250	250	300	300	300
(3) Contact Resistance Milliohms-Max.	150	150	100	150	80	100	150	75
Insulation Resistance Ohms-Min.	10^{12}	10^{12}	10^{12}	10^{12}	10^{12}	10^{12}	10^{12}	10^{12}
Contact Capacitance Picofarads-Max.	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.3
Operating Characteristics								
Operate Time (Inc. Bounce) ms-Typ.	1	1	0.6	0.6	0.4	0.8	1.0	0.8
Release Time ms-Typ.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Resonant Frequency KHZ-Typ.	3.2	3.2	3.0	3.0	3.0	2.2	2.5	2.5
Vibration, 10-2000 Hz G's-Max.	50	50	50	50	50	40	30	30
Shock-11ms, 1/2 Sine Ware G's-Max.	100	100	100	100	100	100	100	100
Operating Temperature °C	-40/+125	-40/+125	-40/+125	-40/+125	-40/+125	-40/+125	-40/+125	-40/+125
Storage Temperature °C	-50/+155	-50/+155	-50/+155	-50/+155	-50/+155	-50/+155	-50/+155	-50/+155
Pull-In Sensitivity Ampere Turns	10-30	7-15	10-50	10-60	15-45	10-60	20-60	10-60

Notes: (1) The specification for VA Rating may be exceeded for less sensitive (high AT) switches, and should be decreased for very sensitive (low AT) switches. Specific life testing for a particular load will be run be Standex Electronics upon request.

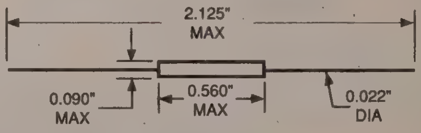
(2) Breakdown voltage is measured in the presence of a radioactive ionizing source with switch leakage current limited to 100 microamperes.

(3) Contact resistance measurements are made at 10ma from a 1 volt source with 5 AT overdrive using a 4 wire (Kelvin) measuring system with contact probes located on 1.7" centers.

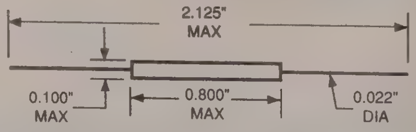
A



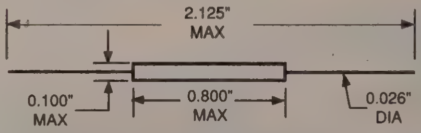
B



C



D



Detail application assistance for custom forming and proximity applications

Call, write or fax for complete Switch and Application catalog.

a Standex company

Standex Electronics

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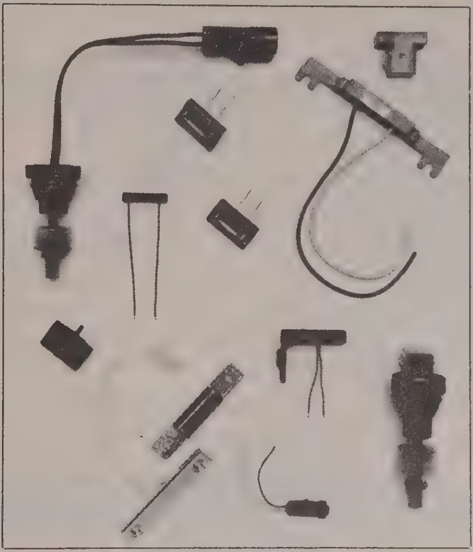
Standex Electronics

Custom Magnetic and Liquid Level Sensors



Standex Electronics designs and builds magnetic proximity sensors for a wide range of markets and applications. The basic sensing element for most applications is the hermetically sealed reed switch. Other technologies are used as the application dictates.

- ☐ Hi-Rel Switching — hermetically sealed contacts — billions of operations switching low level loads
- ☐ No External Power Required
- ☐ Power Switching — direct switching of power loads with up to 2.5 amp DC inrush
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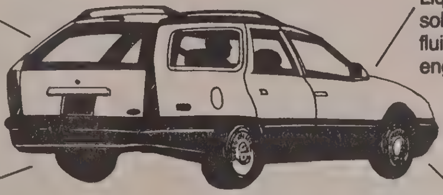
- ☐ Low Cost — very competitive with other technologies



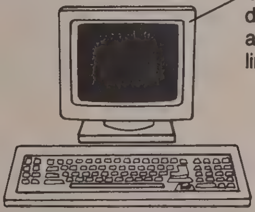
RPM Sensing — cruise control, odometer, speedometer and engine control

Anti-skid Braking System

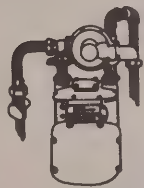
Liquid Level — washer solvent, coolant, brake fluid, transmission fluid, engine oil and fuel.

Lamp Outage

Door ajar sensing, liquid level sensing, lamp switching, dishwasher spray arm rotational sensing, and device enable applications.



Off hook sensing, device disable, interlock applications, and telephone line switching.



Rotational counting applications for gas, electric and water metering and tamper applications.

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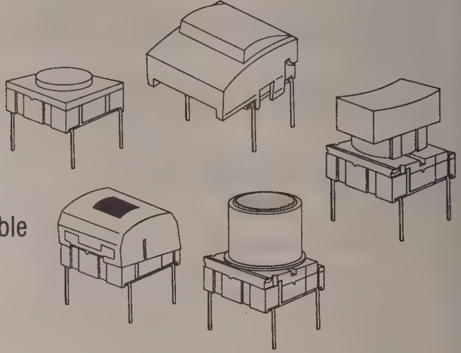
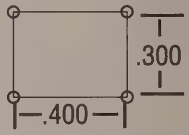
- Available with either thru-hole or surface mount terminals
- Withstands wave soldering procedures
- High temperature (+160°C) & Low temperature versions (+65°C) available
- Various cap and bezel options with ten standard colors
- Can be used with an overlay to simulate a membrane switch
- 250g key pressure actuation force, 1mm key travel
- Rated for 50mA @ 24VDC
- High reliability — 10 million cycles minimum!
- 100% inspected on the assembly line



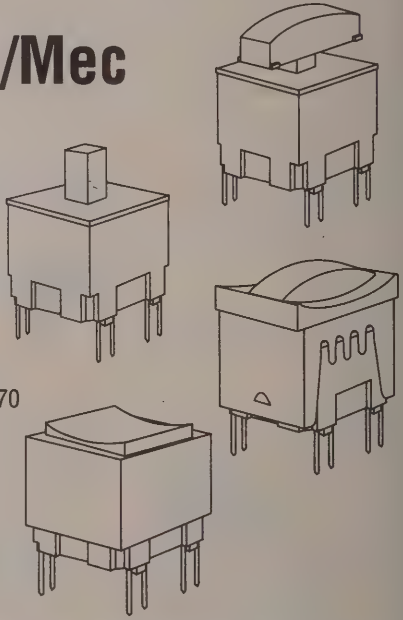
Actual size without cap or bezel - .400 x .400
Mounting pattern for Multimec switch



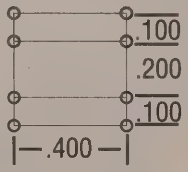
Call today for a free catalog!

The Unimec Switch from SoLiCo/Mec

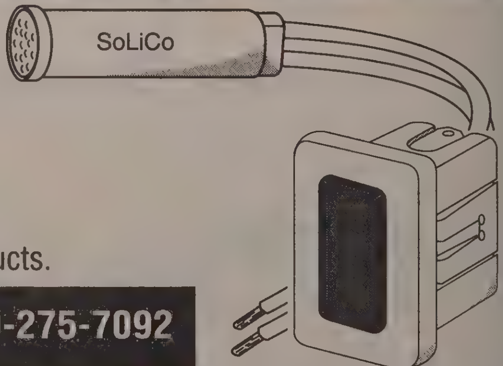
- Momentary or Alternate action
- PC Mountable
- 8 contact functions per switch
- Hundreds of standard keycap legends
- Can be used alone or with a variety of cap, bezel, and LED options
- Vario-support mounting is available for custom keypad configurations
- Square cap available in 6 colors provides switch with a splashproof feature
- Momentary lifetime - 1,500,000 cycles
- Alternate lifetime - 500,000 cycles
- Rated for 250mA @ 120V
- Operating temperature range -25°C to +75°C
- High temperature -25°C to +160°C
- 100% inspected on the assembly line



Actual size without cap or bezel - .470 x .470
Mounting pattern 15.000 Series Unimec



Call today for information!



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HARTFORD, CT 06114

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Switchcraft
A **Raytheon** Company

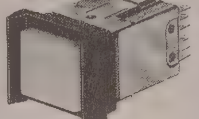
PUSHBUTTON SWITCHES, MULTI-SWITCH SWITCHES AND SLIDE SWITCHES

PUSHBUTTON SWITCHES

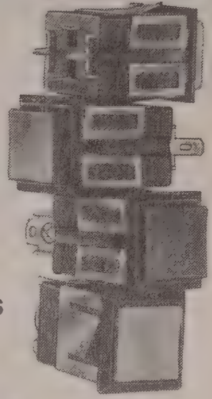
Standard and miniature non-illuminated switches offer broad switching capabilities in minimal space. All switches are easy to mount and are available with a variety of actuator colors, circuitry, terminal styles and mechanical functions. Current ranges from 250mA to 8A.

Series PL "Push-Lite" illuminated switch, momentary and Push-Lock/Push-Release

Series US and LUS "Uniswitch" illuminated and non-illuminated switches, momentary



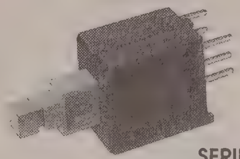
SERIES PL



SERIES US & LUS

IBS MINIATURE PUSHBUTTON SWITCHES

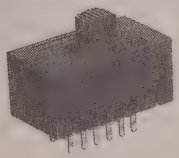
Series 98000R IBS miniature pushbutton switches can be gang mounted on common frames, up to 12 stations long with center-to-center spacing from 10mm, 15mm or 20mm. Available with interlock, non-lock, momentary or push-lock/push-release mechanical functions. .130 inch (3.30mm) x .130 inch (3.30) square plungers accept a full line of industry standard pushbuttons. Switches are stocked without pushbuttons due to wide variety that can be used. Order pushbuttons separately. Switches have .157 inch (4mm) long PC terminals for mounting single- or double-sided PC boards up to .094 inches (2.39mm) thick. Close stacking (centers) permit high density within minimum front panel space. Plunger travel: .144 inch (3.66)



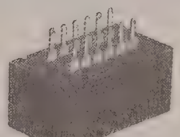
SERIES 98000R

DW MULTI-SWITCH SWITCHES

Up to 18 stations in a single row and ganged assemblies with interaction between rows. Maximum switching per station is 4-C (4PDT). Each station utilizes specially designed switching modules with U-shaped, high reliable bifurcated contractors rated at 3A, AC; 0.5A, DC; 125V, non-inductive load. All provide four standard functions: Interlock - Lock-Out, Non-Lock, All-Lock, Push-Lock/Push-Release - pushbuttons lock when depressed and release when again depressed. All Series - pushbuttons on 3/8" centers.

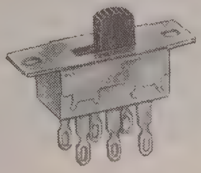


C63212L

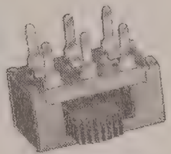


LITTEL MULTI-SWITCH SWITCHES

Series 35000 Non-illuminated. Compact, rugged multiple-station switches feature up to 6PDT per station in .6 square inch space. Excellent selection of contacts for low or high current switching. Plungers accept nine different Switchcraft pushbuttons. Mechanical functions are: Interlock, All-Lock and Push-Lock/Push-Release. One to 18 stations; many legends are possible.



56206L1



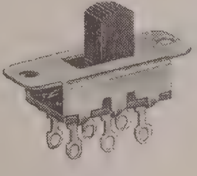
C62206L

"TINI-SLIDE" SWITCHES

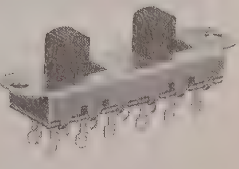
Miniature "TINI-Slide" switches are precision locking switches with unique lift/wipe/slide action and silver contacts. Ratings: 0.5A, 125V AC or DC, non-inductive 2- and 3-position types. UL listed solder lugs or PC terminals. Crowned knobs.

SLIDE SWITCHES

Instrument quality Switchcraft slide switches have low cost, precision "double-wipe" contacts with "U"-shaped bifurcated contacts rated at 0.5A DC, 3A AC, 125V, non-inductive. Solder lugs have 5/64" diameter center holes and wrap-around notch. Various knob styles: crowned, rocker, flush. UL and CSA listed types and heights. Up to 4 poles of switching with locking or momentary action. Also available in miniature size.



46206LR



47206LR

EUROPEAN POWER SELECTOR SWITCHES (EPS SERIES)

Durable slide switches provide quick and easy programming/selection of 115V or 230V primary power in electrical/electronic equipment for the international marketplace with ratings up to 10A, 125V AC. UL, CSA and VDE (Verband Deuscher Elecktrotechniker) approved. Mountings are flange or PC (straight or right-angle). DPDT, locking. Switches also designed to comply with CEE and IEC requirements. Legends: 115V-230V. Ratings: UL and CSA: 10.1A, 125V AC; 5A, 250V AC; VDE: 10A, 250V AC.

EP53-SL1

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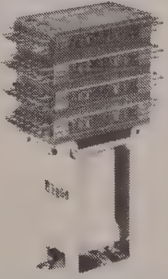
T-bar THE EXPERIENCED COMPANY FOR QUALITY MULTI-CIRCUIT RELAYS AND SWITCHES

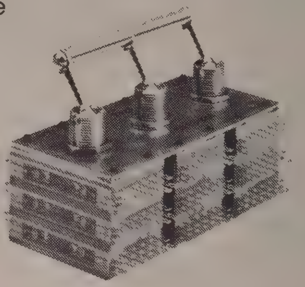
RELAYS

General purpose 800-series, with contact ratings to 5A, and 900-series with low-level to 1A ratings. Both available with 12, 24, 36, 48, and 52 poles in form C (D.T.) and 60 poles, form A. Operation from continuous ac or dc power, pulsed power (latching), or solid-state logic. Environmentally sealed and hermetically sealed relays for aerospace, shipboard and ground support hostile environments are available.



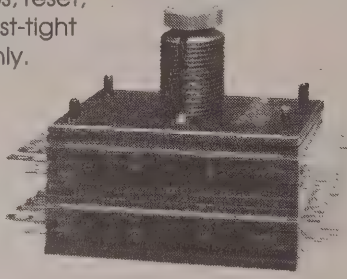
TOGGLE SWITCHES

Same 800-series and 900 series as relays. Available with 12 to 144 poles in form C, maintained action. Typical life in excess of 50,000 operations. Normally dust-tight, T-Bar toggle switches are also available in an environmentally sealed version.



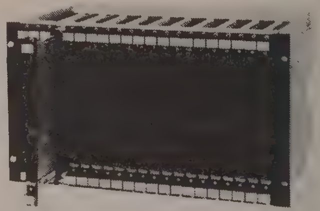
PUSHBUTTON SWITCHES

Momentary pushbutton switches, 800-series only are available with 12 to 36 poles, form C. Typical applications include press-to-test for control panel lamps, reset, and all-call. Dust-tight construction only.



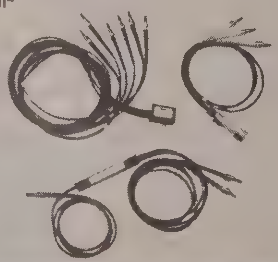
MULTIPOLE SWITCHES

Multipole Switch Modules provide efficient switching for up to 48 poles. Each switch module contains four 48 Pin Din connetors that can be configured as four 12-wire, two 24-wire or one 48-wire circuit. Up to 21 modules can be supported in a T-Bar supplied 19-inch rack mountable cage.



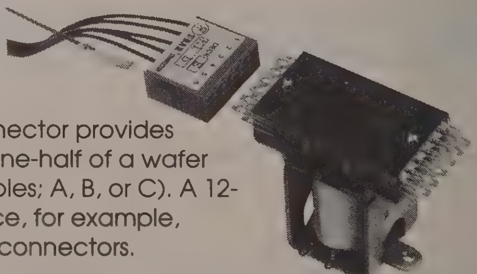
FIBER OPTIC COMPONENTS

Passive single/multi-mode fiber optic components include Switches, Couplers, Wavelength Division Multiplexers, Attenuators, etc. . . Dichroic Wavelength Division Multiplexers contain a patented architecture providing one of the best crosstalk characteristics in the industry. Single sided cable runs on many components simplifies board layout.



CONNECTORS

T-Bar plug-on connectors are available for all dust tight and environmentally sealed relays and switches.



Each connector provides wiring to one-half of a wafer deck (6 poles; A, B, or C). A 12-pole device, for example, requires 2 connectors.

T-bar a DATA SWITCH company

12 Cascade Blvd., Orange, CT 06477
Telephone: (203) 795-0739 or 800-726-8227

Tech labs
SINCE 1935

SWITCHES & ATTENUATORS

FEATURES OF TECH LABS SWITCHES
- Precious Alloy Contacts
- 10,000 M-Ohms Min. Insulation Res.
- Hi-Pot 1500 V RMS Min.
- Contact Resistance less than .01 Ohm
- Low Thermal EMF
- Low Capacitance between Contacts
- Low Electrical Losses at HF
- Fixed or External Adj. Stops
- Exceptionally Long Life
- Adaptability for Remote Drives and Controls
- Custom Design
- Pre-Wired Availability

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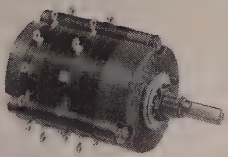
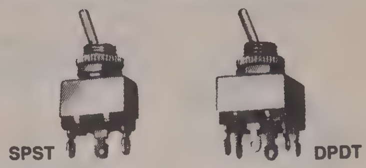
ROTARY SWITCHES



TYPE 2000
- Low Contact Resistance <1 Mili-Ohm
- Insulation Resistance >1 Million Meg-Ohms
- Sizes: 2⅗₂" Dia. x ¹¹⁄₁₆" Depth/Deck
- SP or DP/Deck
- 6 or 12 Pos./Pole MBB
- Indexing: 30° or 60°
- Current Capacity: 5 Amps Continuous

TYPE 3 UL LISTED
- Enclosed Molded Construction
- Size: 1¼" Dia. x ½" Depth/Deck
- SP or DP/Deck
- Up to 12 Pos./Pole BBM or MBB
- Indexing: 30°, 60° or 90°
- UL Listed: 3 Amp Resistive 120 VAC
  3 Amp Resistive 28 VDC

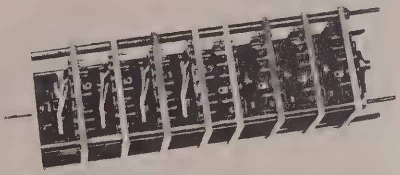
TOGGLE SWITCHES



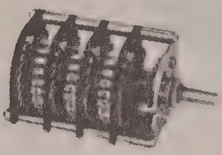
- Meet or Exceed MIL-S3950, MS75028 & 029
- Size: ¼" × ½" × ⁵⁄₁₆" for SP.ST
- Size: ½" × ½" × ⁵⁄₁₆" for DP.ST
- Contact Resistance: 10 Milli-Ohms
- ¼ – 40 Mtg. Bushing, ¼ or ⅜ lg.
- Various Combinations of Bushings, Terminals, Handles and Housings Available.
- Contact Rating: 5 Amps @ 28 VDC
  5 Amps @ 125 VAC Inductive Load

OPEN FRAME ROTARY SWITCHES

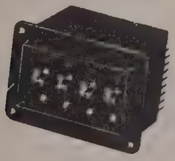
REMOTELY CONTROLLED
- Available as: Stepping Switch
  Motor Driven Solenoid Drives
  Motor and Geneva Drives
  Enercon AC Incremental Motor Drive
- Interrupters or Homing Decks Available.
- May be Remotely Controlled by MasterSlave Arrangement: Computer, External Pulse or Other AC or DC Operation.



SQUARE TYPE
- 13 Styles Available
- Sizes: 1⅗₁₆" x 1⅗₁₆" up to 8" x 8" sq; 15 Decks max.
- 1 to 12 Poles/Deck
- Up to 150 Positions/Pole
- Current Capacity 15 Amps Continuous



TYPE 2
- Single Hole Bushing Mtg.
- Size: 1¾" x 2¼"; ¾" Depth/Deck
- 1 to 4 Poles/Deck
- Up to 24 Positions/Pole MBB
- Up to 12 Positions/Pole BBM
- Indexing: 15°, 30°, 45°, or 60°
- Current Capacity: 5 Amps Continuous



THUMBWHEEL SWITCHES
- Compact Modular Construction
- Size: ½" Wide Modules
- Positive Detent 10, 11, 12 Positions
- Wide Range of Codes
- Various Terminations
- Kelvin Varly Voltage Divider
- Decade Transfer Drive Between Digits
- Capacitance Decades
- Precision Resistance Decades
- Current Capacity: 1 Amp. Continuous

Tech Labs will undertake special prototype design and manufacturing of your switch and attenuator requirements. We can also customize and supply completely pre-wired units.

Contact our factory for competitive quotations.

ATTENUATORS

PRECISION ATTENUATORS

TYPE 11T AND 11H PRECISION ATTENUATORS — DC to 10 MHz*
- Circuit: "T" or Balanced "H"
- Impedance: 50 to 600 ohms, as specified
- Resistor Accuracy: ±0.1% or better
- Accuracy: ±0.1 db to 200 KHz (overall) ±0.6 db to 2 MHz. Lower values of loss, essentially flat to 10 MHz

Type No.	Circuit	db Range	db/ Step	Dimensions
11-T	"T"	111	0.1	5¼"x19"5"
11-H	Bal. "H"	111	0.1	5¼"x19"x10"

* On Low Impedance Units, Lower Losses Usable to 100 MHz.

TYPE 850T AND 850H FOR THE AUDIO RANGE
- Circuit: "T" or Balanced "H"
- Impedance: 600/600 ohms unless specified —Other values to order
- Range: 2 dial unit gives 93 db in 0.1 db steps: 3 dial unit gives 111 db in 0.1 db steps
- Terminals: Telephone type jacks for input and output — Solder terminals provided on rear for permanent connections: Insertion of plugs into jacks lifts rear connections
- Accuracy: Resistors adjusted to ±0.1% excepting low values of loss are ±.25%

FIXED ATTENUATORS
- Two basic models
- Standard circuits "T" and Bridged "H" — others available
- Octal plug-in base available
- Up to 80 db loss
- Many impedance available

ROTARY/VARIABLE ATTENTUATORS
- Five basic models — 1⁷⁄₁₆" to 3" dia.
- All circuit configurations
- Wide range of impedance
- Available with detents, tapers and cueing
- Aluminum anodized can
- Precious metal contacts
- Up to 45 steps
- Audio, video and RF

Pushbutton Switches

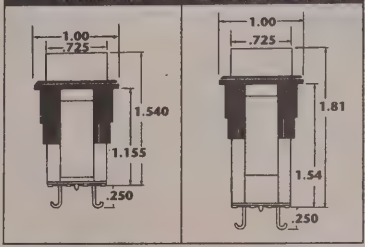
REED PANEL SWITCHES

ILLUMINATED • NON-ILLUMINATED • INDICATOR

MODEL 88SS
Square Top, Square Cap

Mounting Hole: .875" Square Snap-in panel mounting .060 to .125" panel thickness

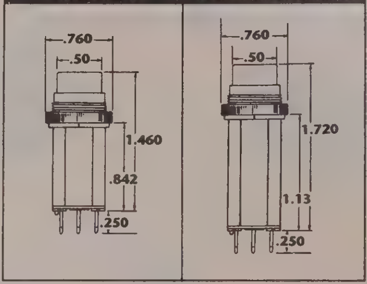
SHORT VERSION (Momentary)	LONG VERSION (Momentary or Latching)



MODEL 62NC
Nut & Collar
Round Top, Round Cap

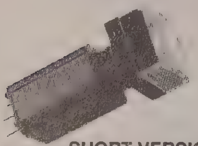
Mounting Hole: .625" Dia. Round Screw-in panel mounting .060 to .125" panel thickness

SHORT VERSION (Momentary)	LONG VERSION (Momentary or Latching)



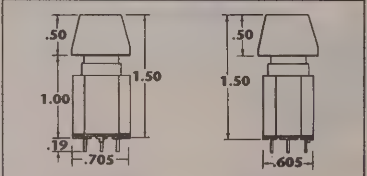
REED KEYBOARD SWITCHES

ILLUMINATED • NON-ILLUMINATED • INDICATOR

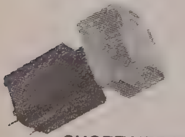


SHORT VERSION
KEYBOARD - 01
Recommended spacing:
.625 or .750 centers

MOMENTARY ACTION ONLY



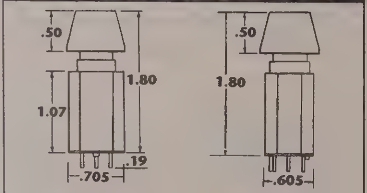
FRONT VIEW SIDE VIEW



SHORT VERSION
KEYBOARD - 02

OPTIONAL SLANT BASE

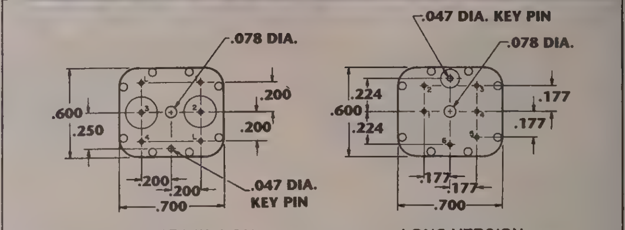
MOMENTARY OR LATCHING ACTION
(Latching in 6.5 oz. Spring Tension Only)



FRONT VIEW SIDE VIEW

Consult Factory for Optional Mounting Methods.

BASE DIAGRAMS (switch viewed from bottom)



SHORT VERSION LONG VERSION

SWITCH ELECTRICAL DATA

SWITCH FORM	CIRCUIT DIAGRAM	MAX. CURRENT	MAX. VOLTAGE	MAX. POWER LOADING	MAX. CONTACT BOUNCE	PIN OUTS
A	SPST N.O.	500 milliamps	200 VDC	10 WATTS	0.5 milliseconds	1 & 2
B	SPST N.C.	250 milliamps	100 VDC	7 WATTS	0.6 milliseconds	3 & 4
AA	DPST N.O.	500 milliamps	200 VDC	10 WATTS	0.5 milliseconds	1 & 2 3 & 4
BB	DPST N.C.	250 milliamps	100 VDC	7 WATTS	0.6 milliseconds	1 & 2 3 & 4
*AB	DPST I.N.O. 1 N.C. (break before make)	250 milliamps	100 VDC	7 WATTS	0.6 milliseconds	1 & 2 3 & 4

*Special Order Only ... Contact Factory

MAXIMUM INITIAL CONTACT RESISTANCE	100 milliohms
LONGEST PERIOD OF OPEN-CIRCUIT ELAPSED TIME DURING ANY ONE EVENT IN A CLOSURE SEQUENCE	50 microseconds
MINIMUM BREAKDOWN VOLTAGE	250 VDC
MINIMUM INSULATION	100 megohms
MINIMUM LIFE (reed)	50 million cycles

SWITCH MECHANICAL DATA

TERMINALS	.025 Diameter Nickel
KEY TRAVEL	.187" ± .007"
PRE-TRAVEL	Minimum .050"
MINIMUM OVERTRAVEL	.020"
OPERATING FORCE (spring tension) (latching in 6.5 oz only)	2.5 oz., 5 oz., 6.5 oz., 10 oz., 12 oz., or 20 oz. (±0.7 oz.)

Diodes (internal) available, switch forms A or B.
Contact Factory for incandescent or LED data.

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Lexington, NE 68850
PHONE: 308-324-4600
FAX: 308-324-4985

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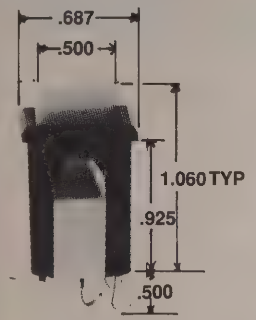
A Touch Above the Rest!
Not loose, not tight....but just right!

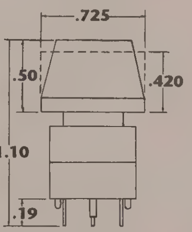
ILLUMINATED • NON-ILLUMINATED • INDICATOR

Reed Panel Switch-04



Low Profile Keyboard Switch – 03

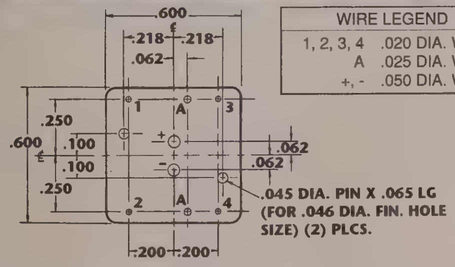
Momentary Action



Recommended spacing of switches: .625"

Cap size should not exceed .725

BASE DIAGRAMS (switch viewed from bottom)


.600
.218
.218
.062
1
A
3
.250
.600
.100
.100
.250
+
-
.062
.062
2
A
4
.045 DIA. PIN X .065 LG (FOR .046 DIA. FIN. HOLE SIZE) (2) PLCS.
.200
.200

WIRE LEGEND	
1, 2, 3, 4	.020 DIA. WIRE
A	.025 DIA. WIRE
+, -	.050 DIA. WIRE

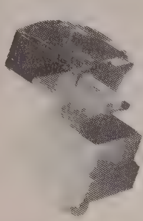
04 SERIES MOUNTING HOLE: 0.625"

SWITCH ELECTRICAL DATA

SWITCH FORM	CIRCUIT DIAGRAM	MAX. CURRENT	MAX. VOLTAGE	MAX. POWER LOADING	MAX. CONTACT BOUNCE	PIN OUTS
A	SPST N.O.	100 milliamps	50 VDC	5 WATTS	0.5 milliseconds	1 & 2
AA	DPST N.O.	100 milliamps	50 VDC	5 WATTS	0.5 milliseconds	1 & 2 3 & 4
MAXIMUM INITIAL CONTACT RESISTANCE					150 milliohms	
LONGEST PERIOD OF OPEN-CIRCUIT ELAPSED TIME DURING ANY ONE EVENT IN A CLOSURE SEQUENCE					50 microseconds	
MINIMUM BREAKDOWN VOLTAGE					150 VDC	
MINIMUM INSULATION					100 megohms	
MINIMUM LIFE (reed)					50 million cycles	

SWITCH MECHANICAL DATA	-03	-04
TERMINALS	.018" Diameter Nickel	.025 Diameter Nickel
KEY TRAVEL	.080" ± .007"	.125" ± .007"
PRE-TRAVEL	Minimum .035"	Minimum .035"
MINIMUM OVERTRAVEL	.020"	.020"
OPERATING FORCE (spring tension)	2.5 oz., or 7 oz. (±0.7 oz.)	7 oz. (±0.7 oz.)

KEYCAPS AND ADAPTERS

KEYCAP TYPES	STYLES	COLORS	SIZES (±.005")
 PYRAMIDAL	2 Options: -concave -slanted can be engraved	ALL COLORS AVAILABLE (see list)	- 1 space, .725" - 1 1/2 space .725" x 1.090" - 2 space .725" X 1.465"
PYRAMIDAL SPACEBAR	Convex	Black, Opaque White, Opaque	8 space (.725" x 5.955")
SQUARE	Flat can be engraved	ALL COLORS AVAILABLE (see List)	.500" .725"
ROUND (62NC switch)	Round, flat top can be engraved	Transparent: Amber, Red Translucent: Lt. Green, White	HT. - .270" DIA. - .50"
 RELEGENDABLE	3 Options: - flat cover - concave cover - pyramidal flat cover Solid available in .600 size only	Flat or Concave: ALL Base Colors Available (see List) Pyramidal Flat: Black or White opaque bases	Square .600" Flat, concave or solid cover .687" concave .725" flat or concave Two space: .725" x 1.465" concave only Pyramidal flat: .725" only
LOW PROFILE RELEGENDABLE	Concave Cover Non-illuminated only	Black or White opaque bases	.600" Square

NOTE: The following caps are also suitable for low profile switch: .725 pyramidal, .725 square, .725 relegendable, and .725 pyramidal flat

-04 PANEL SWITCH CAPS ONLY

- SQUARE .500" SIZE
- CONCAVE RELEGENDABLE .500" SIZE

KEYCAP ADAPTERS

Three adapter styles are available. *Regular stem adapters are standard*. Extended stem adapters can be substituted for keycap to sit higher on keyboard. This will extend the height of assembly .187". Cruciform cap post is also available. Adapters need not be ordered separately.

CUSTOM DESIGNS MANUFACTURED ON REQUEST

VEETRONIX™

1001 North Washington St, P.O. Box 480
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KEYBOARDS/KEYPADS

Manufacturer	Starting EEM Page No.	Type							Features								
		Key Switch	Mechanical (Hard Contact)	Capacitive	Hall Effect	Membrane			Conductive Elastomers	Low Profile	Sealed Keyboard	Back Lighted	Illuminated Switch	Modular	Custom Legends & Symbols	Custom Capabilities	Custom Keypads
						Full Travel	Not Full Travel	Sub Components									
Advanced Input Devices	B•1819	√				√	√		√							√	√
Advanced Rubber Concepts	B•1820	√				√			√	√		√	√		√	√	√
Aztec Industries	B•1821	√		√		√	√	√	√	√	√	√	√	√	√	√	√
Bergquist	B•1822						√		√	√	√	√	√		√	√	√
Cherry Electrical Products	B•1824	√	√			√				√				√	√	√	√
Digitran	B•1825	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√
Douglas Corp.	B•1826	√				√				√	√	√	√		√	√	√
Elma Electronics	B•1827	√	√			√	√			√	√			√			√
Extrusion	B•1828	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Flex-Key	B•1829	√	√							√	√	√				√	
Fujipoly	B•1830	√							√	√					√	√	√
Fujitsu Microelectronics	B•1831					√				√						√	
George Risk Industries	B•1832	√	√							√	√	√	√		√	√	
Grayhill Inc.	B•1833		√							√	√					√	√
The Hall Company	B•1834				√	√			√		√		√		√	√	√
IEE (Industrial Electronic Engineering)	B•1835	√	√		√		√		√	√	√	√	√	√	√	√	√
Intaq Key Panels	B•1836	√	√				√	√	√	√	√	√	√	√	√	√	√
ITT Schadow	B•1839	√							√	√	√	√	√		√	√	√
Jayco Plastics	B•1840		√				√		√	√	√	√	√	√	√	√	√
Low Key Corp.	B•1842						√			√	√	√			√	√	√
LZR Electronics	B•1844	√								√				√	√	√	
Memtron Technologies	B•1845						√	√		√					√	√	√
Metro-Mark	B•1846						√			√		√			√	√	
Multi-National Resources	B•1853		√			√			√		√						
New England Keyboard (NEK)	B•1847	√	√			√	√		√	√	√	√	√	√	√	√	√
Orbit Instruments Inc.	B•1849	√	√						√	√	√	√	√		√	√	
Secma	B•1850	√	√							√	√	√	√	√	√	√	√
Vetra System Corp.	B•1852						√									√	√
VG Controls	B•1855																

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Multiple Input Technology Integration:

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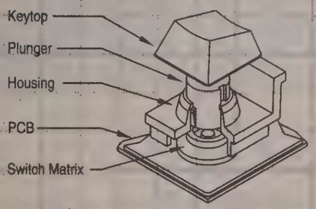
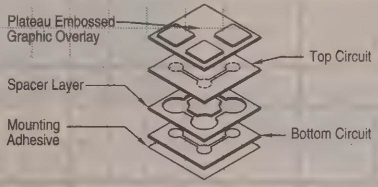
- ☐ Electrical design
- ☐ Mechanical design
- ☐ Alternative technology research and development
- ☐ PCB design
- ☐ Technical assistance
- ☐ Models & prototypes

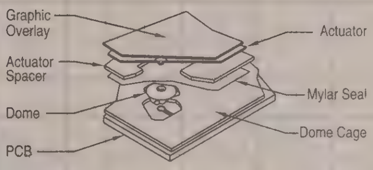
EKT


Keytop
Plunger
Housing
PCB
Switch Matrix

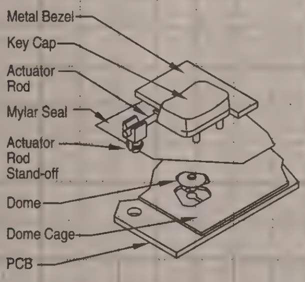
PKMn


Plateau Embossed Graphic Overlay
Top Circuit
Spacer Layer
Mounting Adhesive
Bottom Circuit

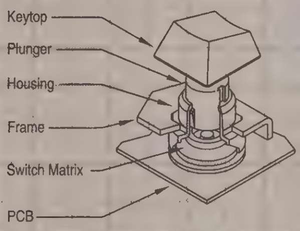
PKD


Graphic Overlay
Actuator
Actuator Spacer
Mylar Seal
Dome
Dome Cage
PCB

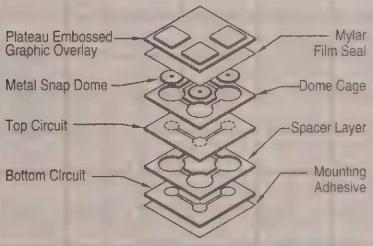
MKD


Metal Bezel
Key Cap
Actuator Rod
Mylar Seal
Actuator Rod Stand-off
Dome
Dome Cage
PCB

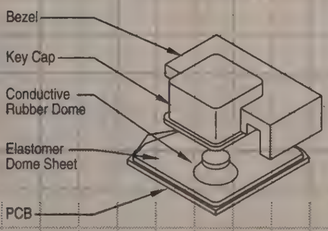
EKS


Keytop
Plunger
Housing
Frame
Switch Matrix
PCB

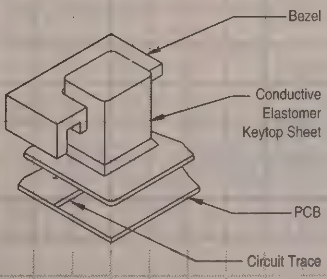
PKMt


Plateau Embossed Graphic Overlay
Mylar Film Seal
Metal Snap Dome
Dome Cage
Top Circuit
Spacer Layer
Bottom Circuit
Mounting Adhesive

MKE


Bezel
Key Cap
Conductive Rubber Dome
Elastomer Dome Sheet
PCB

MKEr


Bezel
Conductive Elastomer Keytop Sheet
PCB
Circuit Trace

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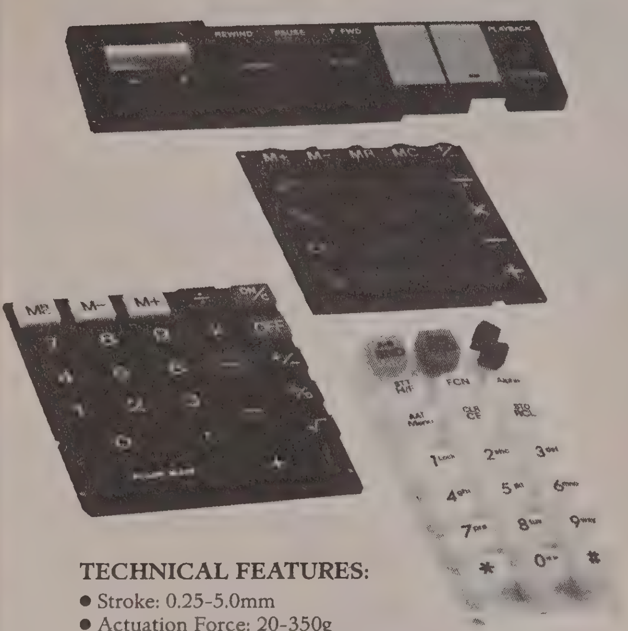


CONDUCTIVE RUBBER KEYPADS

MAIN PRODUCT FEATURES

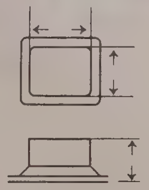
- Versatility • Long Life • Competitive Price
- Tactile/Nontactile Feel • High/Low Profile Keytops
- Multiple Color Keytops • Translucent Keytops
- Multiple Color Legends • Positive/Negative Image Graphics

POLYDOME ASSEMBLY KEYPADS

Low profile keypad utilizing polydome technology for excellent tactile feel.

TECHNICAL FEATURES:

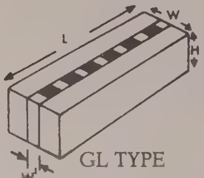
- Stroke: 0.25-5.0mm
- Actuation Force: 20-350g
- Life: 250,000-5,000,000 actuations
- Operating Temp: −30 + 180°C
- Contact Resistance: <200 ohms
- Contact Rating: 30mA @ 12VDC .5 sec.
- UL Flammability Rating: 94HB



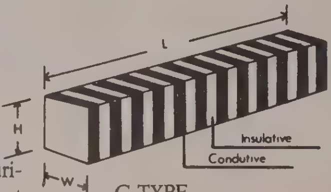
KEYPAD DESIGN GUIDE AVAILABLE

Call for your free copy

- Design Assistance
- Quality Control Department For Customer Use

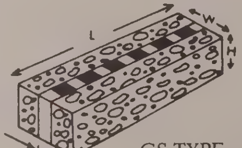


GL TYPE



G TYPE

The trend toward sub-miniaturization and hand-held instruments has created a need for reliable, low profile interconnection devices. Our Elastomeric Connectors provide such a connection and are easy to install. Fine pitch connectors allow for highly reliable interconnection even in most exacting applications.



GS TYPE

ELASTOMERIC CONNECTORS

MAIN PRODUCT FEATURES

- Versatility • Reliability • Long Life
- Competitive Price • Solder Free Installation
- Corrosion Resistance • Fine Pitch Interconnection
- Low Profile Interconnection

QUOTATION REQUIREMENTS

Budgetary pricing available within 24-48 hours of receipt of minimum information listed below:

1. Estimated Annual Usage ______
2. TechnicalSpecs:
   A Length ______ C. Width ______
   B Height ______ D. Pitch ______

See drawing to the left for illustration of dimensions to be supplied.

TECHNICAL FEATURES:

- Length: 1.0-280mm
- Height: 0.5-25mm
- Width: 0.4-5.0mm
- Pitch: 0.03-0.40mm
- Volume Resistivity: ≤5 ohm-cm
- Hardness: (conductor 65±5
  (insulator) 20-40±5
- Insulative Resistance: 10^{14} ohms
- Temp. Range: −20° = 180°C
- Conductive Width (typ.): 0.4mm

ADVANCED RUBBER CONCEPTS

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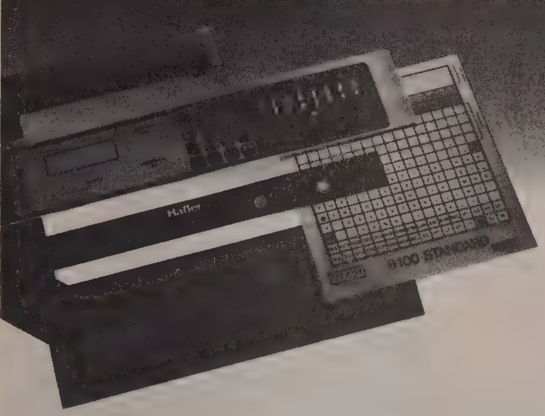
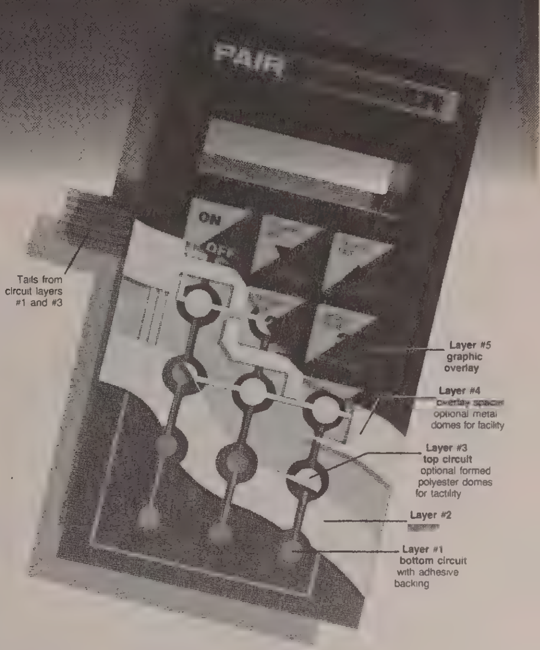
Touch the Future℠

WITH A LEADER IN MEMBRANE SWITCH TECHNOLOGY


Kaller
9100 STANDARD


PAIR
ON
OFF
Tails from circuit layers #1 and #3
Layer #5 graphic overlay
Layer #4 overlay spacer optional metal domes for facility
Layer #3 top circuit optional formed polyester domes for tactility
Layer #2
Layer #1 bottom circuit with adhesive backing

OEMs Take Note. Increased efficiency and reduced cost is a performance fact when membrane switches, decorative overlays and flex circuits are put to work.

Reliably Simple Membrane Switches

Membrane Switches meet tight schedules by shortening development times. One piece construction controls costs. The Lexan™ finish offers many texture options. Colors appear more saturated and vibrant. Sealed surfaces prevent blunders from botching systems. Second-surface printing stands up to scratches and wear.

Decorative Overlays a Marketable Presence

Decorative Overlays ensure enduring quality. Richness and luster remain intact under heavy use. Affix to practically any surface: glass, metal, plastic, wood, etc. Updates achieved without system redesign.

Flex Circuits Reduce Space Problems

Flex Circuits fold or flex to a product's available space. Reduced tooling accelerates production and puts a halt to cost overruns. Virtually no moving parts to wear out. Smooth, flat surfaces clean easily. Works in tangent with Membrane Switches or stands alone.

LEXAN™ IS A TRADEMARK OF GENERAL ELECTRIC CORPORATION

Contact us today and receive this 10 page Membrane Switch Technical Guide filled with all the information needed to design your project.

Specifications

Operating power	1 watt
Contact resistance	2-10 ohms
Contact bounce	5 milliseconds
Circuit resistance	5-100 ohms
Actuation force (normal range)	
Membrane	2-16 oz. ± 25%
Polyester dome	6-16 oz. ± 25%
Metal dome	5-10 oz. ± 25%
Life expectancy (cycles)	
Membrane	10 million
Polyester dome	1 million
Metal dome	1 million
Travel	
Membrane	.002"—.010"
Polyester dome	.020"—.040"
Metal dome	.010"—.020"
Operating temperature	—20°C to 65°C
Storage temperature	—40°C to 65°C

A Quarter Century of Experience

A long standing presence in the industry is required to meld the disciplines of electronics, mechanics and production. The results: devices that are economically attractive, aesthetically pleasing and function faultlessly.

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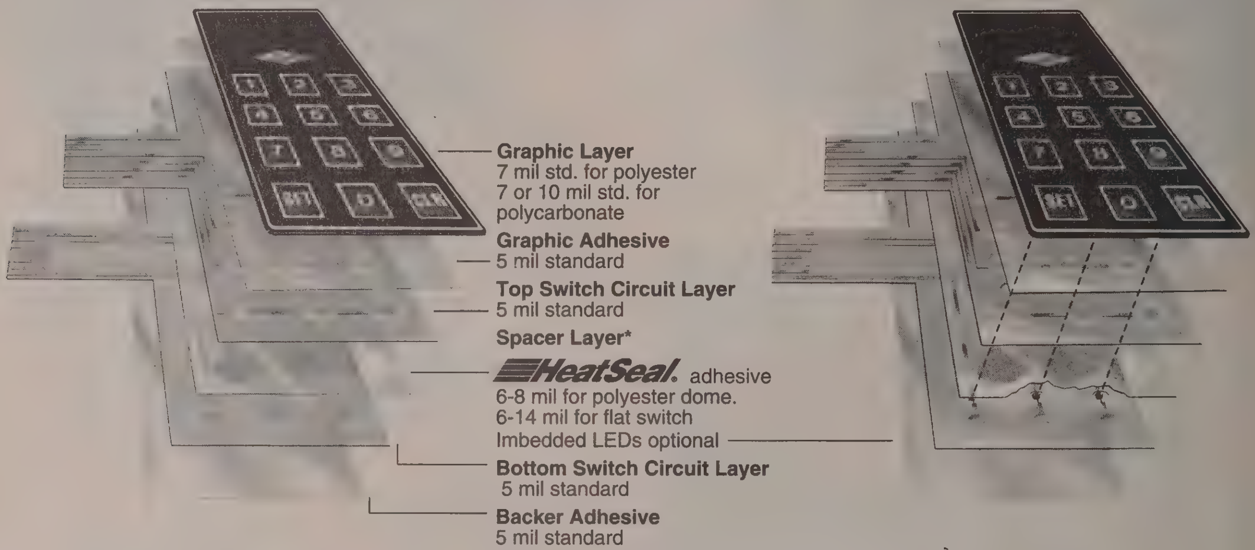
FROM BASIC MEMBRANE SWITCH...

BASIC MEMBRANE

The layer description below is the standard thickness and material designation for the basic membrane switch. All of the switch configurations shown here can be HEATSEALED or use pressure sensitive adhesive construction. Optional features are available on the basic membrane switch. These are listed below.

BASIC MEMBRANE WITH IMBEDDED LEDs

Imbedded LEDs are surface mounted in the bottom circuit layer using a flexible, conductive adhesive, or may be mounted on a separate layer with a separate tail (add approximately .015 to the total switch package thickness).


1
2
3
4
5
6
7
8
9
S/I
0
CLR
Graphic Layer
7 mil std. for polyester
7 or 10 mil std. for polycarbonate
Graphic Adhesive
5 mil standard
Top Switch Circuit Layer
5 mil standard
Spacer Layer*
HeatSeal. adhesive
6-8 mil for polyester dome.
6-14 mil for flat switch
Imbedded LEDs optional
Bottom Switch Circuit Layer
5 mil standard
Backer Adhesive
5 mil standard

* Spacer layer thickness will vary depending on actuation force requirements.

MATERIAL

Polyester (standard thickness .007 in.) The preferred choice for long life and chemical resistance. Polyester is available in a variety of hardcoat textures and finishes.

Polycarbonate (standard thickness .007 and .010 inches) available with mechanical velvet texture.

HARDCOATS

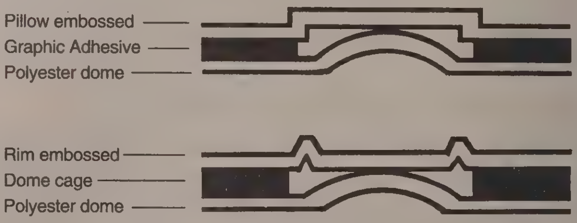
Gloss, semi-gloss and matte finishes are available on polyester and polycarbonate to help reduce scratching and increase chemical resistance. Some of the finishes can be selectively applied to create display windows and decorative finishes.

COLORS

Colors for your membrane switch are selected from the Standard Pantone Matching System or we will match your custom color chip. Transparent and translucent colors are available for backlighting and window areas. Deadfront is also available in certain applications where legends or LED windows remain hidden until a light shines from behind it.

EMBOSSING

Standard graphic embossing styles are pillow embossing, generally used over polyester domes and rim embossing for locating pads by feel.


Pillow embossed
Graphic Adhesive
Polyester dome
Rim embossed
Dome cage
Polyester dome

SWITCH TYPE

The most economical switch type is the screened silver circuit, for switching loads under 1 watt. A printed circuit board construction with copper circuitry can be used when switching loads are 1 watt or more and when temperatures are too high for polyester domes or if other components such as LEDs and displays are included in the assembly.

THE
BERGQUIST
COMPANY

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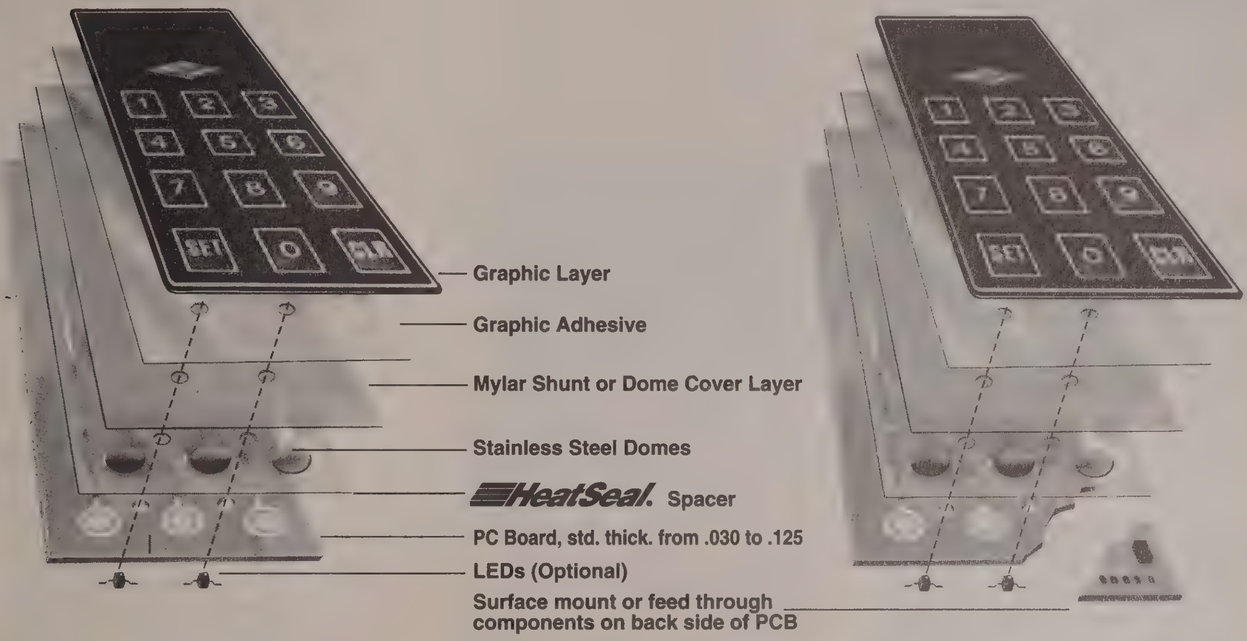
...TO SMART SWITCH

PC BOARD

A PC board is often used in a membrane switch when stainless steel domes are desired for tactile feel. Through holes allow LEDs to be soldered to the rear of the PC board.

SMART SWITCH™

The Smart Switch includes all the features of the PC board. In addition, the Smart Switch includes power and logic components mounted to the back side of the PC board. This eliminates some interconnections and the need for a secondary PC board in many cases.


1
2
3
4
5
6
7
8
9
SET
0
CLR
Graphic Layer
Graphic Adhesive
Mylar Shunt or Dome Cover Layer
Stainless Steel Domes
HeatSeal Spacer
PC Board, std. thick. from .030 to .125
LEDs (Optional)
Surface mount or feed through components on back side of PCB

CIRCUIT

Various circuit types are available depending on the design. Matrix and short to ground are the most common. Please contact us early in the design so we can work with you to ensure the design meets manufacturing capabilities.

SHIELDS

For ESD protection a screened silver grid is applied to the top side of the silver circuit. Aluminum and gold vapor deposition can also be used for ESD, EMI and RFI protection.

SPACERS

When the environment is not a problem pressure sensitive adhesives are commonly used. Bergquist HEAT-SEAL is recommended when moisture, spills, vapor and other extreme conditions are expected.

TACTILE FEEL

Polyester domes are available on silver circuits and as shunts on the PC board. They provide tactile feel and long life. Stainless steel snap domes are used on nickel plated copper PC boards when tactile feel is needed and when temperatures are higher than 150°F.

CONNECTOR

Many types and styles of connectors can be designed into your membrane switch. Screened silver switches are available with female and male connectors or with solder pins. PC board connectors are available with a wide variety of connectors including single and double row headers, shrouded headers and flat cable connectors.

OPTIONAL FEATURES

Graphic Layer Silicone rubber in place of graphic

Polyester Domes The basic membrane switch can include polyester domes with a 23-30 mil dome height (typical). Domes are embossed into the top switch circuit layer.

Backlighting Electroluminescent Lamp, 15-35 mil or fiber optics.

Backers or enclosures Metal, G10 or polycarbonate or plastic enclosure.

PC board components Soldered LEDs, Stainless steel domes, surface mount or feed through components

Pocket Switch Spacer Pocket for interchangeable graphic inserts. 15 mil - for use with a 10 mil insert (includes graphic adhesive).

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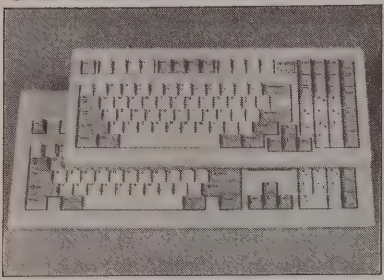
708/360-3500 • FAX 708/360-3566

G81-1600 & G81-1800



G81-1600

IBM Compatible Keyboard with Built-In Bar Code Reader. For PC, XT, AT, and PS/2 Systems.

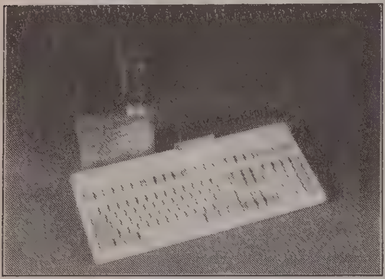
- Input port for bar code stylus, laser scanning gun, or slot reader.
- Bar codes are automatically identified and differentiated (all resolutions).
- 101 key conforming to ASCII international key layout per DIN 66003/66303.
- High reliable membrane switch technology with sealed contacts.

G81-1800

Compact, 101 Key, IBM Compatible Keyboard with Separate Numeric Keypad. For PC, XT, AT and PS/2 Systems.

- Fits into 19 inch rack (less than 16 inches wide).
- 101 keys for PC*, XT*, AT*, and PS/2* systems as well as IBM* terminals.
- Switch selection of PC*, XT*, AT*, and PS/2* modes. LED's indicate the mode selected.
- High reliability full travel membrane switch technology

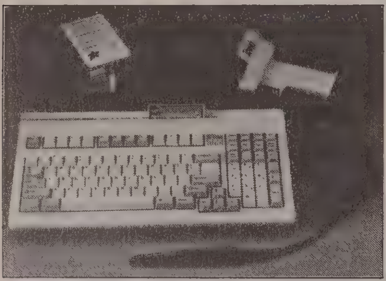
G81-3100



NEW! IBM* Compatible Keyboard with Integrated Magnetic Stripe Reader and Built-In Bar Code Wedge Option for PC, XT, AT and PS/2 Systems

- Cost efficient compared to expensive auto identification hardware
- Auto ID information extend to system as keystrokes via the keyboard line. No software required to operate.
- Saves workspace.
- Magnetic stripe reader accepts all major credit cards.
- Bar code wedge accepts all major bar codes.
- Capable of programming headers and terminators for magnetic card and bar code readers.
- Works with 5V laser guns (adaptor may be required).

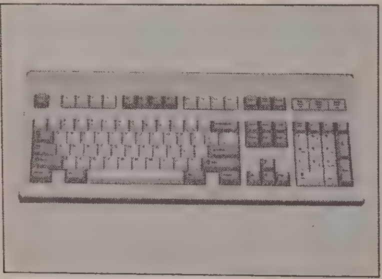
G81-1900



New Small Size IBM* Compatible Keyboard with Integrated Magnetic Stripe Reader and Built-In Bar Code Decoder Option for PC, XT, AT and PS/2 Systems!

- Cost efficient when compared to expensive auto identification hardware
- Auto ID information sent to system as keystrokes via the keyboard line. No software required to operate.
- Saves workspace.
- Magnetic stripe reader accepts all major credit cards.
- Bar code wedge accepts all major bar codes.
- Capable of programming headers and terminators for magnetic card and bar code readers.
- Works with 5V laser guns.
- Reliability: MCBF = 1×10^9 operations
  MTBF = 80,000 hours.
- Safety: DIN VDE 0805/05.90
  EN 60 950: 1988
  IEC 950: 1986
  UL 478
  CSA C 22.2 No. 220
- Card reader complies with ISO regulation no. 3554.
- LED indicators show selected mode.
- Materials conforming to UL 94.
- Linear feel.

G83-3000

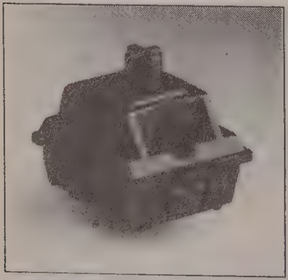


NEW! Low Cost Full Travel Rubber Sheet 101-Key IBM Keyboard

- 101 keys for PC*, XT*, AT*, and PS/2* systems as well as IBM* terminals.
- Switch selection of PC*, XT*, AT*, and PS/2* modes.
- Ergonomic, low profile design. Height of third keyrow is 1.18″ (30mm) (flat keyboard position). Angle of inclination is 6.2°.
- Includes housing and cable.
- Rugged construction.
- Full-travel (4mm) key switches.
- Materials conform to UL 94.
- IBM* overlays fit housing.

*IBM, PC, XT, AT and PS/2 are trademarks of International Business Machines Corporation.

MX Keyswitch

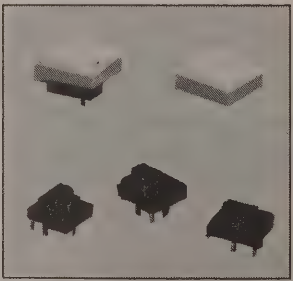


- "Gold Crosspoint" contacts ensure the highest standards of reliability — even during high speed or repeated actuation.
- Full travel (4mm) operation yet fits into modern low profile keyboard designs.
- Meets all current ergonomic standards for word processing and data entry applications.
- Range of actuation choices.

Momentary.	Linear feel.
Alternate.	Tactile feel.

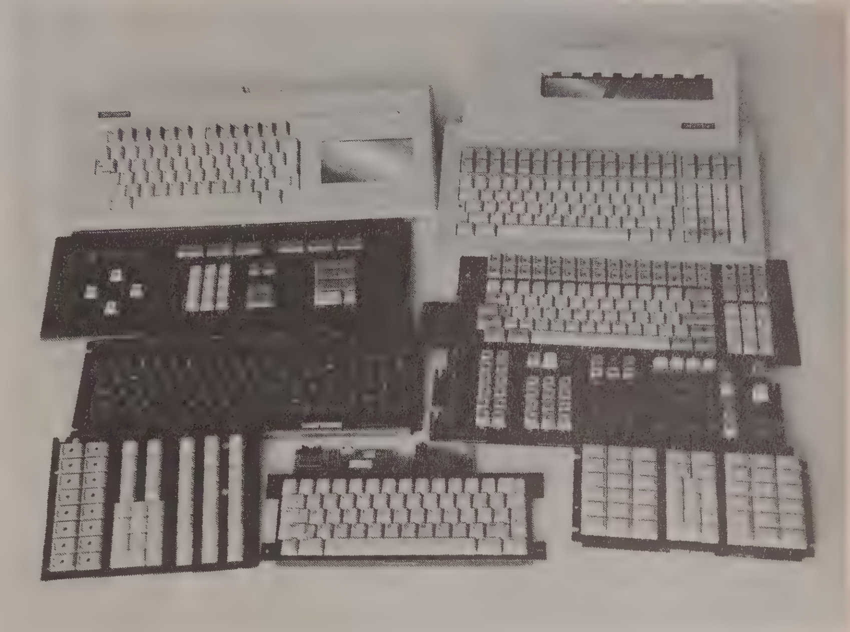
- Keyswitches can be snapped into a frame or mounted directly onto the printed circuit board.
- Low contact resistance.

ML Keyswitch



- ML keyswitch is directly printed circuit board mountable. The standard fixation pins ensure precise positioning.
- "Low profile ≤ 12mm (including keycaps).
- Full 3mm mechanical travel operation fits into modern low profile keyboard design.
- "Gold Crosspoint" contacts ensure the highest standards of reliability.

CUSTOM KEYBOARDS FOR UNIQUE OR DEMANDING APPLICATIONS



For the past 15 years, Digitran has successfully offered custom keyboards for the most demanding applications. Our keyboard customers buy from us because our keyboards are reliable, rugged and can withstand the solvents, solutions, liquids, dust and temperature ranges to which their equipment is exposed. We specialize in rigorous applications such as:

- Point of Sale Terminals
- Industrial Controllers
- Medical Instrumentation
- Telecommunications Systems
- Military Systems
- Intelligent Terminals
- Graphics CAD/CAM Terminals
- Test Instrumentation

Our microprocessor based, intelligent keyboard and application specific firmware allows us to integrate a multitude of Electrical Interface Protocols and Data Input Peripherals, including:

INPUT PERIPHERALS:

- Mouse, Trackball
- Bar Code Magnetic Stripe Readers
- LCD Displays

PROTOCOLS:

- PS-2, PC-AT & PC-XT
- ASCII & TTL
- RS-232
- RS-422
- RS-423

RELIABLE, EXTENDED LIFE: Our full-travel keyboards use our patented capacitance keyswitches which have a rated life of 100 million cycles. We use double-shot legended keycaps and rigid FR4 printed circuit boards to provide the component reliability required to remain compatible with our 100 million lifecycle capacitance switches.

ENVIRONMENTALLY QUALIFIED: We provide keyboards for the widest of temperature ranges. All of our full travel, capacitance keyboards include our PF-SHIELD: a thermo-plastic film that provides environmental protection against dust, liquid spills, water spray, industrial solvents and most laboratory solutions. To maintain the professional image of your equipment, PF-SHIELD is "hidden" underneath your enclosure or front panel, eliminating unsightly plastic, rubber or membrane keyboard overlays.

CUSTOM LAYOUTS: Call us for your custom requirements.

SUBSYSTEM ENGINEERING & MANUFACTURING

In addition to keyboards, XCEL Corporation offers the design, manufacturing and integration of electronic data input and display devices into complete subsystems. We design and manufacture data input devices using our patented capacitance switch technology, as well as membrane, conductive rubber, and snap dome switch technologies. We design and manufacture our own CRT monitors, and have considerable expertise integrating flat panel displays including LCD, plasma, electroluminescent (EL) and vacuum fluorescent. We can design and integrate specialty lighting including LED, EL, ANVIS Night Vision, fiber optic and Infra-Red.

XCEL Corporation combines 35 years experience designing and developing data input and display devices with our extensive, vertically integrated manufacturing capability to offer a complete solution: From concept through design to zero-defect manufacturing. Our goal is to become an extension of your engineering and manufacturing team by reducing your data input and display design and manufacturing costs, your vendor coordination, and your capital equipment investment. XCEL Corporation specializes in:

- Custom Control Panels, Front Panels & Display Panels
- Custom Keyboards & Keypads
- Very Broad Range of Digital Switches Including Thumbwheel, Lever, Push-button & Push Wheel
- High Resolution Color and Monochrome CRT Monitors and Power Supplies
- Custom Applications of Flat Panel Displays Including LCD, Electroluminescent, Plasma and Vacuum Fluorescent
- Specialty Lighting Including LED, EL, Fiber Optic, ANVIS Night Vision, Infra-Red

For conceptual design assistance, technical and budgetary proposals, or ordering information, contact our Marketing Director.

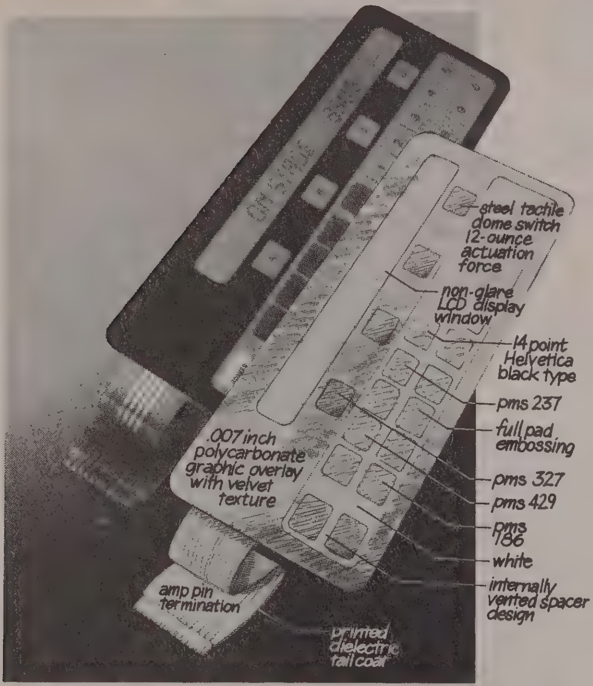
Let Digitran integrate your keyboard/keypad into your subassembly. Contact Digitran's Subsystems Engineering and Manufacturing Services Center at (714) 391-4321. Also see our monitors (2450) and switches (5100).

DIGITRAN
A DIVISION OF XCEL CORPORATION
4290 East Brickell St. Ontario, CA 91761
(714) 391-4321 • FAX: (714) 391-4558

PS-2, PC-AT & PC-XT are registered trademarks of the International Business Machines Corporation.

DOUGLAS CORPORATION

MEMBRANE SWITCHES


steel tactile dome switch 12-ounce actuation force
non-glare LCD display window
14 point Helvetica black type
pms 237
full pad embossing
pms 327
pms 429
pms 186
white
internally vented spacer design
.007 inch polycarbonate graphic overlay with velvet texture
amp pin termination
printed dielectric tail coat

— SPECIFICATIONS —

ELECTRICAL

Operating Voltage: 0-30 VDC

Operating Current:100 MA Max.

Operating Contact Resistance: Less than 100 OHMS typical (as measured at connector.)

Contact Bounce: Less than 10 Milliseconds typical.

Conductors: Printed silver conductive inks or carbon blend. (PC board assemblies available.)

RFI and Static Shielding: Available in most configurations.

MECHANICAL

Life Expectancy: DOUGLAS guarantees 1,000,000 actuations per switch position or 12 months.

Actuation Force: 2-12 oz. range available-depending on customer specification. (4-8 oz. is considered medium actuation force for non-tactile configuration.)

Switch Travel: .005" to .030" typical.

Overall Thickness: .020" to .050" typical.

ENVIRONMENTAL

Storage Temperature: -40°C(-40°F) to +70°C(158°F).

Storage Altitude: Sea level to 40,000 feet.

Operating Temperature & Altitude: Variable depending on customer requirements. (Can be designed to operate in most environments.)

Humidity: No delamination after 24 hours at 85°C and 85%RH.

MOUNTING

Adhesive Mount: 3M 467 typical.

Bezels: Injection molded plastic or die cast zinc.

The specifications above are general. For information on more specific applications, contact one of DOUGLAS CORPORATION's design engineers.

— DESIGN CONSIDERATIONS —

MATERIALS: Depending on the application and environmental requirements, Polyester and Polycarbonates are commonly used. Thickness ranges are .007" to .010". Blended materials and UV hardcoated surfaces are additional options.

SELECTIVE TEXTURING: For hardcoats as well as aesthetic enhancement of graphic overlay.

EMBOSSING: Embossing of the key pads for key location can be achieved by full key pad embossment or rim embossment.

WINDOWS: Transparent and deadfront display windows for viewing LCD and LED displays.

TERMINATION: Tail termination is accomplished by snap fit connectors, solder tabs or exposed silver tabs. .100" centers standard.

TACTILE FEEDBACK: Stainless steel domes range from 8mm to 12mm. Poly domes are embossed onto polyester layer.

SHIELDING: Shielding from EMI/RFI can be accomplished by layer of metallized polyester or screening a layer of graphite.

BACKLIGHTING: Douglas offers several options from Electroluminescent, fiber optics, or translucent copy to allow light penetration of customer supplied light source.

PANEL CUTOUTS: Die cut holes and access for mechanical switches incorporated into membrane switches.

BACK-PLATES AND PRINTED CIRCUIT BOARDS: Available as finished assembly with Douglas membrane switches.

ENVIRONMENTAL DESIGN: Applications subject to various degrees of moisture or high humidity are engineered and constructed accordingly.

GRAPHIC DESIGN AND ENGINEERING ASSISTANCE: Full service art and engineering departments are ready to provide complete or partial assistance in the aesthetic design of graphic overlays and engineering the correct switch construction for your application.

— QUOTATION REQUEST —

- Switch application.
- Quantities required for proto types and production.
- Graphic overlay material, polycarbonate or polyester.
- Finish required, velvet or glossy.
- Number of colors to be printed on graphic overlay.
- Overall dimensions or prints.
- Embossing full keypad, raised key outline.
- Type of termination required and tail length.
- Dome type, if tactile feel is needed.
- Other special requirements.

CALL TOLL FREE:
1-800-728-3189

FAX: 612-942-3125
TEL: 612-941-3847

DOUGLAS
CORPORATION

7180 Washington Avenue South • Eden Prairie, MN 55344-3512

ELMA

ELMA Electronic Inc.
A Member Of The Sulzer Group,
44350 Grimmer Blvd.
Fremont, CA 94538
(510) 656-3400, Fax: 510-656-3783

Full Line of 19" Rackmount Keyboards and Accessories

For complete information write or call for our *free* catalog today!

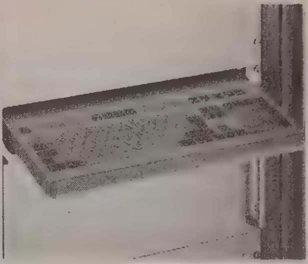
All ELMA products are available off-the-shelf and REASONABLY PRICED

19″ Rackmount Keyboards, Drawers, Panels and Modules

Elma, the leader in PC computer products, now introduces the largest family of 19" rackmount keyboards, keyboard drawers, panels and modules compatible with IBM, XT, AT and PS2 (MCA).

There are two keyboards; one, a full travel and the other, a completely sealed membrane. These keyboards are designed with ruggedness in mind. The keyboards have a rugged aluminum case and conform to DIN 41494 and protection per IP-65. Suitable for harsh industrial environments. Some of the main features of the keyboards are:

70-030-10



70-080-10

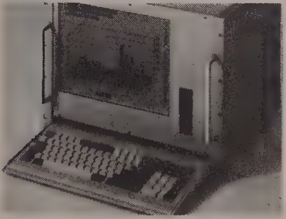
- **19″ rackmount**
- **IBM PC, XT/AT, PS2 compatible**
- **Dust proof protection per IP-65 (membrane)**
- **Switch selectable AT, PC/XT**
- **101 keys**
- **LED's for status display**
- **Only IU (1.75″) vertical space required**
- **US and International versions (6 countries) For list of countries contact factory.**
- **Contact making by Gold/Gold contact (membrane)**
- **12 function keys**
- **Automatic repeat**
- **Optional slides**
- **Powder coated, light grey finish**

FULL TRAVEL

19″ Keyboard module 1U

FEATURES
- This general-purpose 19″ keyboard module to DIN 41494.
- Easy to mount in a cabinet.
- 4 screws for fixing the frontplate.
- Takes up only 1U of space and is 300mm deep.
- Two supports provided for firmer mounting of the 19″ module.
- The keyboard is locked and slightly angled in the working position.
- A spring lock ensures easy opening and closing of the hinged frontplate.

Ordering Information
70-060-10 ....19″ keyboard module



84HP keyboard module 1U

FEATURES
- Can be mounted in an enclosure.
- Easy to mount.
- Module takes up only 1U of space and is 292mm deep.
- The keyboard is locked and slightly angled in the working position.
- A spring lock ensures easy opening and closing of the hinged frontplate.

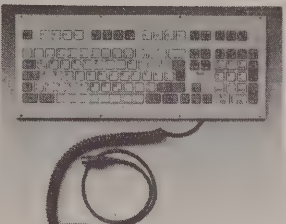
Ordering Information
70-040-10 ....HP keyboard module 1U

FEATURES
- PUR integral foam-protected side pieces prevent damage.

Compact keyboard in metal case

Ordering Information
70-070-10 ....compact keyboard in metal case
.... (8.97"D x 17.08"W x 2.20"H)

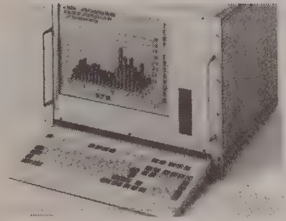
MEMBRANE



19" Keyboard panel 4U/84 HP

FEATURES
- Protection to IP65.
- Jumper for changeover from AT to XT mode.
- Positive tactile switching via metal snap discs.
- Contact-making ensured by gold/gold contacts.
- Service life: 1 million activations per key.

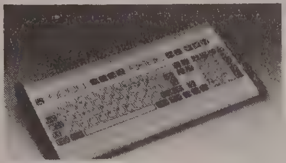
Ordering Information
70-095-10 ....19″ keyboard module



84HP keyboard panel module 1U

FEATURES
- Designed for mounting in an enclosure.
- Strengthened version with protective caps.
- Hinged frontplate with springlock.
- The panel is locked and slightly angled in the working position.
- A spring lock ensures easy opening and closing of the frontplate.
- Can be easily mounted.
- It takes up only 1U of space, 292mm deep.

Ordering Information
70-085-10 ....HP keyboard module 1U



FEATURES
- PUR integral foam protected side pieces.
- It is protected per IP-65.
- Strengthened version with protective caps.

Keyboard panel in metal case

Ordering Information
70-090-10........................keyboard panel in metal case
.... (8.97"D x 17.08"W x 2.20"H)

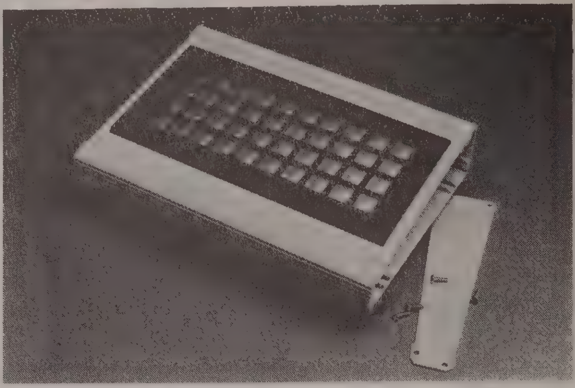
See Section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.), see Section 5100 (Switches), see Section 1400 (Cabinet Enclosures) for additional products.

EXTRUDED ALUMINUM "KEY-BOX" MODULAR ENCLOSURES

KEYBOARDS

KEYPADS

CONTROL DEVICES

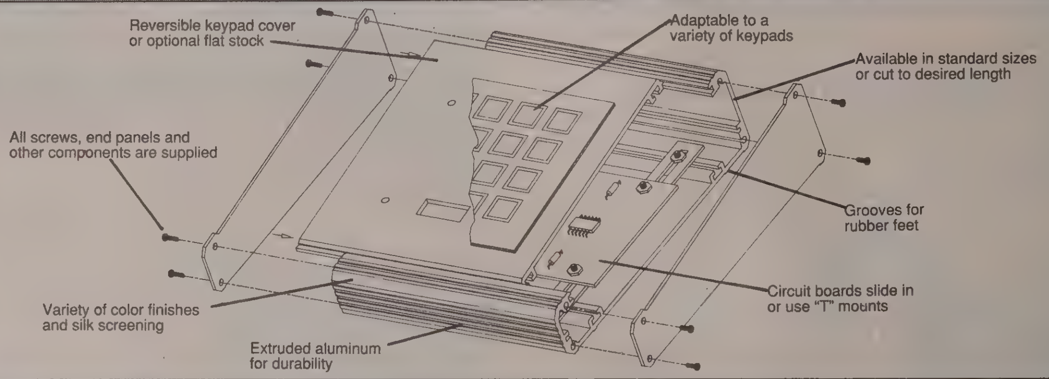


TRACKBALLS

JOY STICKS

TELECOMMUNICATIONS

COMPLETELY FABRICATED MODULAR SYSTEM


Reversible keypad cover or optional flat stock
Adaptable to a variety of keypads
Available in standard sizes or cut to desired length
All screws, end panels and other components are supplied
Grooves for rubber feet
Circuit boards slide in or use "T" mounts
Variety of color finishes and silk screening
Extruded aluminum for durability

"KEY-BOX" – SPECIFICATIONS

MODEL	HEIGHT FRONT	HEIGHT REAR	BOX WIDTH	AREA Y–AXIS	AREA X	HEAD SPACE	END PANELS	SCREW HOLES
KB-6500	0.980"	1.730"	5.00"	4.00"	4.75"	0.65"	2	4
KB-6850	0.980"	1.730"	8.50"	4.00"	8.25"	0.65"	2	4
KB-6XXX	0.980"	1.730"	ANY	4.00"	ANY	0.65"	2	4

ADVANTAGES OF "KEY-BOX" MODULAR ENCLOSURE SYSTEM

- Adapts to a variety of keypads:
  - Flat matrix, cut panel, surface mount
  - Full depression recessed mount
- Cut to desired length or stock 5" & 8.5"
- Keypad cover reversible or optional flat stock
- Circuit boards slide in or use "T" mounts
- End panels can be customized
- Variety of color finishes & silk screening
- No extrusion tooling/die charges
- Rugged, durable and tough
- Easy to assemble & fabricate
- Customized to your application
- Integral RFI/EMI shielding
- Low cost and economical
- Grooves for rubber feet
- Edge detents for label or logo
- Ship from stock or custom
- Complete hardware "kits"

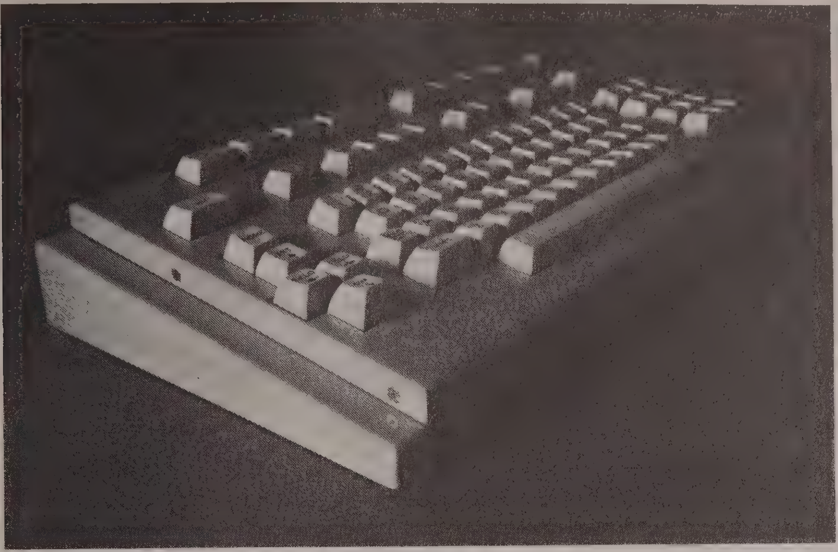
"A UNIVERSAL ENCLOSURE TO SOLVE YOUR APPLICATION PROBLEMS!!"

WE EXTRUDE AND FABRICATE IN HOUSE FOR QUALITY, SERVICE & VALUE

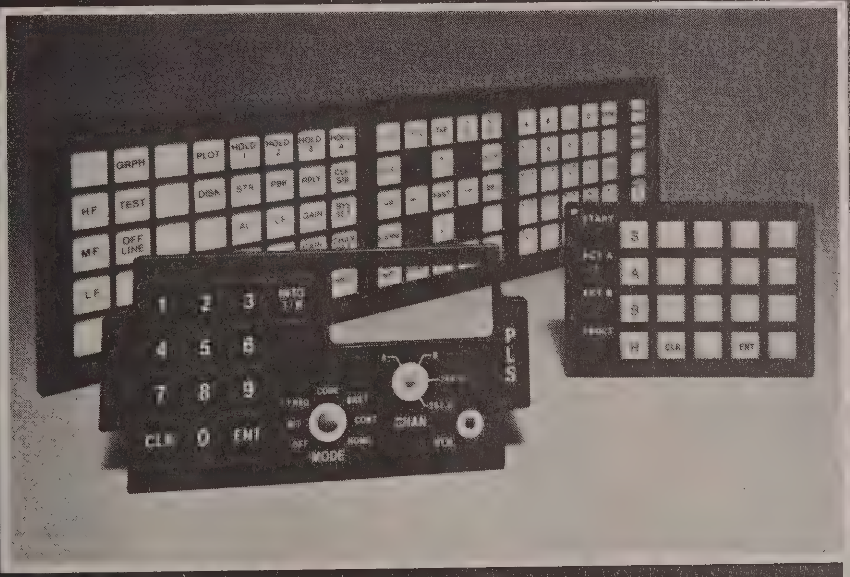
See our other listing
in EEM under
Enclosures, Section 1400

extrusion technology
ALUMINUM EXTRUSIONS AND EXTRUSION-BASED COMPONENT PARTS

EXTRUSION TECHNOLOGY, INC. 83 TRIM WAY, RANDOLPH, MASSACHUSETTS 02368
TEL: (617)-963-7200 **FAX: (617)-963-7203**



FLEX-KEY


GRPH
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HOLD 2
HOLD 3
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GAIN
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CLR
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6
7
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9
0
MODE
CHAN
PLS

specialists in military keyboard systems

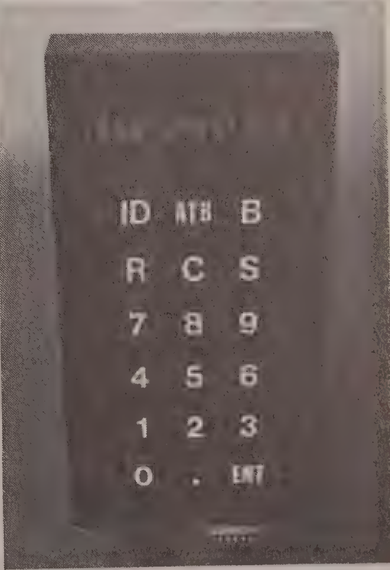
KEYBOARD OPTIONS INCLUDE:

- TRACKBALL INCORPORATION
- BACKLIGHTING
- TEMPEST
- HAND HELD TERMINALS
- EMI/EMP SHIELDING
- HARSH ENVIRONMENT OPERATION
  - SHOCK
  - VIBRATION
  - DRIP/WATER PROOF
  - HIGH/LOW TEMPERATURE

Flex-Key has designed and manufactured keyboards for military applications since 1974. Our focus has resulted in unique knowledge and experience in our chosen specialty. To our customers, this means unmatched competence in military keyboard technology.

Defense electronics companies from around the globe have come to rely on Flex-Key for the highest quality product, engineered and manufactured to meet rigorous specifications.

Contact Flex-Key to learn what our dedication to military keyboards can mean for your hardware system.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ENT

FLEX-KEY AN ASTRONICS CO.

FLEX-KEY CORPORATION, EMERSON AVENUE, GLOUCESTER, MA 01930
Phone: (508) 281-2040 Fax: (508) 281-4730

Silicone Keyboards

Silicone rubber keyboards

The rapid growth of integrated circuit technology and its introduction to diverse product applications has spurred the demand for mechanical keyboards. For a long time, keyboards were manufactured using either metal switches or plastic films with a gold deposit.

Fujipoly, with years of experience in the manufacture of silicone rubber, has permitted the development of economical and high reliability keyboards.

Design features of silicone rubber keyboards

Silicone rubber keyboards, unlike metal keyboards,exhibit excellent resistance to corrosive agents. They do not oxidize or corrode as a result of sulphorous acid, ozone, salt water, high temperature or moisture contact. Abrasion of the printed surface of the printed circuit board is minimal.

In addition, the entire surface of the printed circuit board may be covered, protecting it from dust and contamination. Custom shapes are available to meet specific design applications. The silicone rubber provides a comfortable touch and click sensation to the finger.

Specifications for Light Keyboard

Material	Silicone elastomer Federal standard ZZR765CL2B
Storage temperature	-50°C ~ + 220°C -40°C ~ + 150°C
Approval specs	Auto-extinguishable 94 VO / Flame retardant 94 VO / Standard 94 HB
Durometer	40 to 80

General Silicone Keyboard Specifications

Force	35 ~ 250 grams
Life cycle	50 x 10^4 - 1500 x 10^4 cycles
Tactile feedback	Optional
Key size	Variable
Key travel	0.2 mm - 5 mm
Waterproofing	Optional
***Contact resistance**	< 150 ohm - P.C.B. + Aµ
Contact characteristics	5mA at 12 VDC / 0.5 sec.
***Contact bounce**	< 10 m seconds
Insulation resistance	> 10^{22} ohms at/a 500 VDC
***Breakdown voltage**	25 - 30 KV/mm
Double Zymark® printing	Yes (25 microns built-in)
Surface printing	Yes
Multiple colors	Yes (Legends and molded silicone)
Printing tolerance	±10% of line (Zymark® printing) ±15% of line with (surface printing) ±0.25 mm centered

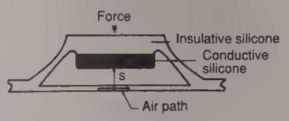
General

Tolerance	±0.1 (min.) 0.4% (Max.)
Stroke	Optional (Optimum 0.8 mm)
Backlighting	Optional

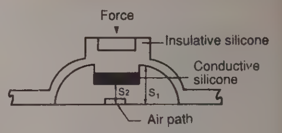
---

* Results may vary depending upon test conditions.

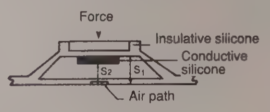
CONE TYPE A


Force
Insulative silicone
Conductive silicone
S
Air path

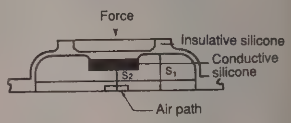
DOME TYPE C


Force
Insulative silicone
Conductive silicone
S2
S1
Air path

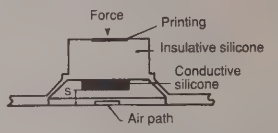
CONE TYPE B


Force
Insulative silicone
Conductive silicone
S2
S1
Air path

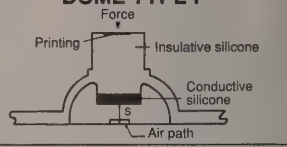
DOME TYPE E


Force
Insulative silicone
Conductive silicone
S2
S1
Air path

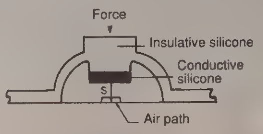
CONE TYPE C


Force
Printing
Insulative silicone
Conductive silicone
S
Air path

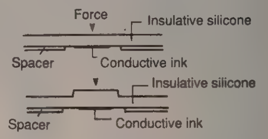
DOME TYPE F


Force
Printing
Insulative silicone
Conductive silicone
S
Air path

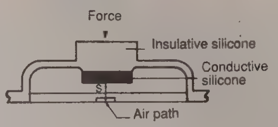
DOME TYPE A


Force
Insulative silicone
Conductive silicone
S
Air path

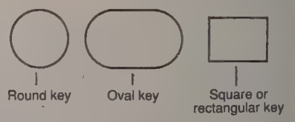
SHEET TYPE


Force
Insulative silicone
Spacer
Conductive ink
Insulative silicone
Spacer
Conductive ink

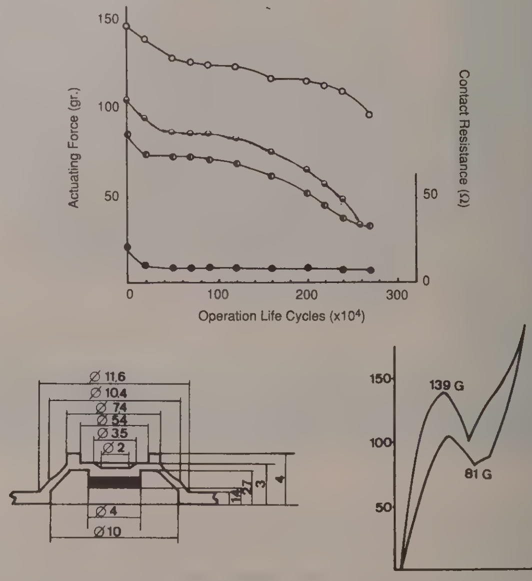
DOME TYPE B


Force
Insulative silicone
Conductive silicone
S
Air path

KEY-TOP SHAPES


Round key
Oval key
Square or rectangular key

Life Cycle/force and resistance



Physical Properties of Silicone Rubber Zymer® E6

Specific gravity at 25°C	1.18 ± 0.05
Durometer hardness (JISS A scale)	60 ± 5
Tensile strength (Kg/cm²)	> 50
Elongation (%)	> 100
Tear strength (DIE B Kg/cm²)	> 9
Compression set, % (after 22 hrs. at 175°C)	< 35
Resistivity (Ω/cm)	< 20

fujipoly® America Corporation

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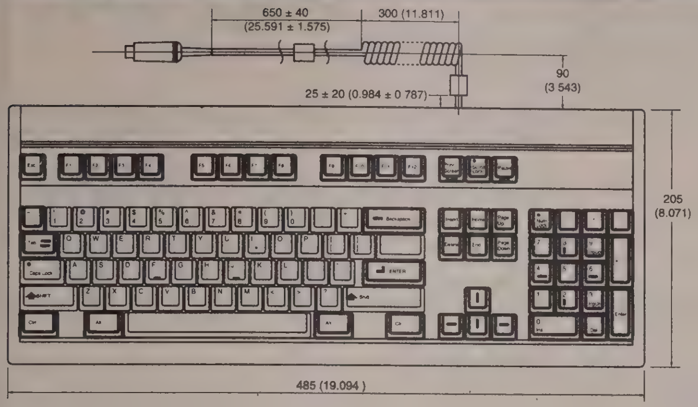
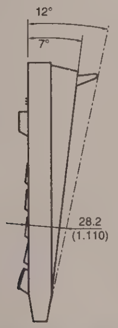
FUJITSU KEYBOARD FKB 4700 SERIES



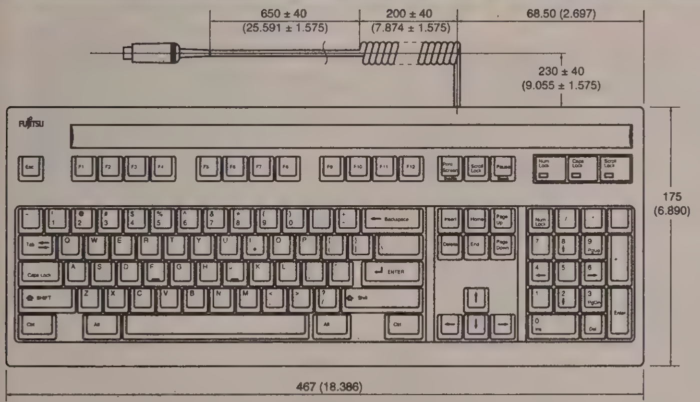
Unit: mm(in.)



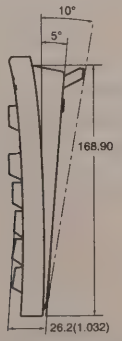
Available as standard, semi-custom, or full custom product.

	Mechanical	
Item		Specification
Operating force		55g ± 25g
Stroke		3.8 ± 0.5mm (.150 ± .020in.)
Tactile		20g typ, SHARP
Operating life		30M ops. min.
Number of keys		US: 101 keys, Others: 102 keys
Keytop	Shape	Rectangular cylindrical
	Form	Sculptured (curved)
Tilt		2 levels
	Environmental	
Operating temp.		0 to 50°C
Storage temp.		-20 to 60°C
Humidity		90% RH at 40°C max. inverse proportional change to 50% RH at 60°C
	Electrical	
Contact resistance		500Ω max. (5V DC,1mA)
Power supply		5 ± 0.25V DC, 250mA max.
Interlock		F-key roll over
Repeat		All keys (AT* mode: repeating rate specified by command)
	Interface	
Data transmission		Serial transmission (synchronous system)
Data format	AT* mode	11 bit (1 start + 8 data + 1 parity + 1 stop)
	XT* mode	9 bit (1 start + 8 data)
Connector		5-pole DIN connector (6-pole Mini DIN connector is available)

FUJITSU KEYBOARD FKB 4870 SERIES



Unit: mm(in.)



Available as standard, semi-custom, or full custom product.

	Mechanical	
Item		Specification
Operating force		55g ± 25g
Stroke		3.8 ± 0.5mm (.150 ± .020in.)
Tactile		20g typ, SOFT
Operating life		10M ops. min.
Number of keys		US: 101 keys, Others: 102 keys
Keytop	Shape	Rectangular cylindrical
	Form	Sculptured (step)
Tilt		2 levels (5°/10°)
	Environmental	
Operating temp.		10 to 50°C
Storage temp.		-20 to 60°C
Humidity		90% RH at 40°C max. inverse proportional change to 50% RH at 60°C
	Electrical	
Contact resistance		1K max. (5V DC,1mA)
Power supply		5 ± 0.25V DC, 100mA max.
Interlock		F-key roll over
Repeat		All keys (AT* mode: repeating rate specified by command)
	Interface	
Data transmission		Serial transmission (synchronous system)
Data format	AT* mode	11 bit (1 start + 8 data + 1 parity + 1 stop)
	XT* mode	9 bit (1 start + 8 data)
Connector		5-pole DIN/Mini DIN connector

*AT and XT are trademarks of International Business Machines Corporation.

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- ✦ High Reliability
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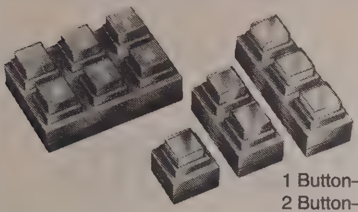
Keyboards and Keypads

Measurement Shown in Inches (Millimeters)

CREATE YOUR OWN KEYBOARD CONFIGURATION AND MAINTAIN BUTTON DISTANCES

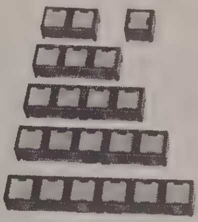


1 Button–0.683" (17,35) Square
2 Button–0.683" (17,35) x 1.37" (34,80)
3 Button–0.683" (17,35) x 2.057" (52,25)
6 Button–1.390" (34,80) x 2.057" (52,25)

SERIES 82

Insertable legend keyboard modules plug into PC boards from 0.063"(1,57) to 0.125"(3,18) thick and mount in any configuration while maintaining 0.687" (17.45) button centers. Button height above board is 0.75" (19.05). Long-stroke, wiping contact is ideal for applications with low voltage or which require constant data entry. Housing gray, base black. Rating at 5VDC: 100mA for one million operations. *Legend insertable assortment which includes symbols, terms, alphabet, and numerals is ordered separately from table below.*

Type/Circuitry	Part No.	Type/Circuitry	Part No.
1 Button SP/ST	**82-101-71**	3 Button SP/ST	**82-301-61**
1 Button 4P/ST	**82-101-74**	3 Button 4P/ST	**82-301-64**
2 Button SP/ST	**82-201-41**	6 Button SP/ST	**82-601-81**
2 Button 4P/ST	**82-201-44**	6 Button 4P/ST	**82-601-84**
Legend Sheet – White Legends on Clear – 82AC2017-1			



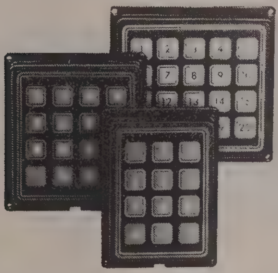
1 Button–0.490" (12,45) Square
2 Button–0.490" (12,45) x 0.990" (25,15)
3 Button–0.490" (12,45) x 1.490" (37,85)
4 Button–0.490" (12,45) x 1.990" (50,55)
5 Button–0.490" (12,45) x 2.490" (63,25)
6 Button–0.490" (12,45) x 2.990" (75,95)

SERIES 87

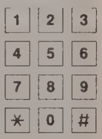
Modules allow low profile, custom keyboards in any configuration and maintain 0.5" (12.7) button centers. Modules available 1-button single pole/ single throw, and 2-, 3-, 4-, 5-, and 6- button strips single pole/common bus; Contact is audible snap-dome; resistance is MOS, CMOS, TTL, and DTL compatible. Rated for 10mA at 24 VDC, resistive for 3 million operations. Switches stand 0.350" (8.89) above PC board. Mount 0.031" (0.787) to 0.125" (3.18) thick PC boards. Housing black; buttons white. Operating temperature: -40°C to +80°C. *Legend insert assortment which includes symbols, terms, alphabet, and numerals is ordered separately.*

Type/Circuitry	Part No.	Type/Circuitry	Part No.
1 Btn. SP/ST	**87CC3-201**	4 Btn. SP/Common	**87FC3-201**
2 Btn. SP/Common	**87DC3-201**	5 Btn. SP/Common	**87GC3-201**
2 Btn. SP/Common	**87EC3-201**	6 Btn. SP/Common	**87HC3-201**
Legend Sheet – Die Cut Legend Inserts – 87AC2046			

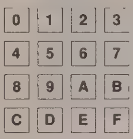
3 x 4, 4 x 4 AND 5 x 4 SEALED KEYPADS



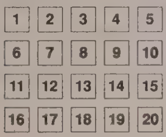
3 x 4–3.0" (76,40) x 2.2" (55,80)
4 x 4–3.0" (76,40) x 2.7" (65,58)
5 x 4–3.0" (76,40) x 3.2" (81,28)



-172, -182



-072, -082



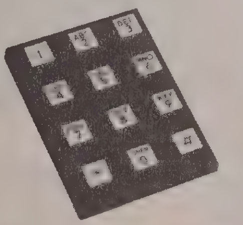
-292

SERIES 88

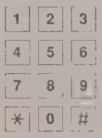
Keypads have the contact system sealed by a graphic overlay. The polyester overlay is printed on the back side eliminating legend wear. The keypad is flange mounted and can be sealed to the panel by a gasket. Gaskets are available for mounting the keypad to the top of the panel or from the back side of the panel. Standard legends are available as shown above. The -172 and -072 versions have white legends with blue accents. The -292 has black legends with silver accents. Keypads are 0.36" (9,14) overall height. Rated for 3 million operations at 10mA 24VDC. Logic compatible with 4mS bounce at make and 10mS at break. Operating temperature -40°C to +80°C.

Description	Part Numbers		
	3 x 4	4 x 4	5 x 4
Matrix	**88AB2-172**	**88BB2-072**	—
SP/Common	**88AC2-172**	**88BC2-072**	—
Matrix	—	—	**88JB2-292**
SP/Common	—	—	**88JC2-292**
Back Panel Gasket	**88M2001-2**	**88M2009-2**	**88M2019-1**
Top Mount Gasket	**88M2012-1**	**88M2015-1**	**88M2018-1**

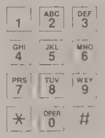
For prices, contact a Sales Office, an authorized Distributor or Grayhill.
Available From Your Local GRAYHILL Distributor



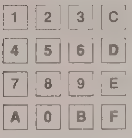
3 x 4–3.1" (78,74) x 2.35" (59,69)
4 x 4–3.1" (78,74) Square



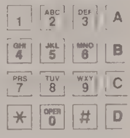
-112



-113



-014



-016

SERIES 84S

12 or 16 button keypads have a one-piece black silicone rubber boot which completely seals the switch contacts and the panel cutout. Audible snap-dome contact is gold-plated; resistance is MOS, TTL, and DTL compatible. Life is million operations per button. RFI/EMI shielding is standard. White buttons, on 0.75" (19.05) centers, are removable and interchangeable. Keypads are mounted by four studs #6-32; nuts are included. C in type number indicates single pole/ common bus circuitry; others have matrix (XY) circuitry. Part number suffix indicates legend.

3 x 4 Configuration		4 x 4 Configuration	
Circuitry	Part Number	Circuitry	Part Number
EMI Shielded			
Matrix	**84S-AB2-112-N**	Matrix	**84S-BB2-014-N**
Matrix	**84S-AB2-113-N**	Matrix	**84S-BB2-016-N**
SP/Common	**84S-AC2-112-N**	SP/Common	**84S-BC2-014-N**
SP/Common	**84S-AC2-113-N**	SP/Common	**84S-BC2-016-N**
Non-Shielded			
Matrix	**84SN-AB2-112-N**	Matrix	**84SN-BB2-014-N**
Matrix	**84SN-AB2-113-N**	Matrix	**84SN-BB2-016-N**
SP/Common	**84SN-AC2-112-N**	SP/Common	**84SN-BC2-014-N**
SP/Common	**84SN-AC2-113-N**	SP/Common	**84SN-BC2-016-N**

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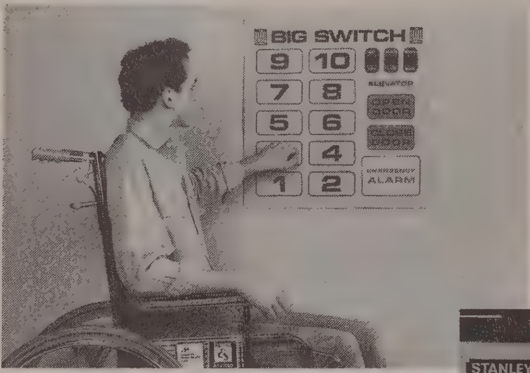
BIG SWITCH
9
10
7
8
ELEVATOR
OPEN DOOR
5
6
CLOSE DOOR
4
EMERGENCY ALARM
1
2

Custom Switch

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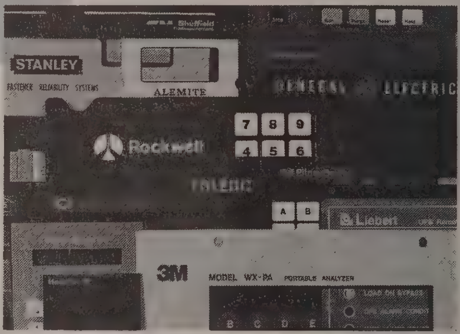
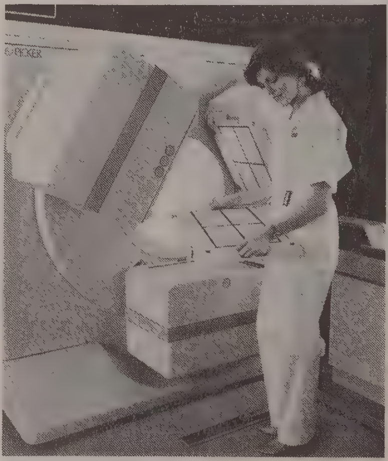
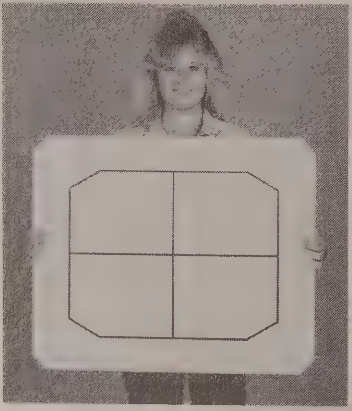

STANLEY
ALEMITE
GENERAL ELECTRIC
Rockwell
7
8
9
4
5
6
A
B
Liebert
3M
MODEL WX-PA PORTABLE ANALYZER





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Sealedswitch

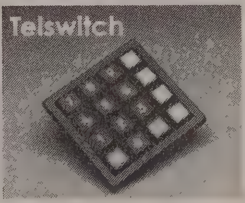
The SEALEDSWITCH™ features our gold-plated snap domes with permanent legends printed on the elastomer keypad providing excellent tactile response and environmental sealing. Standard 4×4 and 4×5 configurations are available with illumination.

Panelswitch

The PANELSWITCH™ features a positive tactile feedback provided by our sealed, gold-plated snap domes with pushbutton keys secured in a low profile bezel. Standard 3×4, 4×4 and 4×5 configurations are available with illumination and EMI/RFI shielding.

Thinswitch

The THINSWITCH™ is a high reliability membrane keypad with gold-plated copper foil contacts sealed within polyester substrates. Standard 3×4, 4×4 and 4×5 configurations can be backlit and are available with tactile feedback and EMI/RFI shielding.



The TELSWITCH™ features an elastomer keypad with individual, replaceable legend inserts and our gold-plated snap domes. It provides outstanding tactile feedback and outstanding environmental protection. Standard 4×4 and 4×7 configurations are available with EMI/RFI shielding.

Thriftswitch

THRIFTSWITCH™ low cost keypads are offered in a variety of styles in 3×4 and 4×4 formats. Both conductive silicone rubber and metal contact types are available with double-shot molded keys and electrostatic shielding.

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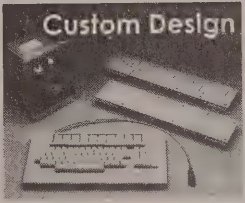

Our custom engineering capabilities include the design and manufacture of keypads and keyboards to meet any set of performance specifications. These custom assemblies include such features as front relegending and relamping, NVIS illumination, EMI/RFI shielding and custom interface electronics.

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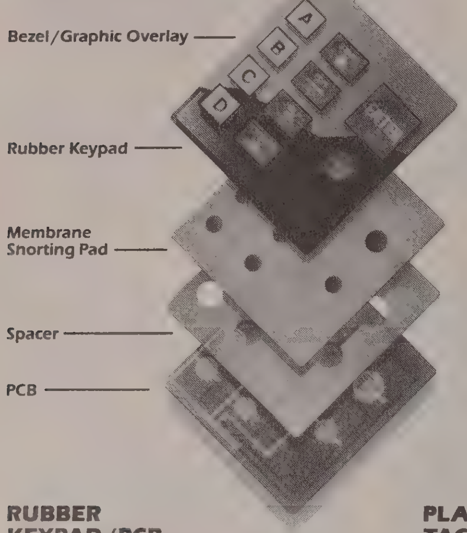
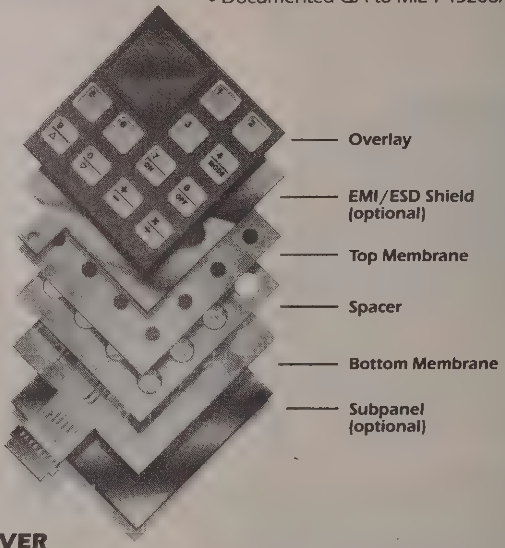
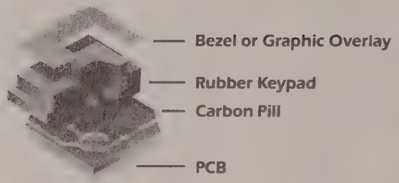
TACTILE/NON-TACTILE, LOW PROFILE/SHORT STROKE ELASTOMERIC (RUBBER) KEY PANEL


Bezel/Graphic Overlay
Rubber Keypad
Membrane Shorting Pad
Spacer
PCB
A
B
C
D

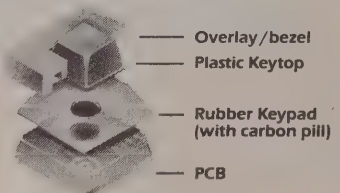
NON-TACTILE MEMBRANE KEY PANEL


Overlay
EMI/ESD Shield (optional)
Top Membrane
Spacer
Bottom Membrane
Subpanel (optional)

RUBBER KEYPAD/PCB


Bezel or Graphic Overlay
Rubber Keypad
Carbon Pill
PCB

PLASTIC KEYTOP OVER TACTILE RUBBER


Overlay/bezel
Plastic Keytop
Rubber Keypad (with carbon pill)
PCB

SERVING THESE PRODUCT LINES

MEDICAL INSTRUMENTATION • CALCULATORS TELECOMMUNICATIONS • REMOTE CONTROLS SECURITY SYSTEMS • COMPUTERS • GAMES AND TOYS • APPLIANCES • AUTOMOTIVE POINT OF SALE TERMINALS • INDUSTRIAL CONTROLS • TV'S & VCR'S • COPY MACHINES MILITARY EQUIPMENT • MARINE EQUIPMENT STEREO EQUIPMENT • OTHER HAND HELD DEVICES.

ELASTOMERIC CONSTRUCTIONS/SPECIFICATIONS:

☐ Bezeless
☐ Undercut
☐ Watertight
☐ Dustproof
☐ Printed, Reverse Printed Keytops
☐ ESD Breakdown Voltage 25-30KV/mm
☐ Dual Durometer
☐ Engraved
☐ Embossed
☐ Laser Etched
☐ Overcoats, Barrier Coats
☐ Compression & LIM Silicone
☐ Fluorosilicone —EPDM —TPE's, TPR's
☐ 94HB & 94VO UL Flammability Ratings
☐ Oxidation & Ozone Resistant
☐ Insulation Resistance >10^{12} ohms @ 500 VDC
☐ EMI-RFI-ESD Shielding
☐ EL, Fibre Optic, LED Backlighting

GM NAMEPLATE CUSTOM PRODUCT IDENTIFICATION COMPONENTS
- nameplates
- ink and computer imprintable labels
- cosmetic front panels and overlays
- fabricated subassemblies

Call Customer Service **206-284-2200** for information, samples or price quotation.

See Our Other Data Page In Vol. C Section 3100

42 YEARS MANUFACTURING MAN-MACHINE INTERFACE PRODUCTS.

CALL OR WRITE FOR DESIGN MANUAL AND COMPLETE SPECIFICATIONS

Nationwide sales, design, engineering, manufacturing...

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The Custom Touch℠

GM Nameplate
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KEY PANELS

PRODUCT SUPPORT SYSTEM

- Trained, nationwide sales engineers
- Experienced design/manufacturing team
- Follow up assistance after product delivery
- One account manager tracks each job from quote through shipment, coordinating manufacture to meet your production schedule.

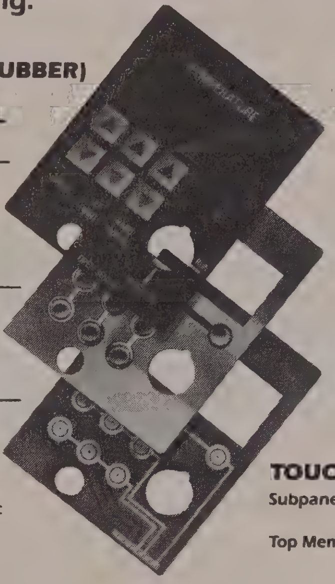
VERTICALLY INTEGRATED MANUFACTURING

Pre-tested, ready-to-install key panels reduce your assembly costs.

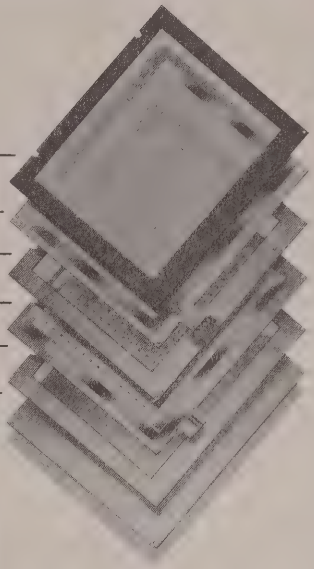
- Custom Design and Graphics
- Color Filter Windows
- Multiple Hard Coat Finishes

FULLY INTEGRATED—TURNKEY—ELECTRONIC/GRAPHIC INTERFACE ASSEMBLIES. Our mission is to own the entire Man-Machine Interface Construction—Keyboard, touchscreen, elastomeric keypad, lighting, interconnection and surrounding bezel. 42 years of precision graphics printing and switch manufacturing.

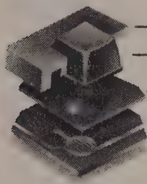
MEMBRANE OR ELASTOMERIC (RUBBER) TACTILE METAL DOME KEYPANEL



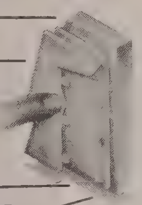
ANALOG AND X-Y MATRIX TOUCHSCREEN KEYPANEL



PLASTIC KEYTOP OVER METAL DOME



TOUCH SCREEN OPERATION



TYPICAL SWITCH SPECIFICATIONS*

	MEMBRANE AND PCB KEY PANELS			ELASTOMER KEY PANELS			PLASTIC KEYTOP KEY PANELS	
	Non-tactile	Tactile Metal Dome	Tactile Polydome	Rubber Keypad/Membrane	Rubber Keypad/PCB Switch	Rubber Keypad/Shorting Pad/PCB Switch	Plastic Keytop/Rubber Keypad/Shorting Pad/PCB Switch	Plastic Keytop/Metal Dome/PCB Switch
ELECTRICAL								
Contact rating (Membrane)	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt
Contact rating (PCB)	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt					
Contact resistance	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<20 ohms	<20 ohms	<20 ohms	<20 ohms
Contact bounce	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms
Capacitance	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf
MECHANICAL								
Actuation force*	3 - 10 oz.	10 - 16 oz.	4 - 18 oz.	4 - 12 oz.	3 - 10 oz.	4 - 12 oz.	4 - 12 oz.	10 - 16 oz.
Life cycle*	5,000,000	5,000,000	1,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Key travel	.007 - .011 in.	.015 - .025 in.	.010 - .030 in.	.025 - .075 in.	.020 - .075 in.	.045 - .075 in.	.040 - .075 in.	.015 - .025 in.
ENVIRONMENTAL								
Operating temp.	-30° - +65° C	-30° - +65° C	-20° - +55° C	-30° - +65° C	-30° - +65° C	-30° - +65° C	-30° - +65° C	-30° - +65° C
Storage temp.	-40° - +80° C	-40° - +80° C	-40° - +80° C	-40° - +70° C	-40° - +70° C	-40° - +70° C	-40° - +70° C	-40° - +70° C

* Force & life cycle may change approaching upper and lower extremes of operating range.

*VARIATIONS AVAILABLE UPON CUSTOMER REQUEST OR DESIGN
(See our ad in Volume C, section 3100, "insulators.")
Three fully-integrated facilities to serve you...

TOTAL QUALITY SYSTEMS ARE IN EVERY PHASE OF OUR [illegible] PROCESS

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PRODUCT SELECTION GUIDES

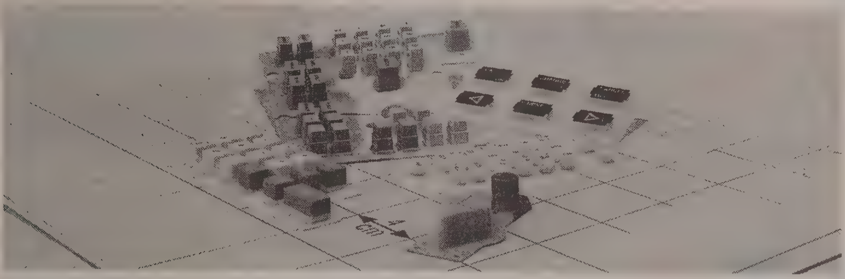
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	D•2221
Batteries, Product Selection Guide	D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	C•1003
Capacitors, Product Selection Guide	A•1003
Coils, Chokes, Inductors, Product Selection Guide	A•1179
Connectors, Terminals & Sockets, Product Selection Guide	C•1139
Cores, Magnets & Ferrites	A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	A•1326
DC-DC Converters	D•2049
DC Power Supplies, Product Selection Guide	D•1488
Delay Lines, Product Selection Guide	A•1513
Discrete Semiconductors, Product Selection Guide	A•2130
Displays, Readouts, & CRTs, Product Selection Guide	B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	C•1557
Fiber Optics, Product Selection Guide	B•1200
Filters, Power, Product Selection Guide	A•1584
Filters, Signal, Product Selection Guide	A•1617
Instruments, Test & Measuring, Product Selection Guide	D•1215
Interconnection Systems, Product Selection Guide	C•1670
Keyboards & Keypads, Product Selection Guide	B•1818
Lamps, Lights, & Indicators, Product Selection Guide	B•1131
Microwave Components, Product Selection Guide	A•1719
Military Qualified Products List	B•1002
Motors, Drives, & Rotating Components, Product Selection Guide	B•1231
Oscilloscopes, Product Selection Guide	D•1402
Panel Hardware, Product Selection Guide	C•1522
Panel Meters, Analog & Digital, Product Selection Guide	D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	A•2053
Power Supplies, AC, Product Selection Guide	D•2221
Power Supplies, DC, Product Selection Guide	D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	B•1341
Relays, Product Selection Guide	B•1401
Resistors, Product Selection Guide	A•1859
Solenoids, Product Selection Guide	B•1626
Switches, Product Selection Guide	B•1658
Thermal Components, Product Selection Guide	B•1857
Transducers & Encoders, Product Selection Guide	B•1911
Transformers, Product Selection Guide	A•2229
Wire & Cable, Product Selection Guide	C•1701

ITT Schadow

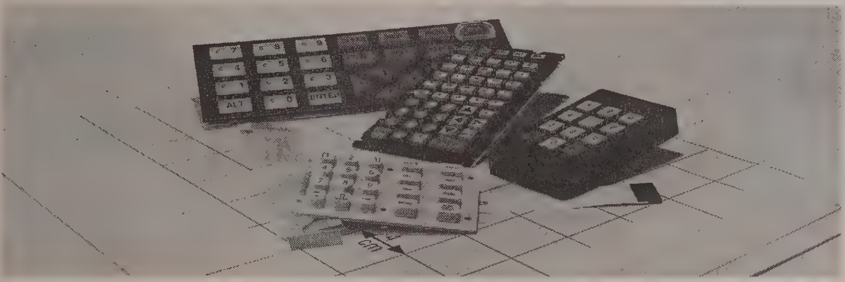
Conductive Rubber SwitchPads



Conductive Rubber SwitchPads

Conductive Rubber SwitchPads (CRS) were developed to meet demanding environmental conditions where cost and reliability are an absolute necessity. These custom switchpads are designed with durable nontoxic silicone rubber materials. CRS switchpads are compression molded. A wide variety of options are available to meet the designer's requirements.

- ☐ Carbon contacts or metal plated varieties
- ☐ Multiple keytop colors on the same switchpad
- ☐ Translucent rubber for back lighted/illuminated switchpads
- ☐ Multiple hardness / durometers
- ☐ Silk screen legends / characters
- ☐ Specially molded compounds for fluid resistance, EMI protection or flammability rating



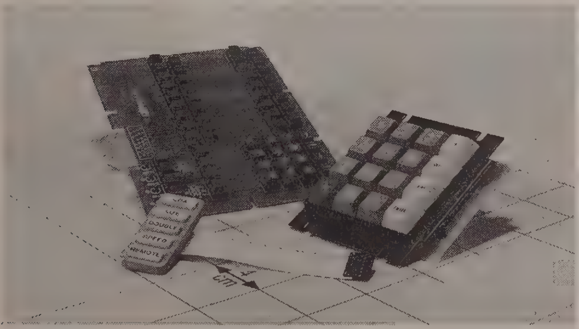
CRS Rubber Assemblies

Conductive Rubber SwitchPad users are discovering the benefits of procuring an entire value added assembly.

ITT Schadow provides a complete switch panel assembly service. We will provide drop-in PCB panel assemblies. These custom assemblies include uniquely designed and engineered conductive rubber switchpads on a PCB. The key panel assembly can also contain a connector, bezel (housing), LEDs, resistors, display (LCD in LED), IC's or any other electrical component.

Benefits

- ☐ Management of a single vendor/supplier
- ☐ Single source component purchasing
- ☐ QC on entire sub-assembly
- ☐ Utilize ITT Schadow's complete technical design capabilities
- ☐ Improved turnaround on prototypes and production



CVA Panel Assembly

ITT Schadow has set-up the CVA panel assembly product line as an outsourcing service providing PCB assemblies to customers who require: Turnkey assemblies, quality, reliability , and on time delivery.

Support Capability

ITT Schadow provides a complete, professional Value Added Printed Circuit Board assembly capability. Schadow CVA services include: Design, tooling, component procurement, turnkey assembly, quality assurance and just-in-time delivery.

Assembly Capability

- ☐ Qualified assembly labor force
- ☐ Wave solder operations (PCB)
- ☐ Molding operation (ie., plastic components, silicone rubber, etc.)
- ☐ Stamping operation (ie., metal components, domes etc.)
- ☐ Tampo printing
- ☐ Hot stamping
- ☐ Custom switch assembly
- ☐ Prototype buiding
- ☐ Automated switch manufacturing

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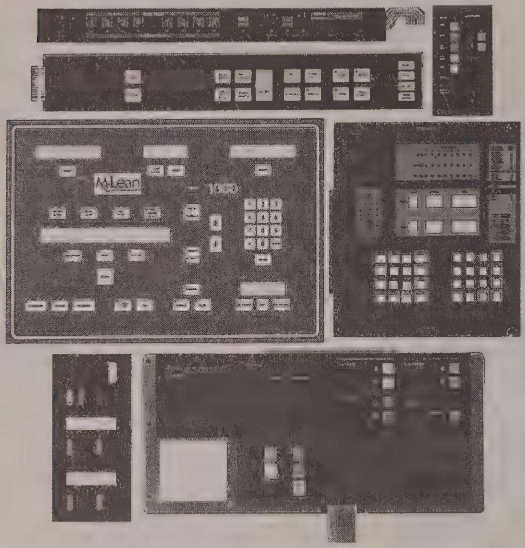
JAYCO

MEMBRANE SWITCHES
HYBRID SWITCH ASSEMBLIES
LEADERS IN FRONT



Jayco specializes in front panel switches & sub-assemblies. Our products are consistently chosen by hardware designers for their performance, superior standards, and visual appeal.

MEETING YOUR NEEDS

Customer satisfaction is our primary business concern. Our unique approach to customer satisfaction guarantees product reliability. At Jayco, quality begins with a complete analysis and planning of your machine interface requirements, before any material selection, design or construction methods are determined.

Our pre-engineering design reviews, testing and inspection to MIL-I-45208A insures that all processes and procedures are in place to anticipate and prevent any and all manufacturing problems. To further maximize customer benefits, Jayco maintains a policy of open communication throughout the design, engineering and manufacturing cycle, as a priority and a critical link in our system. Jayco breaks through the traditional customer–vendor relationships and enters into customer–supplier partnerships where together, we become committed to perfecting your project.

MEMBRANE SWITCHES

Our reliable membranes are thin, light weight, space saving and have a low assembly cost making them ideal for medical devices, process control, test and measurement, diagnostic, telecommunications, security, hand held equipment, and other applications. Membrane Switches are simple to use, offer design flexibility, and they are rugged and durable. They facilitate easy design integration to include displays, bargraphs, CRT windows, and speaker grilles. Many options are also available. (see design options).

HYBRID SWITCH ASSEMBLIES

Hybrid's are a combination of membranes and PCB technology built onto circuit boards. HSA's have the design advantages of membranes and are versatile enough for most applications. In addition, hybrid switch assemblies are a rigid assembly allowing component integration and conventional mounting without separate backplates. HSA's often eliminate another PCB from your product because display components and related circuitry are mounted to the same board used for the switch circuitry. Complete, fully tested sub-assemblies save you money. You have fewer components to order and track, lower assembly costs, and Jayco completes all of the testing for you.

SILICONE RUBBER KEYPADS AND ASSEMBLIES

The ideal choice for applications when a sensitive tactile feedback is required. Silicone keypads can be conductive or non-conductive, with integral or separate keytops, supplied as components or built into membrane or hybrid switch assemblies to produce a totally integrated front panel. Our sub-assemblies include keypads, PCB's, bezels, overlays, displays and other electronic components. This is an excellent money and labor saving alternative to building your own assembly with different components from multiple vendors.

Tailored to your requirements, Jayco's SRK's are molded in a wide variety of operating forces and switch travels. Select SRK's for any design application where positive feedback, low user fatigue, low cost and high reliability are prime requirements. SRK benefits also include: Long life (durability); excellent thermal stability and chemical resistance, light weight, low assembly cost, design flexibility, ESD protection and multi color arrays.

KEYBOARDS AND KEYPADS

Jayco manufactures custom keyboards and pads to your precise design requirements. These switches have few limitations regarding size, layout, number of switches, circuitry or graphic design. Custom keypads eliminate the compromise of off the shelf components which more than offsets the tooling costs in many applications.

DESIGN OPTIONS

EMBOSSING

Jayco embosses all overlays in-house. Proprietary techniques provide exceptional results, lower tooling costs, and a perfect match between printing and embossing. Any part of the front panel can be embossed to add a third dimension.

Embossing is usually pad or rim type. With pad embossing, the entire switch area is raised like a top hat. Rim embossing raises the outline of the switch like a crater. Rim and padding can be combined for special effects.

Pad embossing gives a more conventional keyboard appearance and is generally used with tactile switches. Rim

SILICONE RUBBER KEYPADS KEYBOARDS AND KEYPADS

PANEL TECHNOLOGY

JAYCO

embossing assures better switch location, vital in non-tactile applications.

TACTILE FEEDBACK

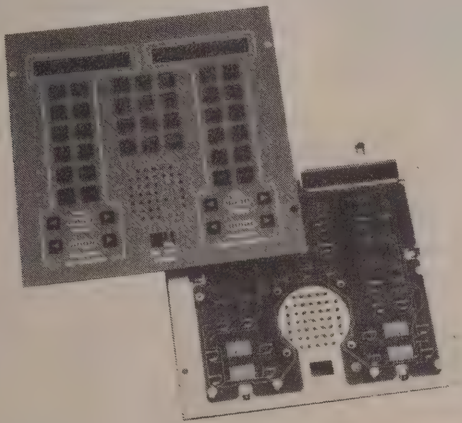
Tactile feedback is the snap action felt at switch closure and is achieved by the oil can effect of a stainless steel or polyester dome. Positive feedback of closure is important in applications utilizing unskilled operators or where other forms of feedback are impractical.

Jayco's tease-resistant tactile feedback mechanisms guarantee simultaneous contact and snap with both metal and plastic dome systems.

Metal (stainless steel) domes offer greater consistency of operation and reliability. Plastic (polyester) domes are more economical and make tactile feedback a practical feature for low cost applications.

SHIELDING

Jayco gives you the option to specify panels with EMI/RFI or ESD shielding. For maximum protection, the shielding is applied between the overlay and the switch layer. Shielding materials include metalized polyester, transparent ITO for windows and printed thick film.



SELECTIVE TEXTURES

Textures are used to optimize display visibility and legend clarity, selective (multi) textures allow the use of optically clear, anti-glare and matt texture coatings on Jayco panels. This technique is also used for aesthetic reasons. An added benefit is that Jayco's hard-coated textures typically have significantly better chemical and scratch resistance than the base materials.

INSERTABLE LEGENDS

Jayco responds to your visual needs with easy to change legends and graphics. An ideal feature for user definable keys, different model options, foreign language versions or prototyping.

INTEGRATED DISPLAYS

Through proprietary processes, Jayco offers one piece or laminated display windows for almost any kind of display device. With windows that are transparent or filtered. Standard filters are available in red, green or gray, with other colors available upon request.

In addition, fully interactive front panels can be made combining thin film LCD's and membrane switches in an assembly less than 0.060" thick. Call Jayco for more details.

DEADFRONT PANELS

Jayco's deadfront panel makes a complex instrument easier to use and the displays more effective.

Deadfront or secret-til-lit panels are invisible or blank until their displays are lit from behind. This effect is typically used for warning displays, or where strong impact of the hidden message is required.

TECHNICAL SPECIFICATIONS

Typical Values

Current Rating	50mA at 30VDC
Circuit Resistance	Less than 100 Ohms
Contact Bounce	Less than 5 Milliseconds (non-tactile) Less than 20 Milliseconds (tactile)
Insulation Resistance	1 Gohm Min at 100VDC
Dielectric Strength	250VRMS Min
Capacitance	27 pf Max Between Any Two Traces
Actuation Force	Variable from 3oz and up
Operating Temperature	40°C to +80°C
Operational Life	Greater than 5 Million Operation (non-tactile) Greater than 1 Million Operations (tactile)
Termination	Dupont "Clincher" Offered as Standard
Tolerances	+ or -0.010" as Standard
Emboss Height	0.010-0.015"

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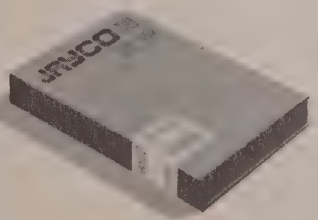

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low key

THERE IS NO GREATER PRIORITY AT LOW KEY THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE

A FULL SERVICE MEMBRANE SWITCH MANUFACTURER FEATURING COMPLETE DESIGN, PROTOTYPING AND PRODUCTION OF CUSTOM SWITCHES/KEYBOARDS, PC ENCODERS AND ASSEMBLY SERVICES

INTRODUCING 1st KEY SERVICE FROM "LOW KEY CORP."

A comprehensive package that translates your prototype design into production ready systems in 15 working days or less.

1st KEY SERVICE is more than just the proven reliability of membrane keyboard technology. 1st KEY SERVICE is the state-of-the-art in producing prototype, brass board, or pre-production keyboards, in as little as 2 weeks! With over 25 years of combined hands-on design knowledge and CAD/CAE support, your prototype is an investment in quality.

Think what the advantages of 1st KEY SERVICE can do to eliminate the work/time loss and bottlenecks created through confusion and the world of parading would-be keyboard suppliers flooding your lobbies today.

CAD/CAE ANALYSIS AND CORRECTION

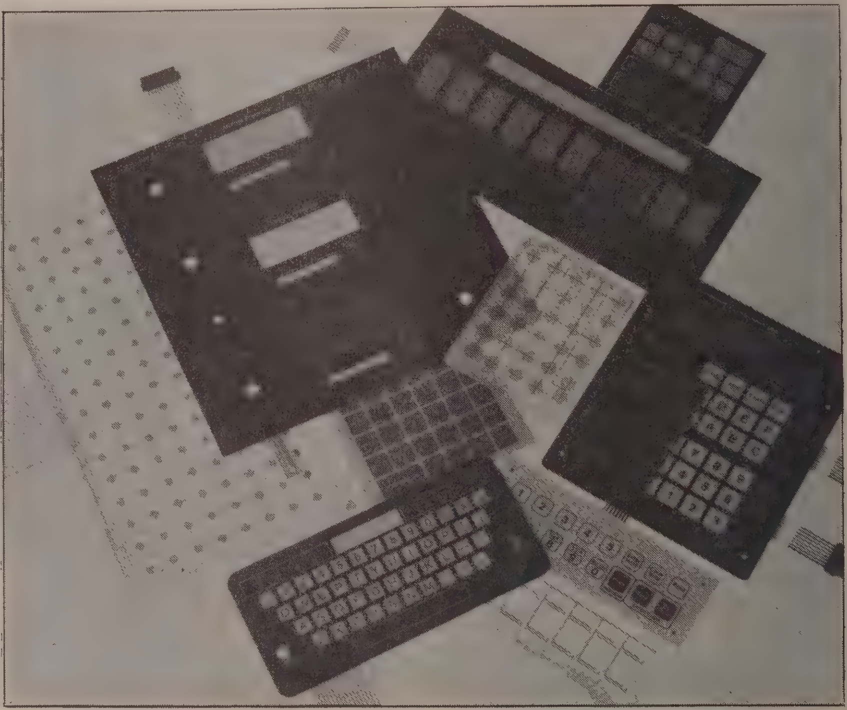
With 1st KEY SERVICE your design documentation must stand the "test." It will undergo CAD/CAE Analysis as the 1st step in validating your design. If conflicts exist, you will be notified immediately by phone and provided with options and solutions.

Most importantly 1st KEY SERVICE ensure conformance to the most rigid of mechanical and electrical standards. We can't afford to give you anything less than outstanding quality.

If you've got a hot project that needs 1st key treatment call us.

BACKLIGHTING

Low Key offers a wide variety of options and configurations. Utilizing both electroluminescent panels, liquid crystal reflective displays and surface mount L.E.D.'s.



CUSTOM SWITCHES/ KEYBOARDS

Low Key membrane products represent the ultimate in state of the art materials, design options and operational stability over a wide range of User environments. Low Key design options, include both polyester film and printed circuit board substrates, offering a wider range of current, temperature and mounting geometries.

GRAPHICALLY APPEALING

Low Key graphics are more than, just so much decorative "window dressing." Utilizing its years of experience, Low Keys graphic arts department has met the most enduring standards of excellence developed over the widest possible range of photographic imaging requirements; And end User environments. The graphic standards today, are what sells "your products" tomorrow.

UNIVERSAL MEMBRANE SWITCH/KEYBOARD ENCODERS

Low Key introduces the USE-144 universal encoder series, providing a pure PC encoding interface for Low Keys custom membrane switch/keyboard designs. The USE-144 is software configurable which can be used with any contact type keyboard with a switching matrix up to 12×12=144 keys.

ASSEMBLY SERVICES

Low Key provides turn-key assembly and testing of display, driver and controller boards, in conjunction with specific switch/keyboard related applications. One stop shopping lessens the USER exposure to costly delays and confusion with multiple sources.

LOW KEY CORP. 105 MAPLEWOOD AVE. / GLOUCESTER, MA 01930-1195 / (508) 281-0448 FAX (508) 281-6321

low key

THERE IS NO GREATER PRIORITY AT LOW KEY THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE

MEMBRANE SWITCHES

A Low Key membrane switch consists of a decorative, silk screened graphic overlay combined with conductive inks on a polyester carrier which, when assembled, forms a low voltage switching device.

Low Key membrane keyboards are sealed from the environment. This protects them from gross chemical and atmospheric contamination. Having no moving mechanical parts to fail, the membrane keyboard is highly reliable, cost effective, and environmentally efficient.

OPERATING CHARACTERISTICS

• Operating Voltage	30Vdc
• Operating Current	20ma Typical
• Contact Resistance	2-50 Milliohms
• Circuit Resistance	20-30 Ohms*
• Life Cycles (MTBF)	5,000,000
• Activation Forces Ounces	3-12 oz
• Travel Inches	0.006 Typical
• Bounce, Milliseconds	20 Typical
• Operating Temperature	0 to 150°F** −18 to 65°C**

Normal range forces can be varied to meet your specifications.

* Depending on size and configuration of circuit.

** Selected lamination materials are available for high temperature applications.

DESIGN OPTIONS TO CONSIDER

A. Transparent lens for LCD display (UV-hardcoated—clear glossy)
B. Frosted windows for LEDs
C. Membrane switch contact with embossed locating ring
D. Die-cut keyways for pushbuttons
E. Electroluminescent lighting
F. Printed gas discharge display window (UV-hardcoated—transparent green)
G. UV-textured velvet finish
H. Membrane switch contact flat keypad surface
I. Printed deadfront legend for seven segment display, visible only when illuminated. A variety of colors available
J. Membrane switch contact with embossed keypad and stainless steel domes
K. Aluminum molded on machined subplates
L. Threaded studs and fasteners
M. Polycarbonate Face with UV-printed hardcoat finish
N. Embossed surface for decorative effect

Note: See Design Data Sheets for specific details on A through N.

CONSTRUCTION & FINISHING

DIE CUTTING

Low Key utilizes laser cut steel rule dies. Steel rule die cutting is carried out on all components of the keyboard. Typical tolerance levels of a steel rule die is generally ±0.010 for overall dimensions, and less for die cut holes, key ways, cut outs, and rounded corners.

EMBOSSING

Embossing of the keypad areas on membrane switch overlays is offered by Low Key, to accent key switch areas and to enhance tactile response. Embossed areas can raise circular, square, or rectangular keys more than 0.030 inches above the overlay surface.

TERMINATIONS

Low Key membrane keyboards are most commonly terminated with Dupont/Berg insulation displacement connectors. Common to all flat and flexible circuit connectors, the clincher assembly mates to 0.025 inch pins or headers on a 0.100 center to form a complete interconnection system. Low Key offers other types of interconnect systems in varying configurations and geometry.

SNAPDOMES

Low Key metal snap action domes provide positive feedback over a wide spectrum of operational conditions. Dome sizes range from 0.50 inches in diameter and smaller. Domes are fabricated from a passivated stainless steel spring material. Electrical contact is made when a snap dome is given sufficient finger pressure, causing the dome to snap over into a flattened shape. This forces the dimple to bring the top and bottom circuits into contact with each other. Snap domes are not in intimate contact with the circuit.

Typical specifications on Low Key tactile domes are:

Operational M.T.B.F.	1.0 million
Total Travel	0.015 max.
Pretravel	0.008
Overtravel Nominal	0.007
Trip Travel at Make Point gm	250 gm ±4
Tactile Range	medium

L.E.D.'S

If densities are shrinking, combine size efficient surface mounted L.E.D.'s within your next membrane switch design. Low Key's construction techniques provide unlimited SMD arrays at no increase in assembly thickness, typically 0.035″ to 0.042″.

ELECTROLUMNESCENT PANELS

The durable thin film of the EL panel offers long life, uniform lighting. They are individually addressable, and add as little as 0.011″ to your assembly.

Capacitance	.0035 ufd/in²
Phase Angle	Up to 75 degrees leading
Frequency	60-400 Hz
Voltage	115 AC

UNIVERSAL MEMBRANE SWITCH/KEYPAD ....ENCODER...........

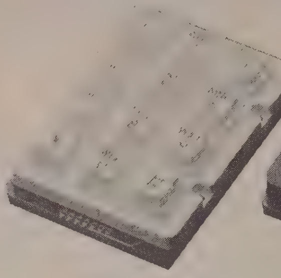
Low Key offers the USE-144 micro-processor based encoder with its custom membrane switch and keyboard products. The USE-144 is software configurable, detecting and encoding up to 144 keys in matrices up to 12 × 12. Selectable output data provides either, PCXT/AT format or in RS232/432 formats. The USE-144 is powered from a single +5v power supply. No +/− 12v supply is required even for true RS-232 signals. The encoder is uniquely size efficient 1.500″ × 3.500″ × 0.500″ and is easily mounted to the back of your custom membrane switch/keyboard. Complete technical data is available upon request.

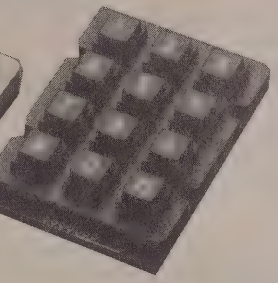
LOW KEY CORP. 105 MAPLEWOOD AVE. / GLOUCESTER, MA 01930-1195 / (508) 281-0448 FAX (508) 281-6321

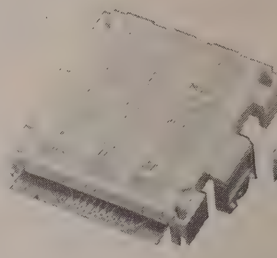
INDUSTRY-STANDARD KEYPADS

Twelve popular styles, with custom markings and colors available.

• TELECOMMUNICATION • CONTROL EQUIPMENT •
• SECURITY SYSTEMS • AND MANY OTHER USES •


TKA2200


TKN2201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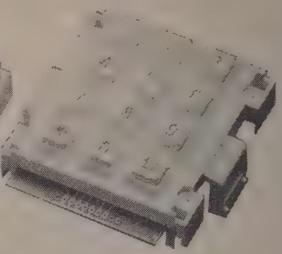
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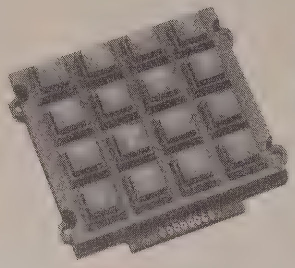
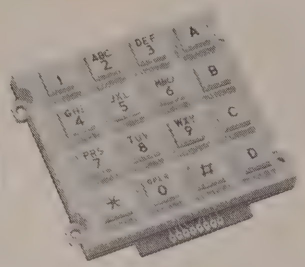

TKA8100
(NUMERIC KEYS)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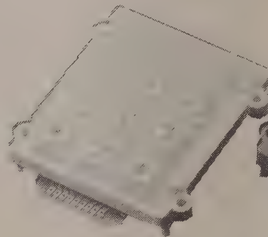
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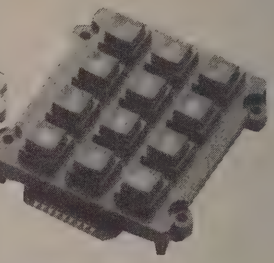
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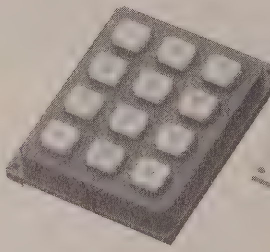
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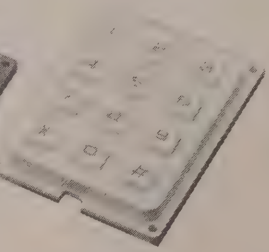
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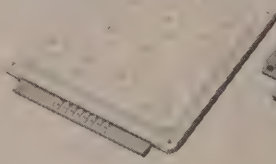
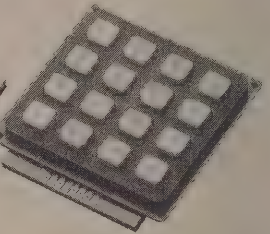

TKN6100

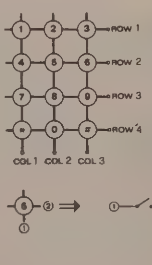

TKA6102

SPECIFICATIONS:

1) LZR ELECTRONICS offers a wide range of standard telephone keyboards utilizing silicone rubber as the elastic actuator and conductive silicone rubber pad as the contact element.
2) GENERAL SPECIFICATIONS:
   - Contact rating: 20mA, 24VDC
   - Contact resistance: 200 ohm max.
   - Life: 1,000,000 cycles per key
   - Operating Temperature: −20°C to +60°C
   - Storage Temperature: −40°C to +65°C
3) MATERIALS
   - Bezel: Material is ABS, or Polycarbonate: black, white or grey.
   - Double-shot keytops: Material is ABS, black or white.
   - PCB: Matrix type circuit, Grade HB or FR2 board with wire jumpers or double-layer jumpers with gold plated contacts
   - Terminal: Pin wafer.
   - Aluminum shield for ESD to be customer specified.
4) Custom designs are welcome. Minimum quantity 5K pcs.

3 x 4

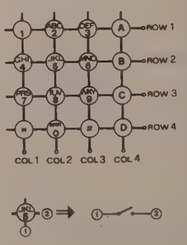
CIRCUIT DIAGRAM



OUTPUT ARRANGEMENT	
OUTPUT PIN NO.	SYMBOL
1	
2	COL 2
3	ROW 1
4	COL 1
5	ROW 4
6	COL 3
7	ROW 3
8	ROW 2
9	
10	

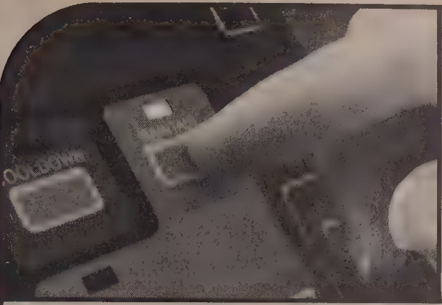
4 x 4

CIRCUIT DIAGRAM



OUTPUT ARRANGEMENT	
OUTPUT PIN NO.	SYMBOL
1	ROW 2
2	ROW 3
3	COL 1
4	ROW 4
5	COL 2
6	COL 3
7	COL 4
8	ROW 1

LZR electronics, inc. 8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301) 921-4600 Fax (301) 670-0436 **LZR**

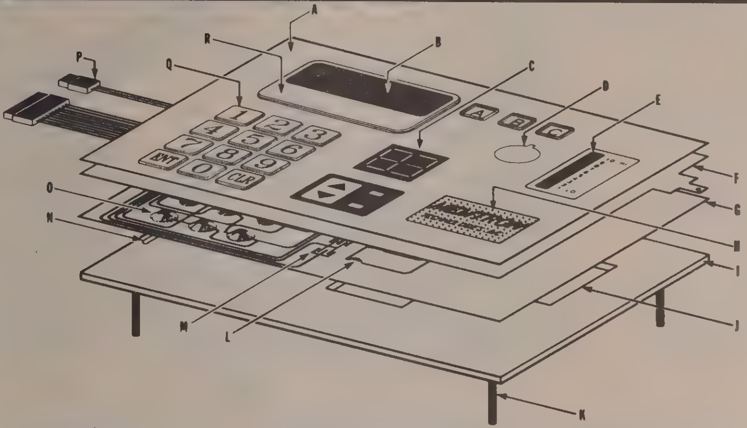


MEMTRON®
MEMBRANE SWITCHES

WHEN YOU NEED ASSURANCE, WE'LL BE IN TOUCH.

Over the years, many membrane switch manufacturers have come and gone, but at MEMTRON, we're stubborn, we've stuck to our guns. And now, when it comes to **quality, research and development, product warranties,** and **service,** we're

"IN TOUCH WITH YOUR TECHNOLOGY®."



A MEMTRON membrane switch consists of a decorative and functional graphic overlay combined with conductive inks on a polyester carrier which, when assembled, form a low-voltage switching device.

MEMTRON membrane switches are completely sealed from the environment, making them extremely impervious to chemical and solvent attack. With no mechanical parts to fail, the panel is highly reliable and efficient.

SPECIFICATIONS OF SNAP DOMES

Life Expectancy, cycles	2,000,000
Total Travel, nominal inches	0.015
Pretravel, nominal inches	0.012
Overtravel, nominal inches	0.003
Trip Force at Operating Point, grams	300
Tactile Feel	high

STANDARD OPERATING CHARACTERISTICS:

Operating Voltage, volts dc	.30
Operating Current, milliamps	.30
Operating Power, watt***	.0.250
Contact Resistance, ohms	.2 to 100
Circuit Resistance, ohms*	.20 to 100
Life Expectancy, cycles	.5,000,000
Activation Force, ounces +	.5 to 8
Travel, inches	.0.006
Bounce, milliseconds	.1 to 10
Operating Temperature, °F (°C)**	.0 to 150 (-18 to 65)

***Operating voltage and operating current in conjunction not to exceed the operation power characteristic

*Depending on size and configuration of circuit

†Normal range Any force can be obtained to meet your specifications.

**Special laminations and materials are available for high-temperature applications

Note: Contact Memtron engineering for special operating requirements

DESIGN OPTIONS

A. **The Membrane Switch Overlay:** To meet special environmental and design conditions. May consist of polycarbonates, polyesters, or special-composition plastics.

B. **Transparent Display Windows:** Used primarily for viewing LCD displays. May consist of the clear, glossy overlay material, with or without U.V. hardcoating. Inserted lenses are also available.

C. **Tinted or Deadfront Display Windows:** Used primarily with LED or gas-discharged displays. May be printed or inserted lenses.

D. **Die-Cut Holes With Keyways:** For application of mechanical switches, in conjunction with the membrane switch, in higher voltage applications.

E. **Gloss UV Hardcoat on Textured Overlay:** Used to create an inexpensive transparency when using a pre-textured overlay material such as velvet polycarbonate.

F. **Shielding Layer:** May consist of solid foil or plastic layer printed with conductive inks. May be designed to guard against EMI, ESD, and RFI conditions.

G.-1 **Membrane Switch Composite:** Consists of layers of heat-stabilized plastics with printed circuitry and spacer layer. Assembled with special adhesives.

G.-2 **Printed Circuit Board Construction:** Consists of Non-oxidizing coated copper-etched circuits on glass epoxy or other PCB substrate.

H. **Selective Texturing:** UV hardcoat textures may be applied in selected areas on gloss overlay materials to impart abrasion, chemical attack, or glare resistance.

I. **Sub-Plates:** A rigid plate used for mounting membrane switches to an enclosure. May consist of aluminum, glass epoxy, or other materials.

J. **Sub-Plate Cut-Outs:** To allow the viewing of displays mounted on a PC board behind the sub-plate.

K. **Studs and Stand-Offs:** For fastening sub-plates to enclosures or for fastening PC boards and displays to sub-plates.

L. **Surface-Mounted Embedments:** May consist of surface-mounted LEDs within the membrane switch composite and powered through the switch circuits.

M. **Standard or Micromotion Switch Design:** Consists of upper and lower circuit layers separated by a spacer. May also consist of a single circuit layer with shorting pad separated by a spacer.

N. **Tail Cut-Out:** An opening in the sub-plate to allow connection of switch with logic board.

O. **Domed (Tactile) Switch Design:** Consists of metal or plastic snap domes for touch response when depressing a membrane switch keypad.

P. **Connector:** May consist of prong or receptacle types with or without housing. May also consist of solder tabs or exposed traces for friction-fit connection.

Q. **Embossing (Functional):** Raised or embossed keypad areas to allow room for tactile domes. Also serves as key referencing device when keypad is ring embossed.

R. **Embossing (Decorative):** Embossed areas to enhance design or draw attention to special features. May also allow space for special legend inserts behind overlay.

For the name of our nearest representative or for literature and details, call collect 1-517-652-2656
or
1-800-234-7525

Or write Memtron Technologies
530 N. Franklin St., Frankenmuth, MI 48734

MEMTRON®
TECHNOLOGIES INC.

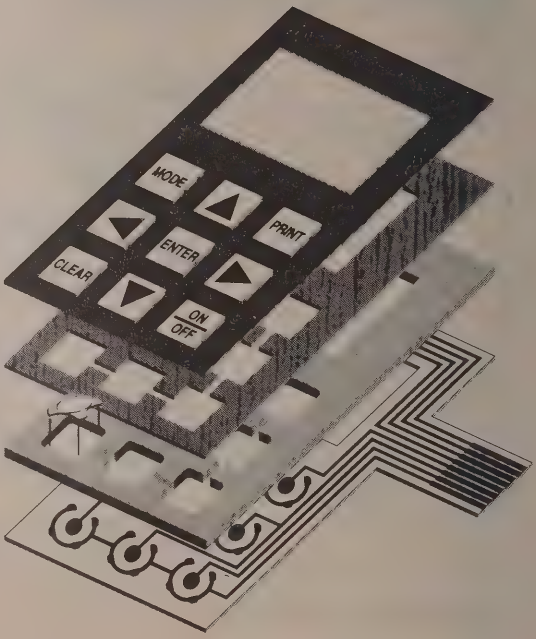
Metro-Mark
INCORPORATED

We protect your good name.

We protect your good name by . . .

*. . . asking the right questions,
listening to and analyzing your needs.
. . . committing ourselves to meeting -
and exceeding your quality standards.
. . . saving you money, without
sacrificing quality.
. . . delivering what you need, when
you need it.*

In short, by doing everything humanly possible to prove that the longer your product must last, the more you need Metro-Mark overlays, labels and flexible membrane switches.



TOOLING DISCOUNT FOR FIRST PRODUCTION ORDER

- *Tooling consists of art, screens and steel rule dies*
- *Discount percentage is determined by the dollar amount of your production order*
- *Multiply your piece price by the quantity ordered to calculate your discount*

Amount	*Discount*
$500.00 to $1000.00	*25% Discount*
$1001.00 to $2500.00	*50% Discount*
$2501.00 to $5000.00	*75% Discount*
$5001.00 and over	*100% Discount*

Other Quality Services . . .

- *Computer Aided Design (AutoCAD) with Compugraphic Laser Imagesetter*
- *Computerized Color Matching*
- *U.V Coating in a Class 10,000 Clean Room*

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Soft Tool Option Program . . .

Metro-Mark, Inc. has been providing prototype and short run orders without the use of costly dies since 1992.

Here's how our Soft Tool Option Program can benefit you:

- *Eliminates die costs*
- *Allows design changes without tool rebuilding*
- *Soft tool parts manufactured with the same care and quality as hard tooled parts*
- *Once the design is finalized, and larger volumes are required, the same CAD program will be used to manufacture the necessary dies.*

Metro-Mark
INCORPORATED
11574 Encore Circle • Minnetonka, Minnesota • 55343
Phone: (612) 935-8844 • FAX: (612) 935-5718

NEK

NEW ENGLAND KEYBOARD INC.
191 Cleghorn Street
Fitchburg, MA 01420
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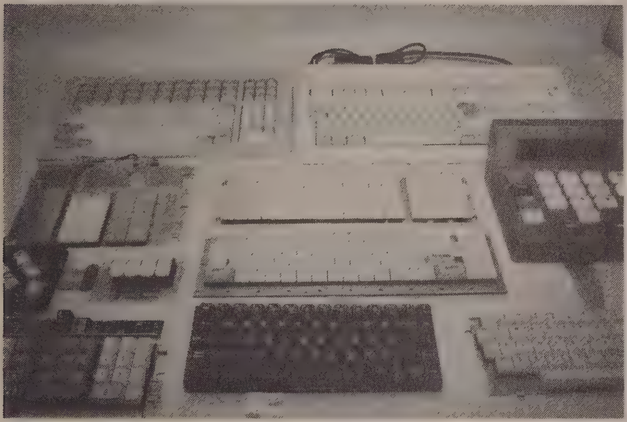
CUSTOM KEYBOARDS

WITH SEALED CONTACTS

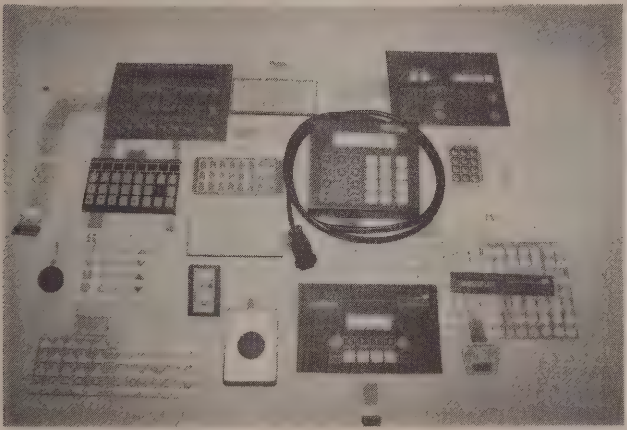
FULL TRAVEL KEYBOARDS



At New England Keyboard we design and manufacture keyboards according to your specific needs. Our modular design concept and computer aided robotic assembly equipment enable us to achieve short lead times and the economies of large scale production in small to medium runs.

- Linear or Tactile Feedback
- Low Profile Din Compliance
- 50,000,000 Key Life
- Customer Defined Electronics
- Military Keyboards
- Choice of Enclosure Styles
- ASCII, IBM™, Apple™, Electronics
- Many Hardware Options
- Backlighted Key Modules
- Choice of Key Colors, Legends
- Relegendable Keycaps

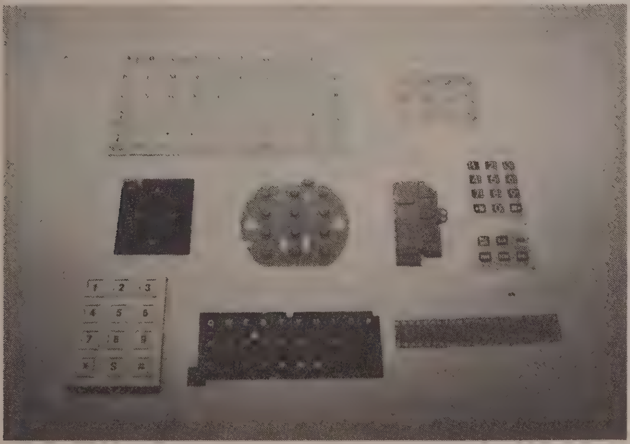
MEMBRANE SWITCHES



Flat panel membrane manufactured to your exact specification. Special solvent resistant textured overlays stand up to the harshest environments. NEK membranes are currently on the job in the Military, in-the-vehicle and the commercial kitchen.

- Unlimited Color Choices
- Tactile Feedback Option
- Clear and Tinted Windows
- LEDs Available
- Embossing
- Alone or with Electronics
- Choice of Connectors
- Dead Front Panels
- Integrated Displays

RUBBER KEYPADS



These rugged short stroke keypads offer substantial design flexibility. Key size, color, shape, height, legends and layout can be designed to exactly meet your requirements.

- Corrosion Resistance
- Plastic Bezels Available
- Glow in the Dark Rubber
- Sealed Contacts
- -40°C to 85°C Temp Range
- Tactile Feedback
- Choice of Key Force

MINIGLOSSARY
FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle*.

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

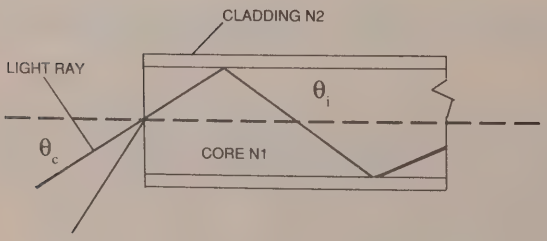
Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image. For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. “Large” is sometimes defined as greater than 85 µm.

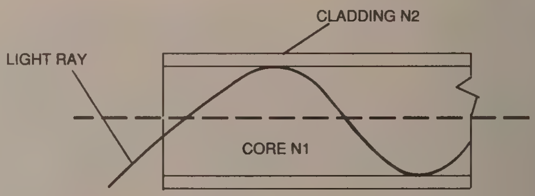
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



(b) Path of light rays in a graded index fiber.

RUGGEDIZED SWITCH PANEL & CUSTOM KEYBOARD DESIGNS

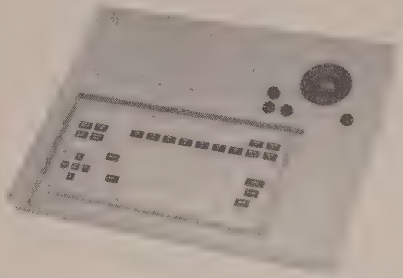
CORPORATE FACILITIES: 80 CABOT COURT,HAUPPAUGE, L.I., NY 11788, TELEPHONE: (516) 435-8300 • FAX (516) 435-8458
5606 CORPORATE AVENUE, CYPRESS, CA 90630, TELEPHONE: (714) 527-0561 • FAX (714) 527-7552

ORBIT INSTRUMENT CORP.

MILITARIZED KEYBOARD / BALL TRACKER ASSEMBLIES

OPERATE CONTROL TRAY
KEYBOARD TRACKBALL

INSTALLED IN CONSOLES AS REMOVABLE ASSEMBLIES FOR EASY ACCESS

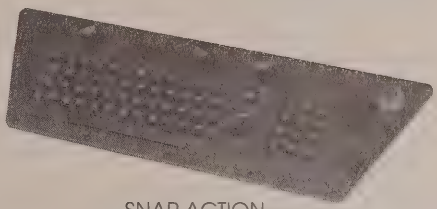


OPERATE CONTROL TRAY
KEYBOARD TRACKBALL

MIL – E – 16400 / MIL – E – 5400

FULL TRAVEL
BACKLIGHTED
KEYBOARD

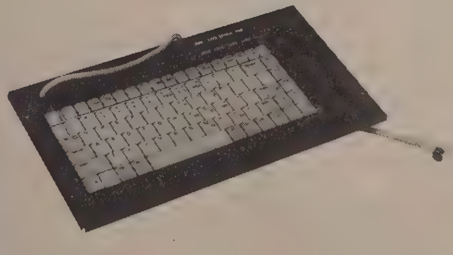
BACK LIGHTED KEYBOARDS & CUSTOM PANEL DESIGNS



SNAP ACTION
BACKLIGHTED
KEYBOARD OPTICAL
ENCODERS,FORCESTICK

FEATURING:

- ORBIT LOW PROFILE SNAP ACTION SWITCH TECHNOLOGY
- SWITCHES CAN BE SPLIT LEGEND OR TRI SPLIT
- RUGGED DESIGN CONSTRUCTION
- RELEGENDABLE KEYCAPS
- FULL TRAVEL
- CUSTOM ENCODING
- BACKLIGHTED



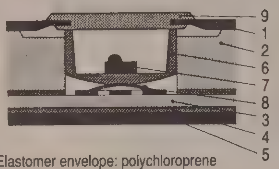
RUGGEDIZED
KEYBOARD/TRACKMARBLE
AT, IBM/PS2 COMPATIBLE

AIRBORNE
BACKLIGHTED
INTERGRATED SWITCHPANEL

secma inc.
A MEMBER OF SECME GROUP

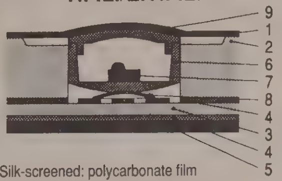
Sealed Illuminated or Non-Illuminated Keypads

T.E.L./A.V.L./P.R.L.



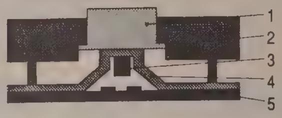
1) Elastomer envelope: polychloroprene
2) Mechanical medium: polycarbonate
3) P.C. Standard UTE 93 703/711
EP GC 2 CU 2 35 A 16 2
4) Insulator: polyester film
5) Mounting plate: Sheet metal Adx Zn B
6) Actuator: polycarbonate
7) LED T5/8" (option) red, green, yellow, amber
8) Moving contact: Cu.Be
9) Cover: polycarbonate or metallic AU 4G

T.F.L./E.T.F.L.



1) Silk-screened: polycarbonate film
2) Mechanical medium: polycarbonate
3) P.C. Standard UTE 93 703/711
EP GC 2 CU 2 35 A 16 2
4) Insulator: polyester film
5) Mounting plate: Sheet metal Adx Zn B
6) Actuator: polycarbonate
7) LED T5/8" (option) red, green, yellow, amber
8) Moving contact: Cu.Be
9) Transparent cover: polycarbonate

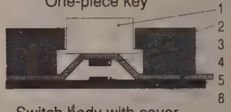
E.CO



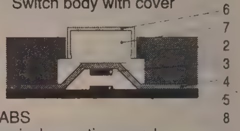
1) Key polycarbonate
2) Mechanical medium: polycarbonate
3) Moving contact: amorphous carbon
4) Elastomer membrane
5) P.C.: Standard UTE 93 703/711 PF CP 4 CU

CT 83

One-piece key



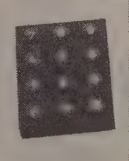
Switch body with cover

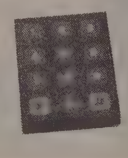


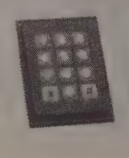
1) Key: ABS
2) Mechanical mounting: noryl
3) Moving contact: amorphous carbon
4) Elastomer membrane
5) P.C. standard: UTE 93703/711
6) Cover: ABS
7) White body (colour on request)
8) Contact area

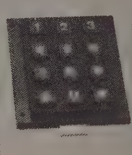
SPECIFICATIONS

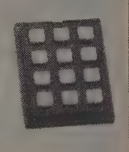
- ISO 9002











ELECTRICAL CHARACTERISTICS		AVL-AVLE-PRL-TEL	TFL	E.T.F.L.	CT 83	E.CO
Function		OFF-MOM	OFF-MOM	OFF-MOM	OFF-MOM	OFF-MOM
Nominal voltage:	V	24	24	24	10	24
Maximum voltage:	V	50	50	50	24	24
Minimum voltage:	mV	10	10	10	500	500
Nominal current:	mA	50	50	50	30	20
Minimum current:	mA	1	1	1	10	10
Nominal contact power rating:	W	1	1	1	0,7	0,5
Contact resistance: (50 mV/10 mA):	mΩ	<100 mΩ	<100 mΩ	<100 mΩ	<120 Ω/1N	220 Ω/1N
Insulation resistance at 100 V DC:	MΩ	>1000 MΩ	>1000 MΩ	>1000 MΩ	>1000 MΩ	>1000 MΩ
Bounce characteristics:		consult SECME	consult SECME	consult SECME	consult SECME	consult SECME
Number of operations:	at nominal capacity	$>10^6$	$>10^5$	$>10^5$	$>10^6$	$>10^6$
Illuminated version: L.E.D.		yes, except P.R.L.	yes	yes	no	no
MECHANICAL CHARACTERISTICS						
Tactile button:		•	•	•	•	•
Actuation force:	N	5,0 ± 35%	6,0 ± 35%	4,0 ± 35%	1,8 ± 35%	1,2 ± 35%
Travel:	mm	0,7 ± 0,3	0,7 ± 0,3	0,7 ± 0,3	2	1,4 ± 0,1
Contact material:		Au/Au	Au/Au	Au/Au	carbon/Au	carbon/Au
Resistant to vibration of 1.5 mm amplitude (IEC 512-4):	Hz 10 cycles 10 G	2000/10	2000/10	2000/10	55/10	55/10
Mechanical shock resistance (IEC 512 - 4):	100 G	•	•	•	—	—
Mechanical shock resistance (IEC 512 - 4):	40 G/1000	•	•	•	—	—
E.S.D. protection:	V	5000	5000	5000	5000	5000
Graphics: symbol height	h(mm)	5,5	5,5	5,5	6,5	3,5
ENVIRONMENTAL CHARACTERISTICS						
Operating temperature range:	°C	-25 +85	-25 +85	-25 +85	-25 +70	-25 +85
Storage temperature:	°C	-40 +85	-40 +85	-40 +85	-40 +85	-40 +85
Saline mist (IEC 512 - 6):	hours	48	48	48	—	—
Damp heat (IEC 512 - 6):	days	21	21	21	—	—
Front sealed when mounted:	IEC 144	IP 67	IP 65	IP 65	—	—

A.V.L. /A.V.L.E. - P.R.L. - T.E.L. series

- **Buttons & marking:** The A.V.L. Series keypad metallic buttons are made of black Au4G, mechanically engraved.
  The T.E.L. & P.R.L. series keypad buttons are made of opaque polycarbonate coloured or translucent (illuminated).
  Marking is done by hot stamping.
- **A.V.L. Keypad:** Mounted behind a metal panel, it offers protection from burning cigarettes, tools, knives, nail files, etc.
- **A.V.L.E. Keypad:** Mounted behind a metal panel, the A.V.L.E. keypad guarantees absolute protection against the wrenching of keys: the specially formed shoulder-keys prevent dismantling from the front of the keypad.
- **T.E.L. Keypad:** For frequent use in an aggressive environment, SECME recommend a negative marking with uniform color under the transparent cover. Any marking wear or erasure will be prevented by this process.
- **Graphics:** Helvetica medium is used for the graphic characters; standard layouts are shown hereby. Other symbols or characters may be used for button marking (consult SECME).
- **Illuminated series:** Each button is lit individually by a circuit independent of the contact circuit, except for the 8 button keypads which are lit simultaneously. Matrix wiring or common point identical with the electrical circuit. Foolproof and polarised connector.

T.F.L. - E.T.F.L. series

- **Design, graphics:** design, custom graphics and identification are silk screened on the reverse side of a polycarbonate film which is thermoformed in the actuation zones. Helvetica medium is used for the graphic characters. The silk screen polycarbonate film is replaceable.
- **Illumination:** For the illuminated T.F.L. series, each actuation zone is lit individually by a circuit independent of the contact circuit. Matrix wiring or common point is identical with the electrical circuit. Foolproof and polarised connector. For the illuminated E.T.F.L. series, the LED simultaneous lighting is provided by a circuit independent of the contact circuit. Matrix wiring or common point is identical with the electrical circuit. A foolproof and polarised connector is used to connect both these circuits.

CT 83 series

These keypads have been designed to be simple and rugged (tear resistant buttons) in order to market a low-cost and reliable product meeting the wide industrial requirement range. The KIT mounting provides a great versatility of application. Colored or marked snap-on covers are available for the user to give a personal touch to the keypad according to the desired configuration. When they are used in an aggressive environment, keypads fitted with transparent covers are recommended. This protection eliminates printing wear or erasure.

E.CO. series

E.CO. series keypads are specially suited for encoding, remote control, telephone, etc. Their polycarbonate buttons are of the tactile actuation type. Typical application of E.CO. keypads is for volume production systems.

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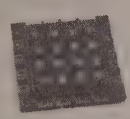
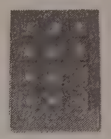
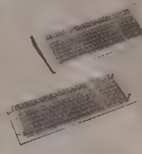
Keypads

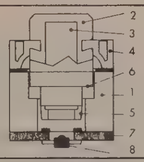
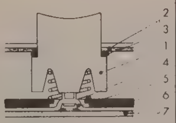
- **Vandal-Proof**
- **Sealed and rugged**
- **PC Compatible keypads**

					
ELECTRICAL CHARACTERISTICS		**A.V.H.S.**	**A.V.H.P.**	**STORM TEC**	**STORM TES**
Function		OFF-MOM	OFF-MOM	OFF-MOM	OFF-MOM
Nominal voltage:	V	24	24		
Maximum voltage:	V	24	24	24	
Minimum voltage:	mV	50	50		
Nominal current:	mA	30	20		
Minimum current:	mA	10	10		
Nominal contact power rating:	W	0,7	0,7	1	
Contact circuit resistance: (50 mV/10 mA)	mΩ	<100	<120		
Insulation resistance at 100 V DC:	MΩ	>1000	>1000	>100	
Bounce characteristics:	ms	<10	<15	5	<5
Number of operations:	(at nominal capacity)	$>10^6$	$>10^6$	2×10^6	2×10^6
Illuminated version: L.E.D.		yes	no	yes	no
MECHANICAL CHARACTERISTICS					
Tactile button:		•	•	•	•
Anti-pull off button:		—	yes	—	—
Actuation force:	N	3 ± 20%	3 ± 20%	1,6 ± 25%	1,6 ± 25%
Travel:	mm	2,5	2,6	1,4 ± 0,1	1,4 ±0,1
Contact material:		Carbon/Au	Carbon/Au	Carbon/Au	Carbon/Au
Resistant to vibration of 1.5 mm amplitude (IEC 512-4):	Hz 10 cycles 10 G	500/10	500/10	2000/55	
Mechanical shock resistance (IEC 512-4):	100 G	•	•	•	•
Mechanical shock resistance (IEC 512-4):	40 G/1000	•	•		
E.S.D. protection:	V	5000	5000	10000	10000
Graphics: symbol marking height	h(mm)	5,5	7	5,5	5,5
ENVIRONMENTAL CHARACTERISTICS					
Operating temperature range:	°C	-25 +85	-25 +85	-55 +125	-25 +85
Storage temperature:	°C	-40 +85	-40 +85	-55 +125	-30 +100
Saline mist (IEC 512-6):	hours	96	96	48	48
Damp heat (IEC 512-6):	days	21	21	10	10
Front sealed when mounted:	IEC 144	IP 65	IP 53	IP 67	IP 67

Vandal-Proof Keypads Series

A.V.H.S. series
The Vandal-Proof High Security keypads are 16 button keypads having possible 4 button modular extensions. Resistance against wear and vandalism is the main characteristic of the A.V.H.S. keypad. The buttons can withstand a 100 N tension or actuation force. These front sealed keypads may be fitted with individually illuminated buttons.

A.V.H.P.
The origin of A.V.H.P. is an order from the French Postage and Telecommunication Administration to implement magnetic card pay phones. These keypads have been designed to withstand all climatic and social environmental stresses of consumer electronics. The anti-pull off resistant buttons can withstand a 200 N tension and a 200 N actuation force.
Highly resistant markings are designed to withstand user vandalism (coins, nail file, keys or other usual tools). Available in 12, 16 and 17 key versions.

A.V.H.S.	A.V.H.P.
	
1) Mechanical medium: reinforced polyester	1) Anti-wrenching key: zamac, resists a wrenching force of 200 N
2) Key: metal Au 4G	2) Frame: stainless steel
3) Actuator	3) O-ring sealing
4) Sealing membrane	4) Compensating spring
5) Moving contact: amorphous carbon	5) Buffer plate: stainless steel, resists a static bearing strength of 200 N Mounting strength: 400 N
6) Mechanical stop, resists a static bearing strength of 100 N	6) Moving contact: amorphous carbon
7) P.C.: Standard 93 703/711 EP GC 2 CU 2 35 A 16 2	7) P.C.: Standard UTE 93 703/711 EP GC 2 CU 2 35 A 16 2
8) LED T5/8" (option): yellow	

Industrial Keypads Storm Series

- STORM keypads are suitable for use in the most severe environments. They are designed to withstand the ingress of liquids and other contaminants; being fully sealed (IP67), they can be used in the most demanding environments: military, medical, industrial applications, etc.
- The exceptional reliability of STORM keypads (more than 2 million operations) is the result of highly developed construction techniques. A moulded silicone rubber mat is secured around a rigid circuit chassis providing its own environmental seal.

All keypads have keytops that move with an "over centre" action when pressed, providing the operator with positive tactile confirmation of contact. This ensures fast and accurate data entry even when the keytops are not struck accurately.

Storm Tec

The 4/12/16 & 36 key STORM keypads modular design enables combinations of keypads to be used to produce specific keyboard layouts.

Storm Tes	**Storm Tes Modules**
91 Keys	- 13 keys (function pad)
PC compatible	- 18 keys (numeric pad)
Desk and rack versions	- 60 keys (Qwerty/Azerty layout)
Pressure equalization system	- led indicator module

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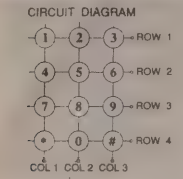
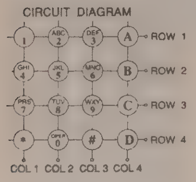
Standard Circuit Diagram


CIRCUIT DIAGRAM
1
2
3
ROW 1
4
5
6
ROW 2
7
8
9
ROW 3
*
0
#
ROW 4
COL 1
COL 2
COL 3

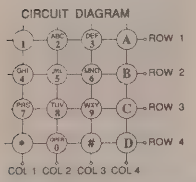
3 X 4

OUTPUT ARRANGEMENT	
OUTPUT PIN NO	SYMBOL
1	
2	COL 2
3	ROW 1
4	COL 1
5	ROW 4
6	COL 3
7	ROW 3
8	ROW 2
9	
10	


CIRCUIT DIAGRAM
1
ABC 2
DEF 3
A
ROW 1
GHI 4
JKL 5
MNO 6
B
ROW 2
PRS 7
TUV 8
WXY 9
C
ROW 3
*
OPER 0
#
D
ROW 4
COL 1
COL 2
COL 3
COL 4

AK-1604, 1604A

OUTPUT ARRANGEMENT	
OUTPUT PIN NO	SYMBOL
1	COL 1
2	COL 2
3	COL 3
4	COL 4
5	ROW 1
6	ROW 2
7	ROW 3
8	ROW 4


CIRCUIT DIAGRAM
1
ABC 2
DEF 3
A
ROW 1
GHI 4
JKL 5
MNO 6
B
ROW 2
PRS 7
TUV 8
WXY 9
C
ROW 3
*
OPER 0
#
D
ROW 4
COL 1
COL 2
COL 3
COL 4

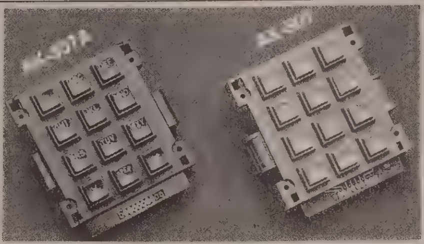
AK-1607, 1607A

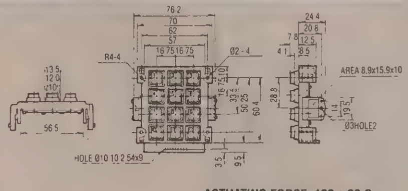
OUTPUT ARRANGEMENT	
OUTPUT PIN NO	SYMBOL
1	ROW 2
2	ROW 3
3	COL 1
4	ROW 4
5	COL 2
6	COL 3
7	COL 4
8	ROW 1

MNR offers a wide range of standard telephone keyboards utilizing silicone rubber as the elastic actuator and conductive silicone rubber pad as the contact element.

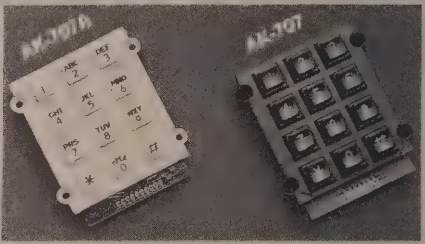
General Specification:

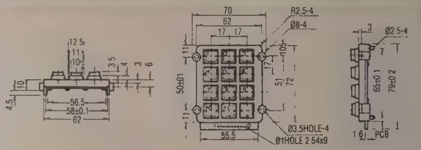
- Contact rating: 20mA, 24VDC
- Contact resistance: 200 ohm max
- Life: 1,000,000 cycles per key
- Operating Temperature: -20°C to +60°C
- Storage Temperature: -40°C to +65°C


AK-301A
AK-301

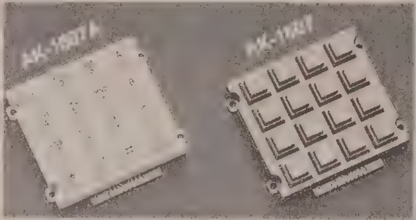

76 2
70
62
57
16 75 16 75
R4-4
Ø2 - 4
24 4
20 8
7 8
12 5
4 1
8 5
AREA 8.9x15.9x10
13 5
12 0
10
56 5
28 8
60 4
Ø3HOLE2
HOLE Ø10 10 2 54x9
3 5
9 5

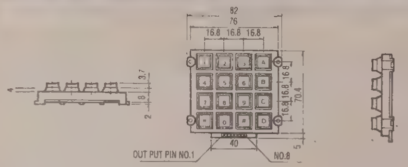
ACTUATING FORCE: 100 ± 30 Grams
STROKE: 2.0 ± 0.5mm


AK-307A
AK-307
ABC 2
DEF 3
GHI 4
JKL 5
MNO 6
PRS 7
TUV 8
WXY 9
*
OPER 0
#

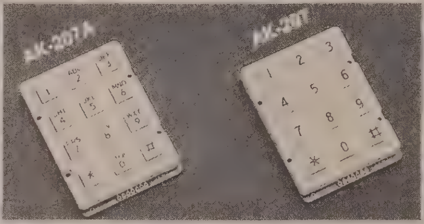

70
62
17 17
R2.5-4
Ø8-4
3
Ø2 5-4
12 5
11
10
3 5
4
3
6
56.5
58±0.1
62
50±01
51
72
65±0 1
79±0 2
55.5
Ø3.5HOLE-4
Ø1HOLE 2 54x9
1 6
PCB

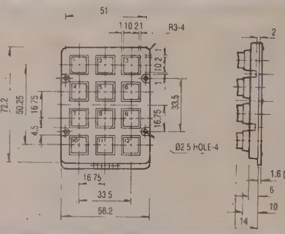
ACTUATING FORCE: 100 ± 30 Grams
STROKE: 2.0 ± 0.5mm


AK-1607A
AK-1607

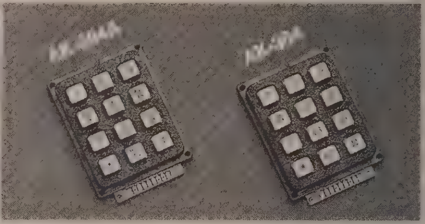

82
76
16.8 16.8 16.8
3.7
16.8
16.8
70.4
40
OUT PUT PIN NO.1
NO.8

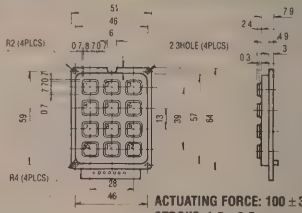
ACTUATING FORCE: 100 ± 30 Grams
STROKE: 2.0 ± 0.5mm


AK-207A
AK-207
1
2
3
4
5
6
7
8
9
*
0
#

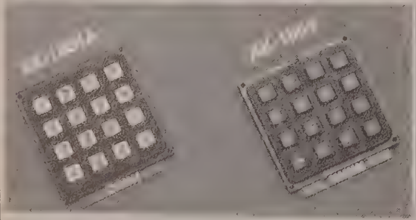

51
11 0 21
R3-4
2
10 2
72 2
50 25
16 75
33 5
16 75
4 5
Ø2 5 HOLE-4
16 75
33 5
56.2
1.6 (P.C.B.)
6
10
14

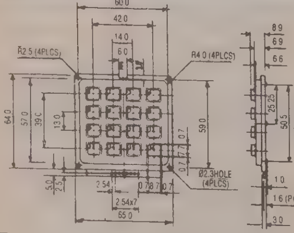
ACTUATING FORCE:
100 ± 30 Grams
STROKE: 2.0 ± 0.5mm


AK-404A
AK-404

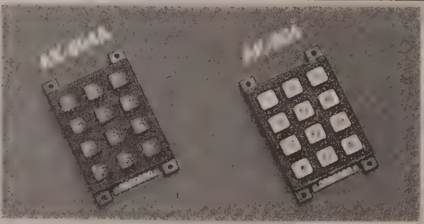

51
46
6
7 9
2 4
4 9
3
0 3
R2 (4PLCS)
0 7 8 7 0 7
2 3HOLE (4PLCS)
59
39
57
64
13
R4 (4PLCS)
28
46

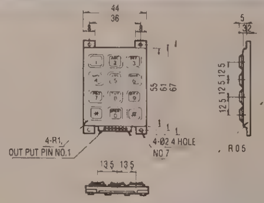
ACTUATING FORCE: 100 ± 30 Grams
STROKE: 1.5 ± 0.5mm



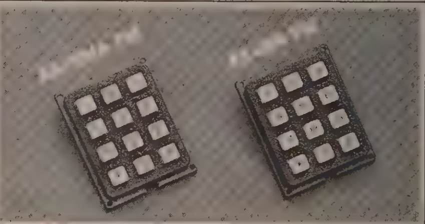

60 0
42 0
14 0
6 0
R2 5 (4PLCS)
R4 0 (4PLCS)
8 9
6 9
6 6
64 0
57 0
39 0
13 0
59 0
50 5
Ø2.3HOLE (4PLCS)
2 54
0 7 8 7 0 7
2 54x7
65 0
1 0
1 6 (P C B)
3 0

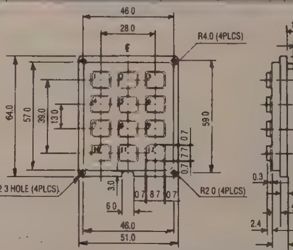
ACTUATING FORCE:
100 ± 30 Grams
STROKE: 1.5 ± 0.5mm




44
36
5
3 2
55
61
67
12 5 12 5
4-R1
OUT PUT PIN NO.1
4-Ø2 4 HOLE
NO 7
R 0 5
13 5 13 5

ACTUATING FORCE: 100 ± 30 Grams
STROKE: 1.0 ± 0.2mm




46 0
28 0
R4.0 (4PLCS)
11.0
7 5
2.5
5.3
64.0
57.0
39.0
13.0
59.0
Ø2 3 HOLE (4PLCS)
3.0
6 0
0 7 8 7 0 7
R2 0 (4PLCS)
46.0
51.0
0.3
3.0
4.9
2.4
7.9

ACTUATING FORCE:
100 ± 30 Grams
STROKE: 1.5 ± 0.5mm

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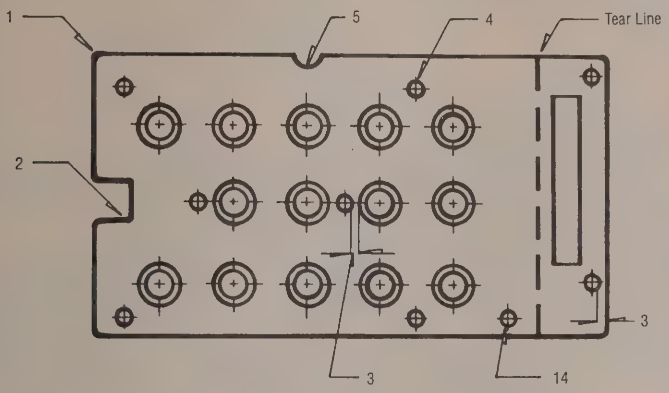
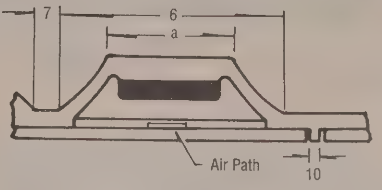
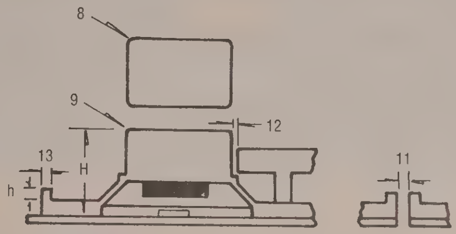
Keypad Design Guide







Design Notes

1. Minimum curvature 1.0 mm in diameter
2. Minimum curvature 0.5 mm in diameter
3. 1.5 mm or more (typical)
4. 1.5 mm or more (typical)
5. According to Notes 1,2 and 4
6. a + 2.5 (or 2.0) mm (approximately)
7. 1.5 mm (typical)
8. H<7 mm minimum R 0.4
   7<H<10 mm minimum R 0.9
9. 0.2 mm minimum
10. 1.5 mm or more (typical)
11. 1.5 mm or more (typical)
12. 0.3 mm (typical, depending on key structure, pad size, guide hole position, bezel design, etc.)
13. ≥ 1/2 h
14. Guide holes should be symetrically located and placed no further than 5mm apart.

Rubber Key Specifications

Actuation force	20 to 500 grams
Contact resistance	less than 150 ohms
Cycle life	0.5 to 30 million
Operating temperature range	-20°C to 180°C
Storage temperature range	-30°C to 250°C
Contact rating	5 milliamperes at 12V DC
	for 0.5 seconds and 20 million cycles
Contact bounce	less than 12 milliseconds
Insulation resistance	greater than 10^{12} ohms at 500 VDC
Dielectric strength	25-30 KV / mm

Dimension Tolerances

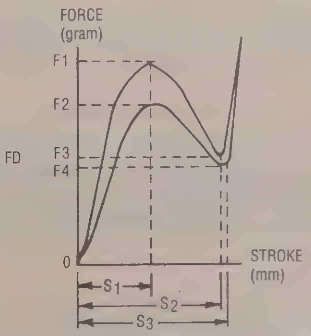
0 to 10 mm ± 0.10 mm
10 to 20 mm ± 0.15 mm
20 to 30 mm ± 0.20 mm
30 to 40 mm ± 0.25 mm
40 to 50 mm ± 0.3 mm
50 mm or greater ± 0.6%

Actuation Force Tolerances

50 grams ± 15 grams
75 grams ± 20 grams
100 grams ± 25 grams
125 grams ± 30 grams
150 grams ± 35 grams
175 grams ± 40 grams
200 grams or greater ± 50 grams

Force- Stroke Curve of Rubber Keypad

FORCE	F1	Actuation Force ($F_{MAX.}$)
	F2	Snap Force
	F3	Min Return Force (F_{MIN})
	F4	Max. Return Force
	FD	Drop Force ($F_0 = F_1 - F_2$)
STROKE	S_1	Peak Stroke
	S_2	Contact Stroke
	S_3	Contact Stroke



Asia - Europe - North America

See our Power Supply, LCD and Fan data in the other volumes of EEM.

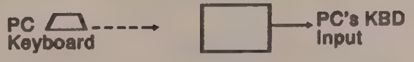
MultiNational Resources, Inc. ™

19 Harvey Road, Suite 17, Bedford, New Hampshire 03110
Telephone (603) 622-3550 [FAX] (603) 641-6991

VETRA
SYSTEMS CORPORATION

Your Authoritative Source for PC Keyboard, Mouse & Video Products

Eliminators



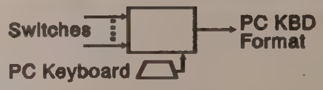
VIP-321 - "Phantom Keyboard"™. Allows error-free boot up of PC's without a keyboard.

VIP-325 - "Phantom Keyboard Plus"™. Same as the VIP-321, but also allows keyboard plug-in/out at any time. Remembers and restores keyboard indicator status.

Power: Both models are powered from the PC.

Size: Module with one or two pig-tail cables, 2.125 in by 3.25 in by 1.125 in

Keyboard Encoders

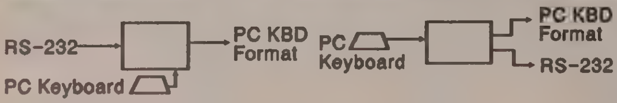


VIP-311 - Encodes switch closures into standard PC keyboard scan codes. Allows custom panels or keypads to be used in place of a PC keyboard.

VIP-312 - The "SmartWye"™ model encoder. Accepts a standard PC keyboard in addition to switches.

VIP-411 - "SmartAe"™ Encoder with RS-232 output.
Capacity: Accept up to 24, 48, 64 or 128 switches. Larger capacities on custom order.
Size: 2.6 in by 4.6 in printed circuit board, VIP-411 either housed in 1.5 in by 5.08 in by 5.25 in enclosure, or a 4.1 in by 4.8 in PCB.
Power: Powered from the PC, VIP-411 uses external power supply.

Protocol Converters

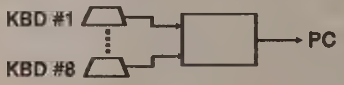


VIP-335 - "Smart Pipe"™ Converts RS-232 to PC keyboard scan code format. Also allows simultaneous use of a PC keyboard.

VIP-345 - "Reverse Pipe"™ Converts the output of a standard PC keyboard to RS-232. At the same time, allows the keyboard to be connected to the PC.

Size: Enclosure 1.5 in by 5.08 in by 5.25 in. OEM models are a printed circuit board 4.1 in by 4.8 in.
Power: VIP-335 is powered from the PC. If the VIP-345 is not connected to a PC, an external power supply is required.

Multiplexers



VIP-357 - "SmartSplice"™ Connects two PC keyboards to one PC. The **VIP-357PM** "MiceSplice"™ connects two PS/2 mice to one PC. The **VIP-343** "TeleMux"™ connects many distributed keyboards to one PC.

VIP-8231 - "MegaMux"™ Connects up to 64 keyboards to one PC, in groups of eight.

Power: VIP-357 and 357PM are powered from the PC. Other models require external power supply.
Size: Enclosure for VIP-343, 357, and 357PM is 1.5 in by 5.08 in by 5.25 in; for VIP-8231 it is 3.4 in by 12 in by 9 in.

Keypads

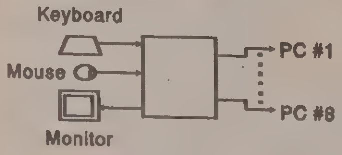
VIP-312-FS - Adapter merges Footswitch with PC keyboard. User selectable code for footswitch.

9001-48 - Programmable Auxiliary 48-key Keypad extends PC keyboard functionality.

Custom Services

CUSTOM SERVICES - We will customize all our products to match your exact needs, including mechanical, packaging, and performance modifications, from simple to complex switching and routing systems.

Keyboard/ Mouse/ Monitor Switches



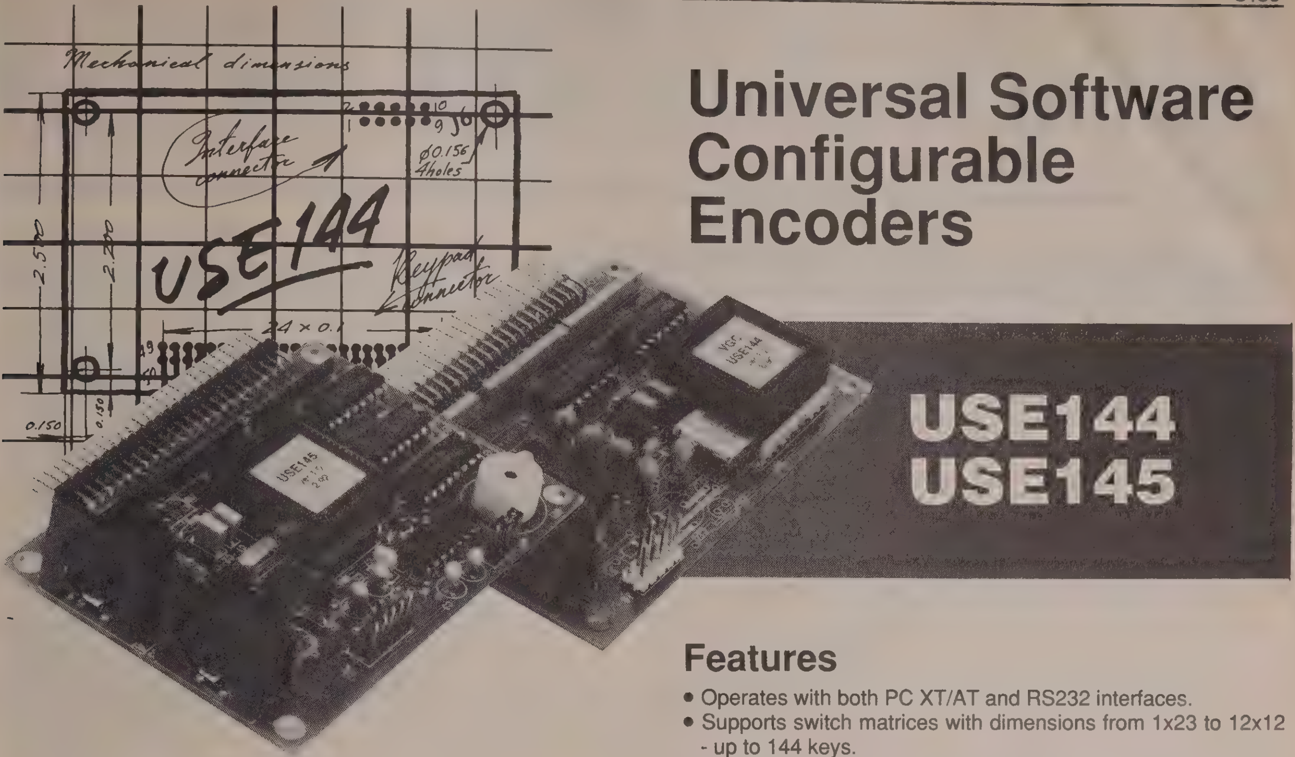
VIP-1328 - "MegaSwitch"™ Allows one keyboard/mouse/monitor set to control up to eight PC's, more with stacking. PC's will boot error free even if they are powered in any order. Keyboard indicators and parameters are set correctly after switching.

Options: Remote Control Unit; remote keyboard and peripherals; broadcast capability; channel selection from keyboard.

Power: Powered from an external 9 V DC power supply. **Size:** 12 in by 9 in by 3.4 in.

27 Newtown Road Plainview, New York 11803 USA Tel:516-454-6469 Fax:516-454-1648

Universal Software Configurable Encoders



Features

- Operates with both PC XT/AT and RS232 interfaces.
- Supports switch matrices with dimensions from 1x23 to 12x12 - up to 144 keys.
  Out of 24 input lines 20 can be configured as either "rows", "columns" or "not used". The remaining four lines must be defined as "rows" or "unused". This pinout feature allows the USE145 to work with practically any keypad pinout. This translates into size and cost savings for the keypad itself.
- Key Codes, Interface type (PC/XT, PC/AT or RS232), keypad pinout, Baud rate, typematic period and typematic delay are all user-programmable parameters.
- Key codes can be entered as Hex, ASCII or character values.
- Produces all appropriate "Make" and "Break" codes for PC/XT and PC/AT interfaces and "Make" codes for a RS232 interface
- Parameters that have been defined for a particular application can be stored in a file, retrieved and programmed into another encoder.
- Key codes and typematic operation can be tested without leaving the design utility USECON.
- Allows to operate in parallel with standard keyboard (USE145 only).
- Provides audio feedback through the optional buzzer (USE145 only).
- Keypads with any combinations of row/column and any pinout can be used without hardware modification.
- More than one keypad can be connected to one encoder.
- Keypad layout and all key codes can be modified in-house without increasing cost or affecting development time.
- Zero lead time for any custom configuration.
- Supports keyboard "macros", i.e. multiple keycodes for one keystroke. NEW

Specifications

- Power supply voltage: 5 V DC @ 25 mA(typ), 7 to 12 V (opt., USE144 only)
- RS 232 parameters: 300 to 9600 Baud, 8 bit, no parity
- Keypad connector: 2x25 right-angle header
- Interface connectors: 2 x 5 straight header and two 5-pin DIN connectors (std. for USE145), DB9 (opt., USE145 only), telephone connectors (opt. USE144 only)
- Operating temperature 0° to 60°C
- Size 2.5"x3.6"

Why Software Configurable?

IBM PC/XT and PC/AT compatible computers have become a popular choice for embedded systems such as electronic instruments, industrial controls and point of sale terminals.

Though such computers come with a keyboard interface port and can use a standard IBM compatible keyboard, a custom keyboard/keypad is often required. This is due to: environmental constraints, size and weight limitations, user interface requirements, company identity, esthetics, or any combination of the above.

Neither PC/XT's nor PC/AT's can directly interface with a membrane keypad. You need an encoder to provide PC/XT or PC/AT compatible signals. Normally you would buy such an encoder to avoid tying up programming resources.

But there are a few additional problems. Normally keyboard controllers can work with one or, at most, a few fixed keypad matrices with fixed pinout. Key codes are standard and though you can have them programmed for your application, it is a costly and time-consuming process.

If you need to change any of the keypad parameters you will probably have to order a new version of the encoder. And if you manufacture a few different products, you will have to stock encoders for each of them.

The USE144/USE145 Universal Software-configurable Encoders provide a solution: let the encoder itself to be programmable, so that it can be easily reconfigured to meet changing customer requirements.

The USE144/USE145 are intelligent, microprocessor-based systems. All parameters can be programmed with the accompanying utility, USECON. Parameters are stored in non-volatile memory, and can be changed at any time.

VGC

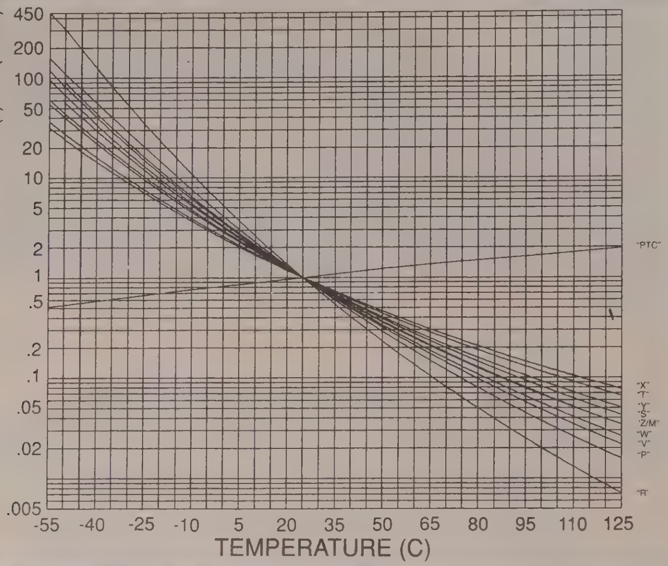
VG CONTROLS, INC

34 Jenkins Road
Hewitt, NJ 07421
Tel: (201) 853-4600
FAX: (201) 853-7913

Quality Thermistor, Inc.

2147 CENTURION PLACE, BOISE, IDAHO 83709
208/377-3373 • FAX: 208/376-4754 • 800/554-4QTI (4784)

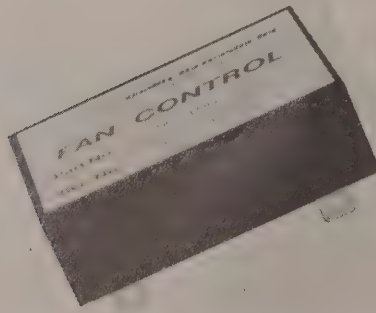
Resistance vs. Temperature Curve Data

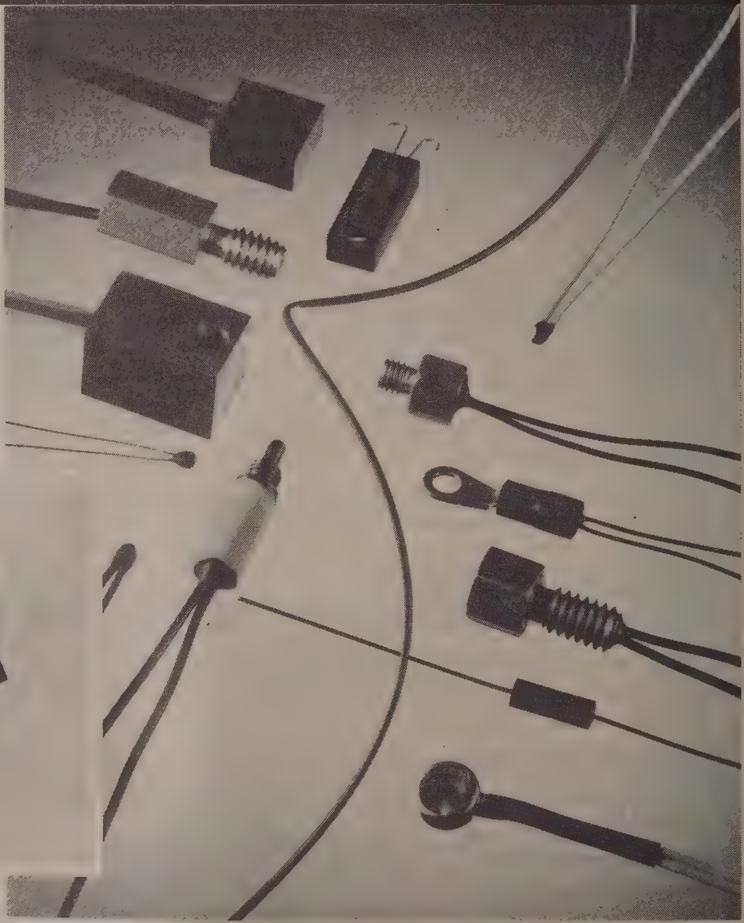


*Complete table for each product in the product line available on request.

NTC/PTC Thermistors of Superior Quality

- Surface Mount Chip
- Precision Interchangeable
- Glass Hermetically Sealed
- Military
- Wire Bondable Chip
- Assemblies and Probes (Standard and Custom)
- Power Devices





eem selection guide thermal components-5300

THERMISTORS, THERMOCOUPLES, & SENSORS

Manufacturer	Starting EEM Page No.	NTC	PTC	Leaded Chip	Disc	Hybrid Chip	Inter-changeable	Inrush Current Sup-pressors	Sensors, Tempera-ture	Switches, Tempera-ture Sensing	Thermo-couple	Other Features
Advanced Thermal Products, Inc.	**B**•1858	√	√	√	√	√	√		√	√		
Advanced Thermistor Div.; U.S. Sensor	**B**•1860	√	√	√	√	√	√		√	√		Micro-medical probes and assemblies; glass encapsualted thermistors.
Best Technology	**B**•1863										√	
Beta Therm	**B**•1864	√		√	√		√		√			
Dale Electronics	**B**•1870	√		√	√	√			√			
Elmwood Sensors	**B**•1872	√	√						√	√		
Fenwal Electronics	**B**•1875	√	√	√	√		√	√	√			
Ketema/Rodan Div.	**B**•1876	√	√	√	√	√	√	√	√	√		
Keystone Carbon Co.	**B**•1879	√	√	√	√		√	√	√	√		
Murata Erie North America	**B**•1885	√	√		√			√	√	√		
Omega Engineering	**B**•1886				√		√	√	√	√	√	
Philips Components/ Discrete Products	**B**•1888								√			
Philips Technologies/ Airpax Protector Group	**B**•1891	√	√									
Quality Thermistor	**B**•1892	√	√	√		√	√	√	√	√		
Raychem	**B**•1894		√									
Selco Products	**B**•1896								√	√		
Sensor Scientific	**B**•1898	√		√	√		√		√			
Thermodisc	**B**•1903	√	√	√	√		√	√	√	√		
Thermodisc (MC)	**B**•1903	√	√	√	√		√	√	√	√		
Warren G-V	**B**•1908								√	√		
Yellow Springs Instrument	**B**•1909	√			√		√		√			

THERMOSTATS

Manufacturer	Starting EEM Page No.	Low Profile	Grounded	Sealed (Immersion)	Isolated Contact	Isolated Case	Hermetic Seal	Disc
Elmwood Sensors	**B**•1872	√	√	√	√	√	√	√
Omega Engineering, Inc.	**B**•1886	√	√	√				
Philips Technologies/ Airpax Protector Group	**B**•1891	√	√	√	√	√	√	√
Selco Products	**B**•1896	√		√				√
Thermodisc	**B**•1903	√					√	√
Thermodisc (MC)	**B**•1903	√					√	√
Warren G-V	**B**•1908	√	√	√	√	√	√	

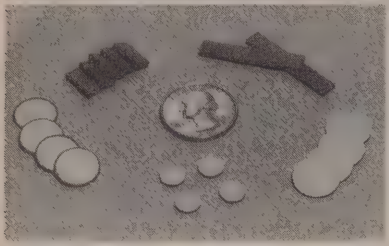
§ Surface Mount

ATP

Thermistors

ADVANCED THERMAL PRODUCTS, INC.

PTC Thermistors For Self-Regulating Heaters



Features:

- No thermostat needed
- Virtually unlimited life
- No moving parts to wear
- Very low cost
- No electrical noise
- Efficient

Typical Applications:

- Curling iron • Hair dryer
- Hot melt glue gun • Food warmer
- Liquid Crystal display
- Automotive chokes
- Plug-in aroma heater • Wax motor
- Plug-in insecticide • TCXO heater
- Heat tracing tape • Diesel fuel heater

Positive Temperature Coefficient thermistors are truly remarkable for their ability to function as self-regulating heating elements. They can operate at a nearly constant temperature over a broad range of voltage and dissipation conditions. PTC heaters can be manufactured in many different configurations. These include discs, rectangles, squares, cylinders, and various shapes with holes to increase surface area. Multiple PTCs can be used in parallel to provide constant heating over a larger area.

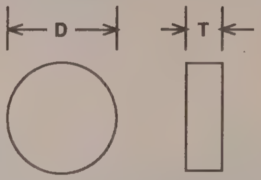
Standard Disc PTC Heaters

Switch Temp.	V_{max}	D	T	R_{25}	ATP Type#
(°C)	(Volts)	(In.)	(In.)	(Ohms)	
50	30	.500	.051	9	P5005B050Z900H
90	30	.500	.051	9	P5005B090Z900H
135	30	.500	.051	9	P5005B135Z900H
170	30	.500	.051	9	P5005B170Z900H
70	265	.500	.083	170	P5008E070Z172H
120	265	.500	.083	170	P5008E120Z172H
150	265	.500	.083	170	P5008E150Z172H
190	265	.500	.083	170	P5008E190Z172H

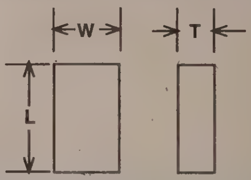
Standard Rectangular PTC Heaters

Switch Temp.	V_{max}	L	W	T	R_{25}	ATP Type#
(°C)	(Volts)	(In.)	(In.)	(In.)	(Ohms)	
50	30	.472	.236	.051	16	PR425B050Z161H
90	30	.472	.236	.051	16	PR425B090Z161H
135	30	.472	.236	.051	16	PR425B135Z161H
170	30	.472	.236	.051	16	PR425B170Z161H
70	265	.472	.236	.083	300	PR428E070Z302H
120	265	.472	.236	.083	300	PR428E120Z302H
150	265	.472	.236	.083	300	PR428E150Z302H
190	265	.472	.236	.083	300	PR428E190Z302H

Disc Heater



Rectangular Heater



—Other Disc and Rectangular sizes available upon request.

PTC Thermistors For Over-Current Protection

Features:

- Fast switching
- No electrical noise
- Virtually unlimited life
- Self resetting
- No contacts
- Automatic operation
- Efficient

Typical Applications:

- Telephone line fault protection
- Transformer protection
- FHP motor protection
- Transistor protection
- Speaker protection

ATP Standard Over-Current Protectors

V_{max}	R_{25}	I_{ns}	I_{ms}	H	δ	D_{max}	Wire Diameter		ATP Type#
Maximum Voltage	Resistance at 25°C (±20%)	Maximum No Switch Current	Minimum Must Switch Current	Heat Capacity	Dissipation Constant	Maximum Diameter			
(volts)	Ω	(Amps)	(Amps)	$\frac{\text{Watt-sec}}{^\circ\text{C}}$	$\frac{\text{Watt}}{^\circ\text{C}}$	(in.)	(in.)	(ga.)	
15	0.8	0.89	1.58	0.57	.015	.650	.032	20	P6004A120X080F
	1.0	0.77	1.37	0.48	.014	.600	.032	20	P5504A120X100F
	1.5	0.56	0.99	0.32	.011	.500	.020	24	P4504A120X150F
	2.0	0.46	0.82	0.25	.010	.450	.020	24	P4004A120X200F
50	5	0.36	0.63	0.85	.015	.650	.032	20	P6006C120X500F
	10	0.21	0.37	0.38	.010	.450	.020	24	P4006C120X101F
	20	0.13	0.23	0.21	.008	.350	.020	24	P3006C120X201F
132	7	0.31	0.55	1.41	.016	.650	.032	20	P6010D120X700F
	10	0.25	0.45	1.19	.015	.600	.032	20	P5510D120X101F
	25	0.13	0.23	0.48	.010	.400	.025	22	P3510D120X251F
	50	0.08	0.15	0.25	.008	.300	.020	24	P2510D120X501F
	100	0.05	0.10	0.16	.007	.250	.020	24	P2010D120X102F
265	25	0.14	0.25	0.94	.012	.450	.025	22	P4015E120X251F
	50	0.09	0.16	0.53	.009	.350	.020	24	P3015E120X501F
	100	0.06	0.10	0.24	.008	.250	.020	24	P2015E120X102F
400	50	0.10	0.18	0.96	.012	.400	.025	22	P3520F120X501F
	100	0.06	0.11	0.49	.009	.300	.020	24	P2520F120X102F

Notes: 1. Maximum Voltage listed as DC or 60Hz. AC. **2.** Maximum No Switch Current (I_{ns}) is the maximum current that the PTC can pass without switching into its high resistance state. **3.** Minimum Must Switch Current (I_{ms}) is the minimum current that is necessary to switch the PTC into its high resistance state. **4.** I_{ns} is calculated at the maximum ambient temperature, while I_{ms} is determined at the minimum ambient temperature. For ATP standard products, Ta_{min} is 0°C and Ta_{max} is 50°C.

Temperature Sensing Probes and Assemblies Using:

- ***Glass Encapsulated NTC Thermistors***
- ***Epoxy Coated Chip NTC Thermistors***
- ***Disc NTC Thermistors***
- ***PTC Thermistors***
- ***National Semiconductor LM34/LM35 Temp. Sensors***
- ***Analog Devices AD590 Temperature Sensors***
- ***Silicon PTC Thermistors***

(See Next Page For Probe Housing Styles)

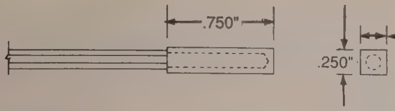
ADVANCED THERMAL PRODUCTS, INC. • P.O. Box 249 • 328 Ridgway Road • St. Marys, PA 15857 • Phone: 814-834-1541 • Fax: 814-834-1556

ATP

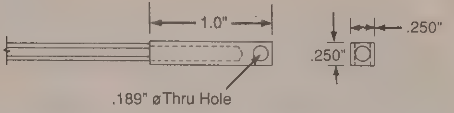
Temperature Sensing Probes and Assemblies

ADVANCED THERMAL PRODUCTS, INC.

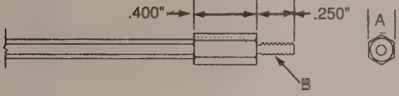
Housing Type: AB - Square Aluminum Block



Housing Type: AS - Square Aluminum Block with Mounting Hole

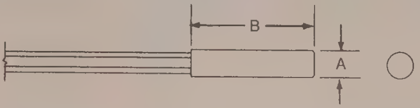

1.0"
.250"
.250"
.189" ø Thru Hole

Housing Type: AY - Hex Aluminum Surface Sensor



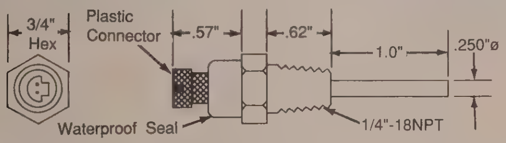
Type	A	B
AYI	.250"	10-32 UNC
AY2	.312"	1/4"-28UNC

Housing Type: BT - Closed End Nickel-Plated Brass Tube

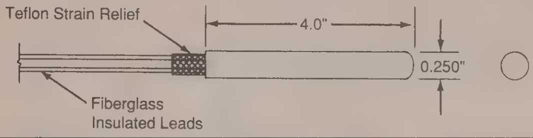


Type	A	B
BT1	.231"	1.25"
BT2	.250"	1.75"

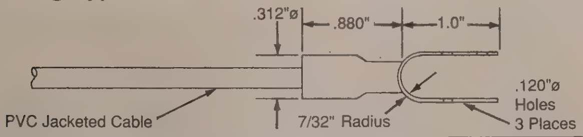
Housing Type: BX - Brass Housing with Integral Connector


3/4" Hex
Plastic Connector
.57"
.62"
1.0"
.250"ø
Waterproof Seal
1/4"-18NPT

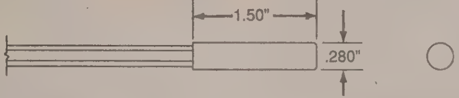
Housing Type: CT - Closed End Copper Tube


Teflon Strain Relief
4.0"
0.250"
Fiberglass Insulated Leads

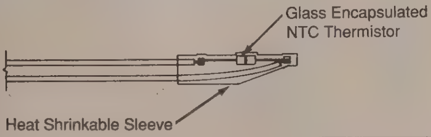
Housing Type: CX - Clamp-On Copper Tube (fits ⅜" & ½" tube)


.312"ø
.880"
1.0"
.120"ø Holes 3 Places
PVC Jacketed Cable
7/32" Radius

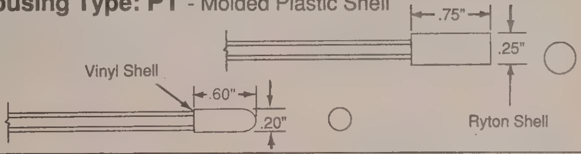
Housing Type: EC - Molded Epoxy Shell



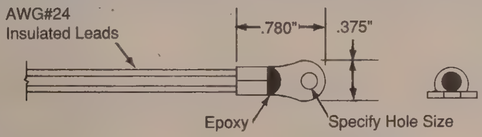
Housing Type: HS - Heat Shrink Sleeve


Glass Encapsulated NTC Thermistor
Heat Shrinkable Sleeve

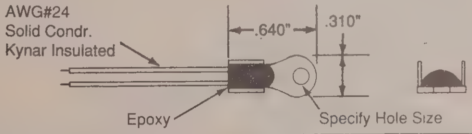
Housing Type: PT - Molded Plastic Shell


.75"
.25"
Vinyl Shell
.60"
.20"
Ryton Shell

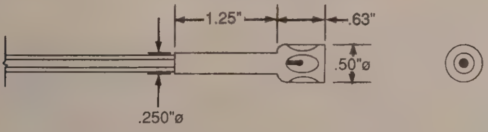
Housing Type: RC - Closed End Ring Terminal


AWG#24 Insulated Leads
.780"
.375"
Epoxy
Specify Hole Size

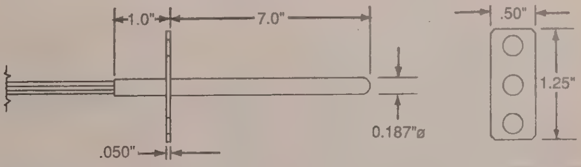
Housing Type: RT - Open End Ring Terminal


AWG#24 Solid Condr. Kynar Insulated
.640"
.310"
Epoxy
Specify Hole Size

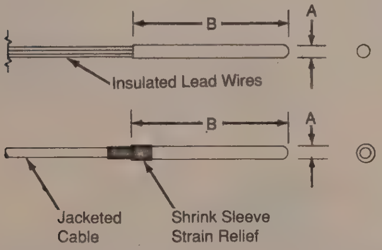
Housing Type: SA - Gas/Air Flow Sensor


1.25"
.63"
.50"ø
.250"ø

Housing Type: SG - Flange Mount Stainless Steel Tube

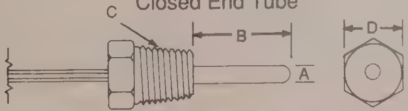

1.0"
7.0"
.50"
1.25"
0.187"ø
.050"

Housing Type: ST - Closed End Stainless Steel Tube - Straight


B
A
Insulated Lead Wires
B
A
Jacketed Cable
Shrink Sleeve Strain Relief

Type	A	B
STI	.125"	0.5" to 6.0"
ST2	.156"	0.5" to 9.0"
ST3	.187"	0.5" to12.0"
ST4	.250"	0.5"to 12.0"

Housing Type: SX - Stainless Steel Hex Head Pipe Plug with Closed End Tube



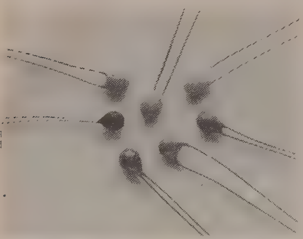
Type	A	B	C	D
SX1	.125"	0.5" to 6.0"	1/8"-27NPT	7/16"
SX2	.156"	0.5" to 9.0"	1/8"-27NPT	7/16"
SX3	.187"	0.5" to 12.0"	1/8"-27NPT	7/16"
SX4	.156"	0.5" to 9.0"	1/4"-18NPT	9/16"
SX5	.187"	0.5" to 12.0"	1/4-18NPT	9/16"
SX6	.250"	0.5" to 15.0"	1/4-18NPT	9/16"

ADVANCED THERMAL PRODUCTS, INC. • P.O. Box 249 • 328 Ridgway Road • St. Marys, PA 15857 • Phone: 814-834-1541 • Fax: 814-834-1556

ADVANCED THERMISTOR DIV.

U.S. SENSOR Corp.

Precision Interchangeable Thermistors



U.S. Sensor's precision interchangeable thermistors are low cost, highly accurate, stable devices designed specifically for temperature sensing, control and compensation applications. They are particularly suited for uses where their precision interchangeability eliminates the necessity for costly individual circuit calibration.

Features

- Low cost • Highly accurate
- Encapsulated • High stability
- Long life • Curve-matched
- Fast thermal time response

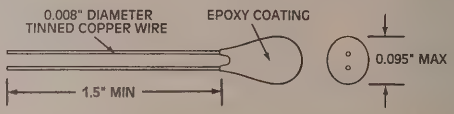
Options

- Special lead materials and lengths
- Special encapsulants or probe housings
- Non-standard resistance values and tolerances

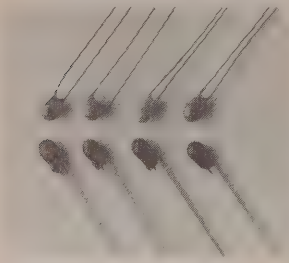
Specifications

- Thermal time constant: 1 second max for a device suspended by its leads in a well stirred oil bath, 10 seconds max in still air.
- Dissipation constant: 1 MW per degree centigrade.
- Maximum power rating: 30 MW at 25 degrees C derated to 1 MW at 125 degrees C.
- Interchangeability tolerance: ±0.2 degrees C from 0 to 70 degrees C.

PART NUMBER	RESISTANCE @ 25°C	INTERCHANGEABILITY TOLERANCE 0-70°C	R-T CURVE	BETA (K) 0-50°C	RESIS-RATIO 25-125°C	MAX. OPERATING TEMP. °C
AT102F2	1000	0.2	F	3420	19.1	100
AT222J2	2252	0.2	J	3890	29.3	120
AT302J2	3000	0.2	J	3890	29.3	120
AT502J2	5000	0.2	J	3890	29.3	120
AT103J2	10000	0.2	J	3890	29.3	120
AT203J2	20000	0.2	J	3890	29.3	120
AT303J2	30000	0.2	J	3890	29.3	120
AT303H2	30000	0.2	H	3810	29.2	120
AT503J2	50000	0.2	J	3890	29.3	120
AT104J2	100000	0.2	J	3890	29.3	120



Standard Leaded Chip Thermistors



U.S. Sensor's leaded chip thermistors are manufactured using the same state of the art manufacturing techniques as those used to produce precision interchangeable devices. This results in devices with superior long term reliability characteristics especially suitable for temperature measurement, temperature control and temperature compensation applications.

Features

- Low cost • High stability
- Small size • Fast thermal response

Options

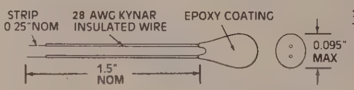
- Special lead materials and lengths
- Special encapsulants or probe housings
- Non-standard resistance values and tolerances
- Point matched at specified temperatures

Specifications

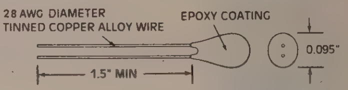
- Thermal time constant: 1 second max for a device suspended by its leads in a well stirred oil bath, 10 seconds max in still air.
- Dissipation constant: 1 MW per degree centigrade

PART NUMBER INSULATED LEADS	PART NUMBER BARE LEADS	RESISTANCE @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C	MAX OPERATING TEMP. °C
KC101B2K	LC101B2K	100	10	B	2930	150
KC102F2K	LC102F2K	1000	10	F	3420	150
KC222J2K	LC222J2K	2252	10	J	3890	150
KC302J2K	LC302J2K	3000	10	J	3890	150
KC502J2K	LC502J2K	5000	10	J	3890	150
KC103J2K	LC103J2K	10000	10	J	3890	150
KC203J2K	LC203J2K	20000	10	J	3890	150
KC303J2K	LC303J2K	30000	10	J	3890	150
KC303H2K	LC303H2K	30000	10	H	3810	150
KC503J2K	LC503J2K	50000	10	J	3890	150
KC104J2K	LC104J2K	100000	10	J	3890	150

*RESISTANCE TOLERANCES OF 1%, 2%, 5% AND 20% ARE AVAILABLE UPON REQUEST

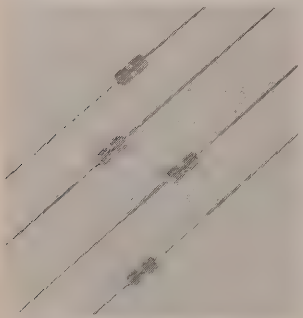


"KC SERIES"



"LC SERIES"

Glass Encapsulated Thermistors



U.S. Sensor's glass encapsulated thermistors are manufactured using super stable NTC chips which are hermetically sealed in a glass (D035 diode style) package. The result is a device which exhibits excellent long term reliability and stability even when subjected to severe environmental or thermal conditions. Their uniform dimensions and axial lead configuration makes them especially suitable for use with automatic insertion equipment.

Features

- High temperature capability (-55 to +220 degrees C)
- Hermetically sealed glass package
- Low cost • High stability

Options

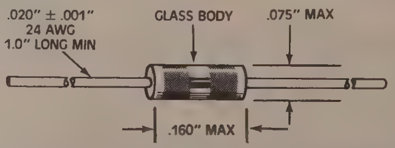
- Non-standard resistance values and tolerances
- Point matched at specified temperatures
- Tape and Reel packaging

Specifications

- Thermal time constant: 8 seconds max
- Dissipation constant: 2 MW per degree C

PART NUMBER	RESISTANCE @ 25°C (OHMS)	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50 °C
202FG1K	2000	10	F	3420
502FG1K	5000	10	F	3420
103JG1K	10000	10	J	3890
203JG1K	20000	10	J	3890
253JG1K	25000	10	J	3890
303JG1K	30000	10	J	3890
503JG1K	50000	10	J	3890
753JG1K	75000	10	J	3890
104JG1K	100000	10	J	3890

*RESISTANCE TOLERANCES OF ±1%, 2%, 5% AND 20% ARE AVAILABLE UPON REQUEST



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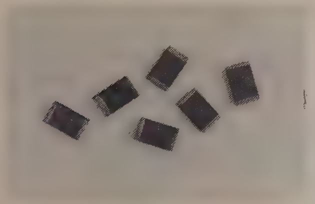
ADVANCED THERMISTOR DIV.
U.S. SENSOR Corp.

Surface Mount Wrap Around Chip Thermistors

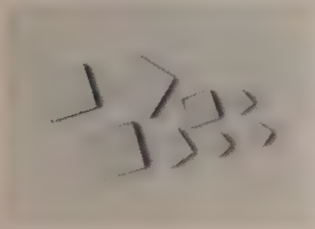


U.S. Sensor's surface mount wrap-around thermistor elements are designed for use on hybrid substrates, integrated circuits or printed circuit boards. They have palladium silver metalization which is suitable for various contact techniques including wire bond, epoxy or solder. Since they are manufactured using the most advanced equipment and technology available, their dimensional parameters are extremely uniform making the devices especially suitable for use with automatic handling and placement equipment.

Features
- Surface mountable
- Small size • Low cost
- Fast thermal response

Options
- Non-standard resistance values and tolerances
- Special electrode materials
- Special dimensions

Leadless Chip Thermistors



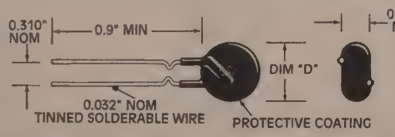
U.S. Sensor's leadless thermistor elements are designed for use on hybrid substrates, integrated circuits or printed circuit boards. They have silver metalization on their top and bottom surfaces which is suitable for various contact techniques including wire bond, epoxy or solder. Since they are manufactured using the most advanced equipment and technology available, their dimensional parameters are extremely uniform making the devices especially suitable for use with automatic handling and placement equipment.

Features
- Surface mountable
- Small size • Low cost
- Fast thermal response

Options
- Non-standard resistance values and tolerances
- Special electrode materials
- Special dimensions

Inrush Current Limiting Power Thermistors

U.S. Sensor's inrush current limiting power thermistors are specially formulated and processed NTC thermistors suitable for suppressing high inrush currents in switching power supplies and other applications where the high initial starting currents are undesirable. Their unique design enables them to handle extremely high current and voltage levels. In a typical power supply application, the device is used in series with the filter capacitors. Upon application of the initial voltage, the device, due to it's relatively high resistance, limits the current flow to an acceptable level until the capacitors are charged. Thereafter, the device decreases in resistance substantially to a level where the voltage drop across it is negligible.

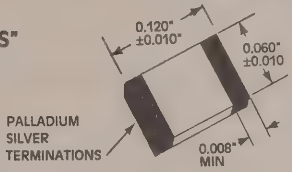


Specifications
- Thermal time constant: 10 seconds max
- Dissipation constant: 1 MW per degree C min.

PART NUMBER	RESISTANCE @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C
WC102B1K	1000	10	B	2930
WC252B1K	2500	10	B	2930
WC502F1K	5000	10	F	3420
WC103F1K	10000	10	F	3420
WC203F1K	20000	10	F	3420
WC253J1K	25000	10	J	3890
WC303J1K	30000	10	J	3890
WC503J1K	50000	10	J	3890
WC753J1K	75000	10	J	3890
WC104J1K	100000	10	J	3890

*Resistance Tolerances of 5% and 20% Are Available Upon Request

"WC SERIES"

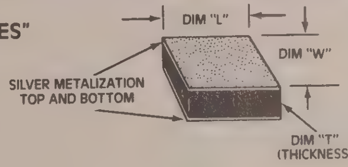


Specifications
- Thermal time constant: 10 seconds max
- Dissipation constant: 1 MW per degree C

PART NUMBER	RESISTANCE @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C	NOMINAL DIMENSIONS "INCHES" DIM "L"	DIM "W"	DIM "T"
BC102F1K	1000	10	F	3420	0.045	0.045	0.015
BC222J1K	2252	10	J	3890	0.070	0.070	0.010
BC302J1K	3000	10	J	3890	0.065	0.065	0.010
BC502J1K	5000	10	J	3890	0.055	0.055	0.015
BC103J1K	10000	10	J	3890	0.040	0.040	0.015
BC203J1K	20000	10	J	3890	0.030	0.030	0.015
BC303J1K	30000	10	J	3890	0.025	0.025	0.020
BC303H1K	30000	10	H	3810	0.040	0.040	0.015
BC503J1K	50000	10	J	3890	0.020	0.020	0.020

*Resistance Tolerances of 5% and 20% Are Available Upon Request

"BC SERIES"



Specification Table

PART NUMBER	Ro RESISTANCE @25°C ±20% Ω	Imax MAX STEADY STATE CURRENT (AMPS)	Rmax RESISTANCE @ MAX CURRENT Ω	DIMENSION "D" MAX OVER COATING
SL2R505	2.5	5	0.050	0.550"
SL2R507	2.5	7	0.050	0.550"
SL2R509	2.5	9	0.070	0.700"
SL2R510	2.5	10	0.060	0.700"
SL5R002	5.0	2	0.180	0.400"
SL5R005	5.0	5	0.150	0.400"
SL5R007	5.0	7	0.130	0.550"
SL8R004	8.0	4	0.250	0.400"
SL10003	10.0	3	0.250	0.400"
SL10005	10.0	5	0.230	0.550"
SL10006	10.0	6	0.230	0.550"
SL20002	20.0	2	0.500	0.400"

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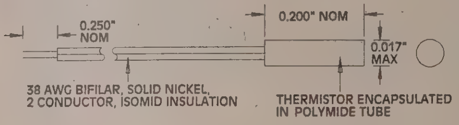
ADVANCED THERMISTOR DIV.

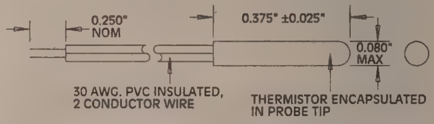
U.S. SENSOR Corp.

U.S. Sensor Micro-Medical Probes

U.S. Sensor has developed a line of extremely small thermistor probes specifically designed for medical applications. Due to their very small size, super fast thermal response and extremely high stability, these devices are useful in many other applications as well.

Please contact U.S. Sensor's application engineering department for specific electrical and physical characteristics of these devices.


0.250" NOM
0.200" NOM
0.017" MAX
38 AWG BIFILAR, SOLID NICKEL, 2 CONDUCTOR, ISOMID INSULATION
THERMISTOR ENCAPSULATED IN POLYMIDE TUBE


0.250" NOM
0.375" ±0.025"
0.080" MAX
30 AWG. PVC INSULATED, 2 CONDUCTOR WIRE
THERMISTOR ENCAPSULATED IN PROBE TIP

Features

- High Precision • High Stability
- Interchangeability • Encapsulated
- Super Fast Response
- Low Cost • Extremely Small Size

Custom Probes and Assemblies

U.S. Sensor manufactures a complete line of probes and assemblies suitable for temperature measurement and control in a variety of commercial, industrial and military applications. Most probe assemblies can include one or more of the thermistors listed in this catalog. U.S. Sensor's highly skilled applications engineering personnel are available to aid in the design of the most advantageous housing and sensor for your application.

Resistance Temperature Chart

CURVE TYPE	"B"	"F"	"H"	"J"	"Y"
BETA 0-50°C	2930	3420	3810	3890	4640
R RATIO R_O/R_{50}	5.28	6.95	8.66	9.065	13.85
TEMP° C	R_T/R_{25}	R_T/R_{25}	R_T/R_{25}	R_T/R_{25}	R_T/R_{25}
-50	24.3	40.95	56.44	67.01	139.8
-40	14.4	21.51	29.49	33.65	63.29
-30	8.93	12.33	16.03	17.70	30.03
-20	5.69	7.307	9.040	9.707	14.87
-10	3 .68	4.476	5.267	5.533	7.642
0	2.45	2.825	3.166	3.265	4.067
10	1.68	1.830	1.958	1.990	2.265
20	1.18	1.216	1.243	1.249	1.303
25	1.00	1.000	1.000	1.000	1.000
30	0.854	0.8267	0.8090	0.8057	0.7726
40	0.628	0.5742	0.5383	0.5326	0.4704
50	0.464	0.4067	0.3657	0.3602	0.2936
60	0.350	0.2937	0.2533	0.2488	0.1878
70	0.267	0.2160	0.1786	0.1752	0.1231
80	0.208	0.1615	0.1281	0.1255	0.08250
90	0.163	0.1229	0.09330	0.09154	0.05642
100	0.130	0.09460	0 .06897	0 .06786	0.03932
110	0.105	0.07400	0.05167	0.05106	0.02788
120	0.0852	0.05850	0.03920	0.03896	0.02009
130	0.0700	0.04710	0.03010	0.03010	0.01469
140	0.0579	0.03820	0.02337	0.02354	0.01089
150	0.0483	0.03140	0.01834	0.01861	0.008170

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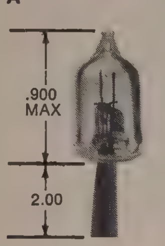
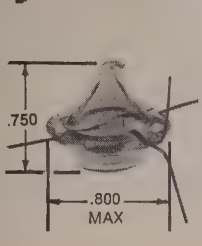
400 Boren Ave. N., Seattle, WA 98109 206/623-6135 FAX 206/382-0186

VACUUM THERMAL CONVERTERS

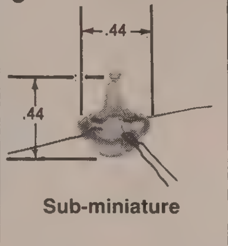
A



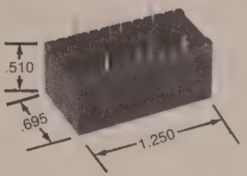
B



C

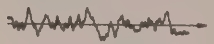


D **DIP PACKAGE**
24 PIN STD.



TRUE RMS MEASUREMENT

—where the signal is periodic with distorted wave shapes



—or where random wave shapes are present, even with high crest factors

D package will house one or two sub-miniature units. Ideal for T.C. Control, Spare or Matched Pairs.

Vacuum Thermal Converters (VTC) are true RMS current measuring devices. A VTC consists of a thermocouple mounted on an electrically heated wire and encased in an evacuated glass bulb. The measured temperature of the heater wire is independent of wave shape or frequency over very wide ranges. The VTC is calibrated at D.C. and used to measure A.C. to as high as 1 GHz. Extremely high crest factors can be accomodated. Operating range is from 0-65 MHz for the standard pattern models, up to 300 MHz for UHF pattern and up to 1 GHz for sub-miniature UHF pattern models. BEST VTC's are used throughout the world as basic AC-DC transfer standards as well as for true RMS Voltmeters and Power Meters. They can be made as Vacuum gages by exposing the heater and thermocouple to the Vacuum to be measured instead of being mounted inside an evacuated bulb. BEST supplies Vacuum gages to custom order.

APPLICATIONS CHART

VTCs are used as basic AC-DC transfer standards as well as other instrumentation applications including vacuum measurement.

VTC Type	Current mA **	Freq MHz	R/E %*	Applications
UHF	2.5-1000	0-300	.04	General purpose
UHF Matched Pairs	2.5-1000	0-300	.005	Voltmeters
Sub-Min. UHF	2.5-1000	0-1GHz	.08	Artificial squibs
Sub-Min. UHF Matched Pairs	5	0-1GHz	.005	Voltmeters
Std. Pattern	1-1000	0-65	.005	Low current models available
Std. Pattern Matched Pairs	1-1000	0-65	.005	Voltmeters
Low AC-DC Transfer error	5 10	1.0 1.0	NA NA	SS288 SS283 } AC-DC Transfer error 1 ppm to 100KHz, 10ppm to 1MHz
Vacuum Gages	1-1000	NA	NA	Vacuum measurement
Open Heaters	1k-50k	0-300	.20	High current RF

** Range of full scale current values.

* Best reversal error, standard is 0.2%

POPULAR MODELS

Model No.	Range mA	Heater Resis. Ohms±10%	Couple Resis. Ohms±10%	O/C EMF ±12% mV	Max. Overload %	See Fig.
S1	1.0	1750	13	7	250	A
S4	2.0	800	12	7	250	A
S7	5.0	90	8	7	250	A
S9	10.0	25	8	7	250	A
SS288	5.0	90	8	7	200	A
SS283	10.0	25	8	7	200	A
S102	5.0	125	8	10	200	A
S104	10.0	40	4	10	200	A
U1	5.0	90	8	7	250	B
SUB MIN U1	5.0	90	8	7	250	C or D
U2	10.0	25	8	7	250	B
U27	2.5	200	8	7	250	B

Hundreds of other models available. Thermocouple vacuum gauges to custom order. Write or call for application assistance.

BetaTHERM NTC Thermistor Devices

INTERCHANGEABLE *BetaCURVE* THERMISTOR DEVICES

FEATURES

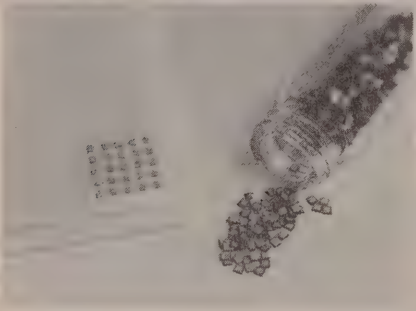
- Available in all Chip & Probe styles, insulated & non-insulated leads
- Superior Temp. Accuracy & Interchangeability
- Rugged—Reliable—Cost Efficient
- Proven Stability and Life Capability
- Rapid Time Response
- Rated from −55 to 150°C.
- 1.0 mW/°C Dissipation Constant
- 10 sec. Maximum Time Constant

BetaCURVE THERMISTOR DEVICES (±0.2°C 0 to 70°C.)

Nominal R @ 25°C. (ohms)	Part Number	R-T Curve #	0-50°C Beta Value (K.)	α @ 25°C. (%/°C)
100	0.1K1A1	1	3108	−3.5
300	0.3K1A1	1	3108	−3.5
1,000	1K2A1	2	3263	−3.7
1,000	1K7A1	7	3422	−3.9
2,252	2.2K3A1	3	3892	−4.4
5,000	5K3A1	3	3892	−4.4
10,000	10K3A1	3	3892	−4.4
10,000	10K4A1	4	3749	−4.0
30,000	30K5A1	5	3811	−4.3
50,000	50K6A1	6	4143	−4.7
100,000	100K6A1	6	4143	−4.7
1,000,000	1M9A1	9	4582	−5.1

+*BetaCURVE* devices have ±0.2%C. curve track tolerance capability over the recommended use temperature span. Products with tighter deviation or extended temperature range can be factory ordered.
+ +Interchangeable *BetaCURVE* products with ±0.2 to 1.0 deg. C curve-track tolerance capability over 0–70°C are available. Products with tighter dT deviation or extended temperature can be factory ordered.

GOLD TERMINATION *BetaCHIP* THERMISTOR



FEATURES

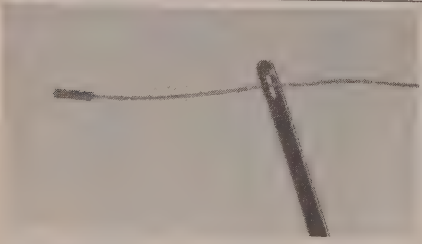
- Top and Bottom Metallization
- Rapid Time Response
- Rated from −55 to 150°C.
- Surface Mount Capability
- Uniformly Sized for Pick & Place Assembly
- 1.0 mW/°C. Dissipation Constant
- 10 sec. Maximum Time Constant

LEADLESS *BetaCHIP* THERMISTOR (±10% Tolerance @ 25°C.)

Nominal R @ 25°C. (ohms)	"Chip" Part Number	R-T Curve #	0-50°C Beta Value (K.)	α @ 25°C. (%/°C)
100	0.1K1CG2	1	3108	−3.5
300	0.3K1CG2	1	3108	−3.5
1,000	1K2CG2	2	3263	−3.7
1,000	1K7CG2	7	3422	−3.9
2,252	2.2K3CG2	3	3892	−4.4
3,000	3K3CG2	3	3892	−4.4
5,000	5K3CG2	3	3892	−4.4
10,000	10K3CG2	3	3892	−4.4
10,000	10K4CG2	4	3749	−4.0
30,000	30K5CG2	5	3811	−4.3
30,000	30K6CG2	6	4143	−4.7
50,000	50K6CG2	6	4143	−4.7
100,000	100K6CG2	6	4143	−4.7
1,000,000	1M9CG2	9	4582	−5.2

Standard *BetaCHIP* Leadless Thermistor Elements available in other R_{25} tolerance limits.
BetaCHIP Products with tighter R_{25} tolerance or sorted at T other than 25°C can be factory ordered.

microCHIP THERMISTOR PROBES



FEATURES

- High Stability Probe (Industrial & Medical Applications Typically)
- Temperature Accuracy +0.1 C.
- Extremely small profile diameter
- Rapid Time Response Design
- Time Constant — <1.0 sec.*

Other Styles, Resistance Values and Tolerances Available. Contact Beta THERM Application Engineering for details.

microCHIP THERMISTOR PROBE CHARACTERISTICS DEVICE AVAILABILITY

Part No.	Material No.	Ro@25°V (ohms)	Temp. Tol. (°C)	Max Exposure Temp. (°C)	Typical Application Use
2K7MCD1	7	2,000	0.2	150	Laboratory Instrument Probe
10K3MCD1	3	10,000	0.1	150	Medical Probe
100K6MCD1	6	100,000	0.2	150	Fast Response

GLASS COATED *microCHIP* THERMISTOR PROBE

Part No.	Material No.	Ro@37°V (ohms)	Temp. Tol.	Max Exposure Temp. (°C)	Typical Application Use
G22K7MCD8	7	14,004	±15%@37°C	150	Thermodilution Catheters, and other medical applications

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BetaTHERM

NTC Thermistor Devices

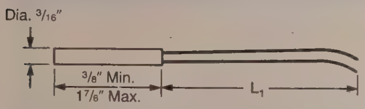
CUSTOMIZED PROBE ASSEMBLY CONSTRUCTIONS (TYPICAL)

FEATURES

- Customized for Each Application
- Cost-Effective Designs to Performance Specs
- Prompt Betatherm Design/Build Execution
- Rugged—Reliable—Stable—Constructions
- Surface, Immersion and Gas Sensing Designs
- Customized Sense Element for Each Application

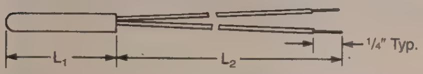
CONFIGURATIONS

PH005 ROUND ALUMINUM PROBE (Flat End)



Available with Individual (Teflon or PVC) Insulated Wire or (Teflon or PVC) Insulated Cables.

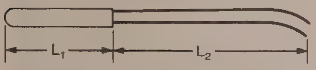
PH006 ROUND GLASS PROBE (Spherical End)



Standard Glass Dia.
.107" ± .005" O.D.
.090" ± .005" O.D.
.057" ± .002" O.D.

Available with Individual (Teflon, PVC or Varnish) Insulated Wire.

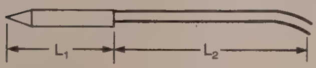
PH008 ROUND T304 T316 STAINLESS STEEL PROBE (Spherical End)



Available with Individual Lead Wires or Cable. Teflon or PVC Insulation.

(Probe Diameters Available in Hypodermic Gage Sizes 6.5 to 22.5 and Fractional Sizes 1/16" to 3/8".)

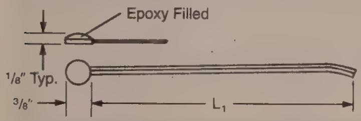
PH009 ROUND T304 T316 STAINLESS STEEL PROBE (Pointed End)



Available with Individual Lead Wires or Cable. Teflon or PVC Insulation.

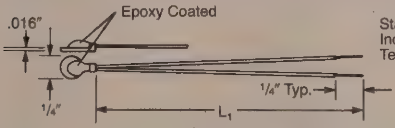
(Probe Diameters Available in Hypodermic Gage Sizes 6.5 to 22.5 and Fractional Sizes 1/16" to 3/8".)

PH010 FLAT STAINLESS STEEL CUP (Surface Sensing)



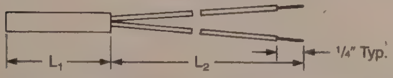
Available with Dual Cond Zip Cable, Individual Leads and or Cable. Teflon or PVC Insulation.

PH014 FLAT ALUMINUM (Anodized) DISC WITH CRIMP (Surface Sensing)



Standard with 30 AWG Stranded Individual Leads with Teflon Insulation.

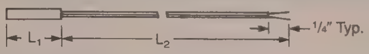
PH019 PLASTIC (Nonshrink Mylar) TUBE EPOXY FILLED



Standard Outside Dia.
.070" O.D.
.078" O.D.
.095" O.D.

Standard with 28 AWG to 34 AWG Individual Leads. Teflon PVC or Uninsulated Leads.

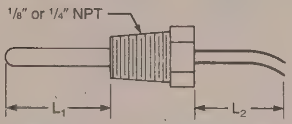
PH020 PLASTIC (Polyimide) MICROTUBE EPOXY FILLED



Standard Outside Dia.
.017" Max O.D.
.018" Max O.D.
.040" ± .002" O.D.

Standard with 40 AWG Bifilar Nickel Leads with Isomid Insulation.

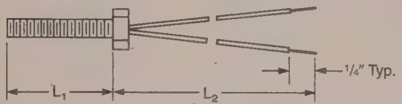
PH025 STAINLESS STEEL PIPE THREAD PROBE



Standard Probe Dia.
1/8" S.S.
3/16" S.S.
1/4" S.S.

Available with Individual Leads or Jacketed Cable Teflon or PVC.

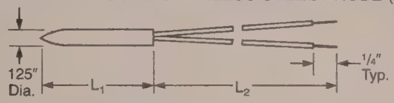
PH032 BRASS OR STAINLESS STEEL HEX HEAD SCREW



Standard Thread Size
10–32
1/4–20
3/8–16

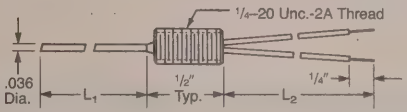
Standard with Individual Leads, Teflon or PVC Insulation.

PH043 ROUND STAINLESS STEEL PROBE (Conical End)



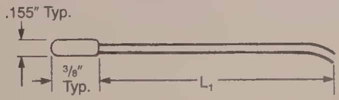
Standard with Individual Leads, Teflon or PVC Insulation

PH051 ROUND STAINLESS STEEL MICROPROBE (Round End)



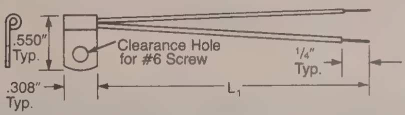
Standard with Individual Leads, 28 to 34 AWG, Teflon or PVC Insulation

PH064 ROUND VINYL MEDICAL PROBE (Round End)



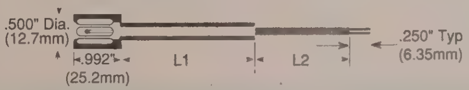
Standard with White or Gray PVC Jacketed Cable Only.

PH066 TINNED COPPER "FLAG TERMINAL" (Surface Mounting)

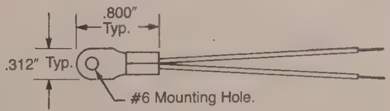


Available with Individual Leads, 24 to 30 AWG, Teflon or PVC Insulation.

PH069 STAINLESS STEEL AIR (GAS) SENSING PROBE



PH080 TINNED COPPER "RING TONGUE TERMINAL" (Surface Mounting)



Standard with Individual Leads 22 AWG to 24 AWG, Teflon or PVC Insulation.

Interchangeable BetaCURVE and BetaCHIP devices are available in most probe assembly configurations. For more information please contact BetaTHERM Application Engineering Department.

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BetaTHERM

WIRE & CABLE

BetaTHERM WIRE & CABLE STYLES AND CHARACTERISTICS

Wire P/N	Cond. Mat'l	Plating	AWG	Insul. Type	Nom. Dia.	Notes & Colors
LW - 001 thru 099 Bare Wire						
001	Alloy 180	Tin	32		.008"	Standard on BetaCHIP/BetaCURVE
003	Copper	Tin	28		.0128"	
005	Copper	Tin	32		.008"	
LW - 101 thru 199 Teflon Insulated Wire						
101	Copper	Silver	30-7/38	Teflon	.024"	ET/White; ET/Red; ET/Black
102	Copper	Silver	30-7/38	Teflon	.032"	ET/White; ET/Blue; ET/Black
103	Copper	Silver	28-7/36	Teflon	.035"	ET/Red; ET/Green; ET/Orange; ET/White; ET/Yellow; ET/Blue
106	Copper	Silver	24-19/36	Teflon	.036"	ET/Black
107	Copper	Silver	22-7/30	Teflon	.050"	ET/White
108	Copper	Silver	24-7/32	Teflon	.036"	ET/White
110	Copper	Silver	28-7/36	Teflon	.027"	ET/Black; ET/White
111	Copper	Silver	30	Teflon	.021"	ET/White
112	Copper	Silver	28	Teflon	.022"	White, Red
115	Copper	Silver	26-7/34	Teflon	.040"	ET/Black
120	Copper	Silver	22-19/34	Teflon	.048"	Yellow (U/L 1213), White
121	Copper	Silver	24-7/32	Teflon	.044"	Red, Black, (U/L 1213)
123	Copper	Silver	30-19/40	Teflon	.025"	Red, Green, Brown
124	Nickel	Silver	30	Teflon	.021"	Red
125	Copper	Silver	28-19/40	Teflon	.048"	White (U/L 1180)
LW - 201 thru 299 PVC Insulated Wire						
201	Copper	Tin	30-7/38	PVC	.032"	Grey, White, (U/L 1061)
202	Copper	Tin	24-7/32	PVC	.056"	White, Brown, (U/L 1569)
203	Copper	Tin	22-7/30	PVC	.050"	Green Mil-W 16878D
204	Copper	Tin	24-7/32	PVC	.044"	Green Mil-W 16878D
205	Copper	Tin	26-7/34	PVC	.039"	Green Mil-W 16878D
206	Copper	Tin	24-19/36	PVC	.043"	Black (U/L 1429)
208	Copper	Tin	28-7/36	PVC	.035"	Black Mil-W 16878D
209	Copper	Tin	22-19/34	PVC	.095"	Black (U/L 1015)
210	Copper	Tin	20-10/30	PVC	.070"	White Mil-W 76B
211	Copper	Tin	30-7/38	PVC	.044"	Brown, Red, Green, Blue, (U/L 1007)
212	Copper	Tin	20-10//30	PVC	.102"	White (U/L 1015)
213	Copper	Tin	24-7/32	PVC	.088"	White (U/L 1015)
LW - 301 thru 399 MISC.						
301	Copper		30	Polyurethane	.011"	Clear
302	Copper	Silver	30	Kynar	.019"	White, Black, Blue, Brown
304	Copper		34	Polyurethane Imide Polymer	.0065"	Clear
306	Copper		32	Magnet Wire Varnish	.009"	Red, Green, Blue, Gold
307	Copper		28-7/36	Polyolefin	.035"	Black
308	Nickel		32	Himol	.009"	Dark
310	Copper		34	Varnish	.005"	Green, Gold, Clear, Blue, Red
312	Copper	Tin	24-45/40	Rubber	.066"	Black

Wire P/N	Cond. Mat'l	Plating	# Cond.	AWG	Insul. Type	Nom. O. D.	Colors
LW - 401 thru 499 Teflon - Cable							
402	Copper	Silver	2 + S	6-7/34	TFE Teflon	.120"	White (OJ), White/Black
403	Copper	Siler	3 + S	30-19/42	FEP Teflon	.065"	Clear (OJ), Red/White/Black
404	Copper	Silver	2	24-7/32	TFE Teflon	.080"	Twister Pair, Black
405	Copper	Silver	4 + S	22-19/34	Teflon Wrap	.172"	White (OJ)/Black/Red/White/Green
406	Copper	Silver	2	28-7/38	Clear Teflon	.027" x .100"	Clear
LW - 501 thru 599							
501	Copper	Tin	2	30-7/38	PVC	.030" x .060"	White
502	Copper	Tin	1 + S	20-10/30	PVC	.135"	Grey (OJ)/Red
503	Copper		2	26-65/44	PVC	.060" x .120"	Grey
504	Copper	Tin	3	22-7/30	PVC	.169"	Grey (OJ)/Red/White/Black
505	Copper	Bare/Tin	2	24-7/32	PVC	.058 x .115"	Grey
507	Copper	Tin	1 + S	22-7/30	PVC	.115	Black (IJ)/Grey (OJ)
509	Copper	Tin	2	22-7/30	PVC	.164"	Grey (OJ)/Red/Black
510	Copper	Tin	2 + S	22-7/30	PVC	.170"	Grey (OJ)/Red/Black
512	Copper	Tin	3	24-7/32	PVC	.165"	Grey (OJ)
513	Copper	Tin	2	28-7/36	PVC	.105"	Clear (OJ)
514	Copper	Tin	2 + S	26-7/34	PVC	.150"	Grey (OJ)
516	Copper	Tin	2S	24-19/36	PVC	.150"	Grey (OJ)
517	Copper	Tin	2S	22-19/34	PVC	.168"	Grey (OJ)

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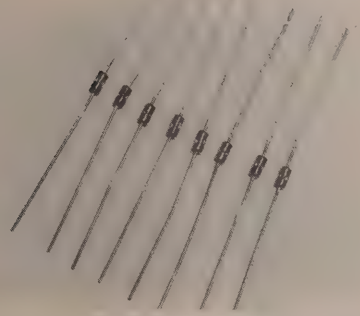
BetaTHERM NTC Thermistor Devices

DO35 PACKAGE **BetaCHIP & BetaCURVE** THERMISTOR



DO-35 packaged Thermistor are made from the same high quality and high stability **BetaCHIP** and **BetaCURVE** Thermistor Chip Elements that are manufactured for all of **BetaTHERM's** product family.

The rugged construction of the DO-35 package is ideally suited for applications which cover the temp. range of −60°C to 300°C with leads that are solderable or weldable.

FEATURES

- High Temperature Device (300°C)
- Glass to Metal Hermetic Seal
- Low Cost, High Reliability
- T.C. 8 Sec. in Air
- D.C. 2 mW/°C in Air
- Values from 1K Ω to 5 Meg Ω
- Dumet Leads Tin Plated for 200°C Max Operation or Gold Plated Leads for 300°C Max Operation
- Axial Leads

STANDARD (±10% @ 25°C) THERMISTOR DEVICES

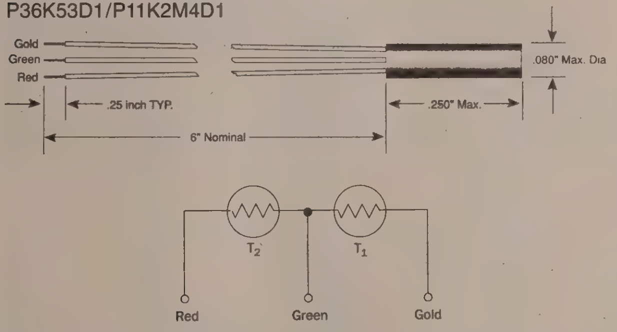
Part Number	RT Curve	Part Number	RT Curve	Part Number	RT Curve
1K2DP2	2	10K3DP2	3	200K6DP2	6
2K7DP2	7	20K3DP2	3	500K6DP2	6
3K7DP2	7	30K3DP2	3	1M6DP2	6
5K7DP2	7	50K3DP2	3	5MDP2	12
10K7DP2	7	100K3DP2	3	M2	

Custom Specification: For Resistance Values and or Tolerances not listed above, contact **BetaTHERM** Applications Engineering for details.

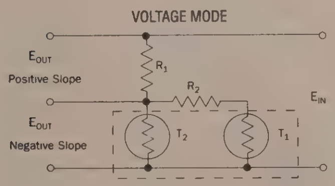
BetaLINEAR THERMISTOR/RESISTOR NETWORKS

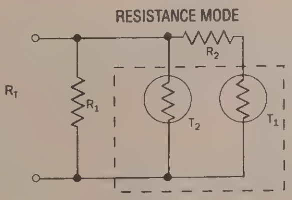
BetaLINEAR Thermistor/Resistor Networks produce precision linear output for both Linear Voltage versus Temperature or Linear Resistance versus Temperature. Wiring schematics are as shown below.

BetaLINEAR Composite
P36K53D1/P11K2M4D1

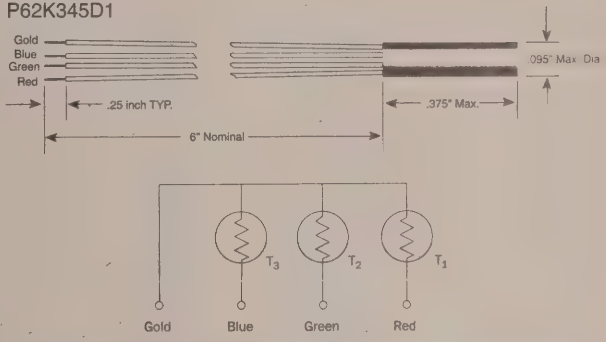

Gold
Green
Red
.080" Max. Dia
.25 inch TYP.
.250" Max.
6" Nominal
T_2
T_1
Red
Green
Gold

NOTE: Use P36K53D1 and P11K2M4D1 composite in the above schematics only. R1 and R2 resistors are supplied in resistor sets. Their values are dependent on the temperature range to be used.

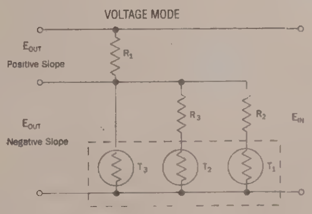

VOLTAGE MODE
E_{OUT}
Positive Slope
E_{OUT}
Negative Slope
R_1
R_2
T_2
T_1
E_{IN}

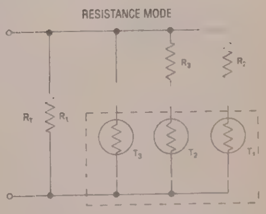

RESISTANCE MODE
R_T
R_1
R_2
T_2
T_1

BetaLINEAR Composite
P62K345D1


Gold
Blue
Green
Red
.095" Max. Dia
.25 inch TYP.
.375" Max.
6" Nominal
T_3
T_2
T_1
Gold
Blue
Green
Red

NOTE: Use P62K345D1 composite in the above schematics only. R1, R2, and R3 resistors are supplied in resistor sets.


VOLTAGE MODE
E_{OUT}
Positive Slope
E_{OUT}
Negative Slope
R_1
R_3
R_2
E_{IN}
T_3
T_2
T_1


RESISTANCE MODE
R_T
R_1
R_3
R_2
T_3
T_2
T_1

To simplify and accommodate various assembly configurations, **BetaTHERM** supplies precision resistor sets as a separate item or in kit form with **BetaLINEAR** Thermistor Composites.

BetaTHERM Corporation • 910 Turnpike Road, Shrewsbury, Massachusetts 01545 • 508-842-0516 Fax: 508-842-0748
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BetaTHERM NTC Thermistor Devices

BetaTHERM RESISTANCE RATIO—TEMPERATURE AND DEVIATION TOLERANCE TABLES

TEMP		Material (Curve) #1				(Curve) #2				(Curve) #3				(Curve) #4			
°F	°C	Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE
-112	-80	169.20	-6.72	12.5	1.82	233.5	-7.16	12.0	1.68	729.68	-8.90	13.0	1.46				
-103	-75	121.59				163.5				471.37							
-94	-70	88.34	6.28	10.0	1.55	115.9	-6.69	9.0	1.34	309.56	-8.29	9.5	1.15				
-85	-65	64.87				83.17				206.49							
-76	-60	48.12	-5.88	7.8	1.31	60.39	-6.26	7.0	1.12	139.79	-7.69	7.5	0.98				
-67	-55	36.04				44.33				95.978				60.86			
-58	-50	27.24	-5.51	6.3	1.13	32.89	-5.85	5.0	0.85	66.782	-7.14	5.5	0.87	44.17	-6.30	4.3	0.68
-49	-45	20.778				24.64				47.061				32.39			
-40	-40	15.983	-5.16	5.3	1.00	18.641	-5.47	3.8	0.58	33.5668	-6.61	4.3	0.79	23.983	-5.92	3.6	0.61
-31	-35	12.395				14.231				24.2193				17.928			
-22	-30	9.689	-4.85	4.3	0.88	10.960	-5.12	3.0	0.48	17.6682	-6.21	3.5	0.68	13.523	-5.56	2.9	0.53
-13	-25	7.630				8.511				13.0242				10.289			
-4	-20	6.053	-4.56	3.3	0.73	6.662	-4.82	2.3	0.39	9.6973	-5.81	2.7	0.56	7.893	-5.23	2.3	0.44
5	-15	4.835				5.255				7.2894				6.1030			
14	-10	3.888	-4.29	2.5	0.58	4.175	-4.54	1.6	0.29	5.5297	-5.51	2.0	0.45	4.7549	-4.94	1.7	0.35
23	-5	3.147				3.341				4.2314				3.7316			
32	0	2.563	-4.04	1.7	0.42	2.691	-4.25	1.1	0.21	3.2651	-5.20	1.4	0.33	2.9490	-4.65	1.2	0.25
41	5	2.100				2.182				2.5395				2.3462			
50	10	1.730	-3.82	1.0	0.26	1.780	-4.02	0.6	0.13	1.9903	-4.80	0.8	0.20	1.8787	-4.40	0.7	0.15
59	15	1.434				1.460				1.5714				1.5136			
68	20	1.194	-3.60	0.3	0.09	1.205	-3.78	0.2	0.04	1.2494	-4.52	0.3	0.07	1.2268	-4.16	0.2	0.05
77	25	1.0000	-3.50	0.0	0.00	1.0000	-3.68	0.0	0.00	1.0000	-4.39	0.0	0.00	1.00000	-4.04	0.0	0.00
86	30	0.8414	-3.41	0.3	0.09	0.8342	-3.57	0.2	0.05	0.80560	-4.26	0.3	0.07	0.81966	-3.92	0.2	0.05
95	35	0.7114				0.6993				0.65301				0.67539			
104	40	0.6043	-3.22	0.9	0.27	0.5892	-3.39	0.6	0.15	0.53249	-4.03	0.7	0.21	0.55937	-3.73	0.6	0.16
113	45	0.5155				0.4987				0.43669				0.46557			
122	50	0.4417	-3.05	1.4	0.46	0.4240	-3.21	1.0	0.25	0.36010	-3.80	1.2	0.36	0.38933	-3.53	1.0	0.28
131	55	0.3800				0.3620				0.29851				0.32707			
140	60	0.3283	-2.89	1.9	0.65	0.3104	-3.04	1.3	0.37	0.24871	-3.61	1.6	0.52	0.27599	-3.36	1.3	0.40
149	65	0.2846				0.2673				0.20823				0.23387			
158	70	0.2477	-2.74	2.4	0.85	0.2310	-2.88	1.7	0.49	0.17516	-3.42	2.0	0.68	0.19900	-3.19	1.7	0.52
167	75	0.2164				0.2004				0.14801				0.17000			
176	80	0.1897	-2.60	2.8	1.02	0.1745	-2.73	2.0	0.62	0.12562	-3.25	2.3	0.85	0.14579	-3.05	2.0	0.65
185	85	0.1668				0.1524				0.10706				0.125483			
194	90	0.1472	-2.47	3.2	1.19	0.1336	-2.58	2.3	0.75	0.091610	-3.07	2.7	1.03	0.108395	-2.91	2.3	0.78
203	95	0.1302				0.1175				0.078698				0.093960			
212	100	0.1156	-2.35	3.7	1.43	0.1037	-2.49	2.7	0.91	0.067863	-2.92	3.0	1.20	0.081719	-2.78	2.5	0.91
221	105					0.0917				0.058730				0.071303			
230	110					0.0814	-2.40	3.0	1.09	0.051006	-2.77	3.3	1.37	0.062409	-2.65	2.8	1.05
239	115					0.0725				0.044448				0.054792			
248	120					0.0647	-2.25	3.4	1.27	0.038859	-2.64	3.6	1.59	0.048246	-2.52	3.0	1.20
257	125					0.0579				0.034082				0.042603			
266	130					0.0519	-2.23	3.7	1.47	0.029982	-2.51	3.9	1.73	0.037723	-2.42	3.3	1.33
275	135					0.0467				0.026454				0.033492			
284	140					0.0421	-2.03	4.0	1.67	0.023408	-2.41	4.1	1.91	0.029812	-2.32	3.5	1.50
293	145					0.0380				0.020770				0.026604			
302	150					0.0344	-2.01	4.3	1.85	0.018478	-2.31	4.4	2.17	0.023798	-2.23	3.7	1.66

TEMP		(Curve) #5				(Curve) #6				(Curve) #7			
°F	°C	Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE	Resistance Multiplier	α (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP	Max. Deviation (%) from Curve Nom. Beta-CURVE
-112	-80												
-103	-75												
-94	-70												
-85	-65												
-76	-60												
-67	-55	79.36				121.63				54.14			
-58	-50	56.43	-6.67	4.70	0.70	83.38	-7.40	7.0	0.95	39.49	-6.67	5.7	0.85
-49	-45	40.57				57.89				29.11			
-40	-40	29.47	-6.26	3.61	0.58	40.672	-6.83	5.1	0.74	21.68	-5.55	4.3	0.77
-31	-35	21.63				28.909				16.31			
-22	-30	16.02	-5.91	2.92	0.49	20.774	-6.45	4.1	0.64	12.38	-5.43	3.5	0.64
-13	-25	11.98				15.085				9.485			
-4	-20	9.032	-5.57	2.29	0.41	11.065	-6.08	3.2	0.53	7.329	-5.08	2.7	0.53
5	-15	6.869				8.1938				5.709			
14	-10	5.266	-5.25	1.71	0.33	6.1237	5.74	2.4	0.42	4.482	-4.76	2.0	0.45
23	-5	4.068				4.6169				3.546			
32	0	3.166	-4.94	1.17	0.24	3.5102	-5,40	1.6	0.30	2.825	-4.48	1.4	0.30
41	5	2.481				2.6904				2.266			
50	10	1.958	-4.67	0.68	0.15	2.0781	-5.10	1.0	0.19	1.830	-4.21	0.8	0.19
59	15	1.556				1.6170				1.487			
68	20	1.243	-4.41	0.22	0.05	1.2673	-4.81	0.3	0.06	1.216	-3.99	0.3	0.07
77	25	1.0000	-4.30	0.00	0.00	1.00000	-4.68	0.0	0.00	1.0000	-3.87	0.0	0.00
86	30	0.8089	-4.18	0.21	0.05	0.79428	-4.55	0.3	0.06	0.8270	-3.76	0.3	0.07
95	35	0.6580				0.63489				0.6876			
104	40	0.5382	-3.96	0.61	0.15	0.51058	-4.30	0.9	0.20	0.5747	-3.56	0.7	0.20
113	45	0.4425				0.41301				0.4827			
122	50	0.3656	-3.77	0.98	0.26	0.33598	-4.08	1.4	0.33	0.4074	-3.36	1.2	0.35
131	55	0.3036				0.27480				0.3454			
140	60	0.2332	-3.58	1.33	0.37	0.22593	-3.87	1.9	0.48	0.2941	-3.17	1.6	0.50
149	65	0.2122				0.18669				0.2515			
158	70	0.1786	-3.42	1.66	0.49	0.15502	-3.68	2.3	0.63	0.2160	-2.99	2.0	0.66
167	75	0.1509				0.12932				0.1862			
176	80	0.1281	-3.25	1.97	0.60	0.10837	-3.49	2.7	0.78	0.1612	-2.84	2.3	0.82
185	85	0.1091				0.091215				0.1400			
194	90	0.09333	-3.10	2.26	0.73	0.077097	-3.33	3.1	0.94	0.1220	-2.69	2.7	0.99
203	95	0.08011				0.065428				0.1067			
212	100	0.06900	-2.95	2.53	0.86	0.055744	-3.17	3.5	1.11	0.0937	-2.54	3.0	1.18
221	105	0.05964				0.047674				0.0825			
230	110	0.05173	-2.81	2.79	0.99	0.040921	-3.04	3.9	1.27	0.0728	-2.36	3.3	1.39
239	115	0.04500				0.035251				0.0645			
248	120	0.03928	-2.68	3.03	1.13	0.030469	-2.91	4.2	1.45	0.0573	-2.31	3.6	1.55
257	125	0.03438				0.026424				0.0510			
266	130	0.03019	-2.59	3.26	1.26	0.022990	-2.87	4.5	1.67	0.0456	-2.12	3.9	1.82
275	135	0.02658				0.020064				0.0408			
284	140	0.02346	-2.49	3.48	1.40	0.017563	-2.74	4.8	1.96	0.0366	-2.00	4.1	2.06
293	145	0.02077				0.015419				0.0330			
302	150	0.01843	-2.39	3.69	1.55	0.013575	-2.6	5.1	2.16	0.0298	-1.88	4.4	2.33

BetaTHERM MATERIALS R-T SLOPE SPECIFICATIONS

		Material (Curve) #1			(Curve) #2			(Curve) #3			(Curve) #4			(Curve) #5			(Curve) #6			(Curve) #7		
TYPICAL "CHIP" ELEMENT Resistance Range (Ohms @ 25°C.)		50 to 500			100 to 1,000			2,000 to 20,000			5,000 to 30,000			10,000 to 50,000			50,000 to 1,000K			100 to 10,000		
		BETA Value	Max % Dev. BetaCHIP	Max % Dev. BetaCURVE	BETA Value	Max % Dev. BetaCHIP	Max % Dev. BetaCURVE	BETA Value	Max % Dev. BetaCHIP	Max % Dev. BetaCURVE	BETA Value	Max % Dev. BetaCHIP	Max % Dev. BetaCURVE	BETA Value	Max % Dev. BetaCHIP	Max % Dev. BetaCURVE	BETA Value	Max % Dev. BetaCHIP	Max % Dev. BetaCURVE	BETA Value	Max % Dev. BetaCHIP	Max % Dev. BetaCURVE
BETA Value & Max. Beta Deviation for 0/50°C. Ro Ratio		3108	1.7	0.40	3263	0.92	0.38	3892	1.4	0.32	3575	1.0	0.30	3811	0.94	0.30	4143	1.3	0.30	3422	1.0	0.36
		R Ratio Value			R Ratio Value			R Ratio Value			R Ratio Value			R Ratio Value			R Ratio Value			R Ratio Value		
Nominal R Ratio & Max. Deviations for Temperature Span (°C.)	0/50	5.80	3.2	0.9	6.35	2.1	0.7	9.06	2.5	0.7	7.58	2.2	0.9	8.65	2.2	0.9	10.45	3.1	0.9	6.95	2.5	0.7
	0/70	10.35	4.2	1.1	11.65	2.8	1.0	18.65	3.4	1.0	14.82	2.9	1.1	17.73	2.9	1.1	22.65	4.1	1.1	13.08	3.4	1.1
	25/125	15.22	NA	NA	17.33	3.7	1.5	29.27	3.9	1.4	23.51	3.3	1.3	29.15	3.3	1.3	38.07	4.6	1.3	19.05	3.9	0.7

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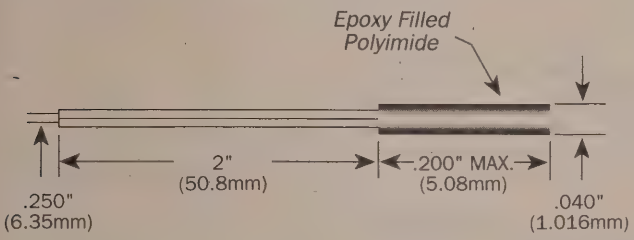
BetaTHERM NTC Thermistor Devices

*INTERCHANGEABLE mini **BetaCURVE** PROBE*

TEMPERATURE SENSORS PRECISION INTERCHANGEABLE NTC THERMISTORS

BetaTHERM Corporation introduces it's NEW "mini-BetaCURVE" Thermistor Series.

This new addition to the ***BetaTHERM*** product family has taken the Thermistor Interchangeable market to new heights. All of the outstanding electrical features of the Standard Interchangeable ***BetaCURVE*** devices plus smaller controlled size result in faster Time response.



FEATURES:

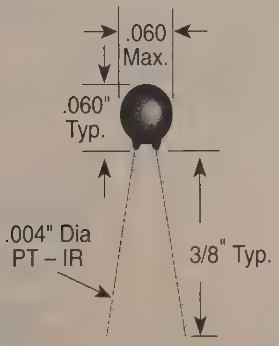
- Controlled Package Size (.040" Nom. Diameter)
- Fast Time Response (TC=.5 Sec. Typ. in oil bath)
- * Standard Temperature Tol. ±.2°C 0°C to 70°C
- Standard Ro @ 25°C Values 100Ω to 100KΩ

Ro@25°C Nominal	Part Number	Material	0–50°C Beta	α@25°C %/°C
100Ω	.1K1MBD1	1	3108	–3.5
300Ω	.3K1MBD1	1	3108	–3.5
1000	1K2MBD1	2	3263	–3.7
1000	1K7MBD1	7	3422	–3.9
2,252	2.2K3MBD1	3	3892	–4.4
3,000	3K3MBD1	3	3892	–4.4
5,000	5K3MBD1	3	3892	–4.4
10,000	10K3MBD1	3	3892	–4.4
10,000	10K4MBD1	4	3575	–4.0
30,000	30K5MBD1	5	3811	–4.3
50,000	50K6MBD1	6	4143	–4.7
100,000	100K6MBD1	6	4143	–4.7

Standard Lead Wire–32 A.W.G. Copper Bifilar with Himol

*STANDARD GLASS COATED **BetaCHIP***

Betatherms Glass Coated ***BetaCHIP*** Thermistors are made from the same high quality and high stability chip element as Betatherms other product family members. High Temperature Storage tests (2000 hrs @150°C) have been documented showing superior stability (Avg ΔR= 0.016%). The recommended operating range for the glass coated ***BetaCHIP*** Thermistor is –60°C to 300°C. The glass coated ***BetaCHIP*** Thermistors will meet or exceed the testing requirements of Mil-T-23648A.



STANDARD GLASS COATED ***BetaCHIP*** CONFIGURATION

FEATURES:

- Resistance values from 200 Ohms to 1 meg. Ohms
- High reliability
- Hermetically sealed in glass coating
- Excellent long-term stability at elevated temperatures
- Platinum-Iridium leads are solderable and weldable

Ro@ 25°C. (ohms)	% Tol	Code Number	0/5°C Ratio	RT Curve
200	10	G.2K1BA2	4.8	1
1,000	10	G1K7A2	6.93	7
2,000	10	G2K7A2	6.93	7
5,000	10	G5K7A2	7.58	4
10,000	10	G10K3A2	9.06	3
20,000	10	G20K3A2	9.06	3
50,000	10	G50K63A2	9.53	63
100,000	10	G100K6A2	10.45	6
500,000	10	G500K18A2	11.78	18
1meg.	10	G1M9A2	13.40	9

T.C. 4 sec., **D.C. .4MW/°C
Lead length 3/8"; lead material PT-IR; lead dia. .004

*Contact ***BetaTHERM*** Corporation Engineering relative to specific requirements and product availability.
D.C.—Power in milliwatts required to raise thermistor temperature 1°C
T.C.—Time required for thermistor to indicate 63% of a new impressed temperature

Other tolerances, materials, and configurations available upon request.

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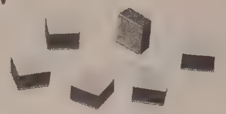
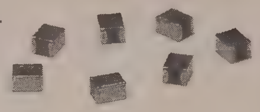
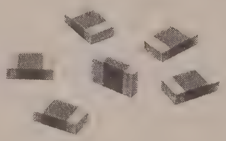
MODEL W, NTHS, J NTC Thermistors

Surface Mount Chip

A COMPANY OF VISHAY DALE

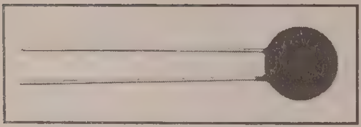
MODEL W 	• Top and bottom surface terminations • High-density monolithic ceramic construction • Allows design flexibility for use with hybrid circuitry • Model W is a thermistor die with silver conductors fired on the top and bottom surfaces. The bottom surface can be reflow soldered or conductive epoxied directly to a substrate bonding pad and the top surface wire bonded to complete the circuit connection.
MODEL NTHS 	• Wraparound terminations • Allows design flexibility for use with hybrid circuitry • High-density monolithic ceramic construction • Available in 8mm tape and reel
MODEL J 	• Wraparound terminations • Allows for design flexibility for use with hybrid circuitry • High-density monolithic ceramic construction • Available in 8mm tape and reel • Model J chips are thermistor dies with wraparound terminations of fired-on platinum/palladium/silver for mounting directly to the bonding pads of a hybrid substrate. The use of low temperature 2% to 5% silver bearing solder paste or a suitable conductive epoxy is suggested for mounting.

MODEL SSN "SOFT-START" NTC Thermistors

For Inrush Current Suppressing Devices

1.5 A to 25 A at 65°C

A COMPANY OF VISHAY DALE



ELECTRICAL SPECIFICATIONS

Standard Tolerance: ± 20% at + 25°C.

Dielectric Strength: 500 V, 2 minutes.

Insulation Resistance: Not < 500 Meg.

MECHANICAL SPECIFICATIONS

Resistive Element: Various metal oxides.

Encapsulation: Silicone coating.

Terminals: Tinned copper-clad steel.

FEATURES

- Switching power supply applications
- Special marking is available upon request
- Protective silicone coating is standard and has a nominal thickness of .040" [1.0]. Other coatings are available upon request.
- "Soft-Start" devices display relatively high resistance to starting currents in a variety of electronic circuits. Having a negative temperature coefficient of resistance, these devices exhibit a large decrease in resistance when AC or DC current begins to flow at Iop.

  Unlike circuit breakers and fuses, "Soft-Starts" prevent dangerous, short-duration, peak inrush currents present at turn-on. Especially useful in power supplies where charging capacitors initially present extremely low impedance. "Soft-Starts" actually limit inrush currents thereby extending the life of other critical components.

MODELS X, M, C, F, T, B NTC Thermistors

Coated

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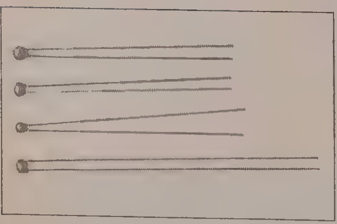

FEATURES

- Small size, wide resistance range, available in 11 different R-T curves, configured for standard P.C. board mounting or assembly in probes. Models are conformally coated, leaded thermistors for standard P.C. board mounting or assembly in probes. The coating is baked-on phenolic for durability and long-term stability. Leads are solid tinned copper, except T models have solid nickel wires with Teflon® insulation to provide isolation when assembled in metal probes or housings.

MODEL X: ± 10%, ± 5% R70 tolerance.

MODEL M, C, F, T, B: ± 10%, ± 5%, ± 3%, ± 2%, ± 1% R25 tolerance. Leads solid tinned copper. M, C, F and B are 1.8 ± .2 [45.7 ± 5.1] long. T is 3 ± .25 [76.2 ± 6.4] long.

NTC Thermistor Assemblies

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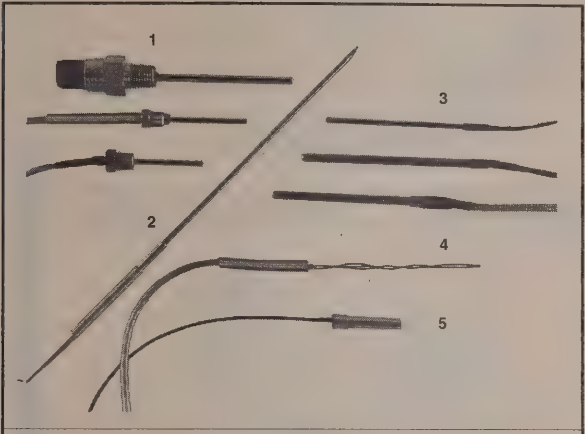
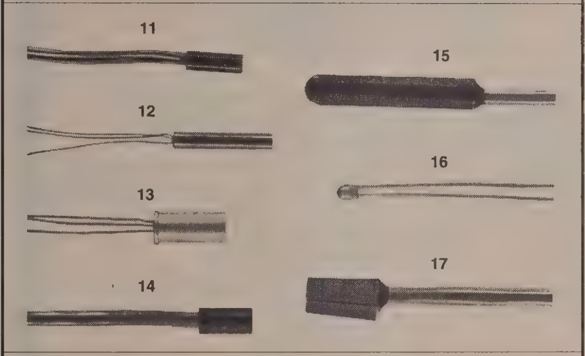
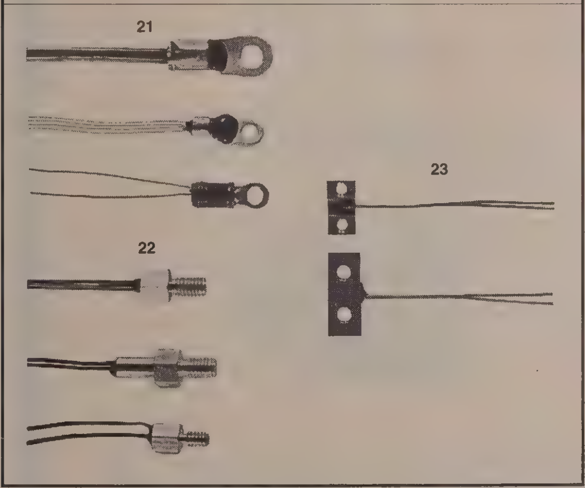






NOTE: A variety of wire styles is available from stock. Depending on the probe and application, the wire will vary. Consult the factory for this and other information.

HOW TO ORDER

1. Choose Style: Immersion probe.
2. Select Style Type: "1" = thread mount.
3. Select Thermistor: 1M1002-C3.
4. Indicate style, type and thermistor to factory for part numbers.

Standard and custom assemblies are available in a variety of configurations. The choice of assembly style is dependent on the application. The primary factors which determine the optimum configuration of a thermistor assembly are the operating environment, mounting, time response and minimum dissipation constant.

The two factors which do vary considerably with assembly design are time constant and dissipation constant. The time constant will typically be of greater duration in encapsulated thermistors. This is, of course, due to additional mass surrounding the thermistor element; therefore, extending the thermal transfer time. Dissipation constant will also be greater in assemblies. The additional housing mass serves well as a heat sink. Greater power is therefore required to induce self-heating.

Both time constant and dissipation constant will vary with the selected thermistor and housing. Heat transfer properties of the housing, thermistor location, mass and wire type determine these constants. It is recommended to evaluate or consult the factory in applications where T.C. and D.C. are critical.

ASSEMBLY STYLES

■ Immersion Probes

1. **Thread Mounted:** Features a stainless steel tube with a hermetically sealed threaded hex fitting. Available in 1/8", 3/16" and 1/4" outer diameter tubes with 1/8" or 1/4" NPT hex fittings. Ideal for pressured, closed systems.

2. **Penetration Probe:** 7" long x 1/8" outer diameter stainless steel tube. Pointed tip easily penetrates soft and semi-frozen materials. Also ideal for soil and ground measurements.

3. **Tubular Stainless Steel:** 1/8", 3/16" and 1/4" outer diameter tubes in variable lengths. Good for universal immersion applications. Adaptable to use with compression thread mounts to give designer variable immersion depths.

4. **Tubular Pyrex®:** 6" long x 3/16" outer diameter glass tube. Excellent for lab use where a chemically inert probe is required.

5. **Flexible Immersion:** 1.5" long x .280" outer diameter aluminum housing. Flexible 105°C PVC tubing to protect wire and thermistor element from the liquid medium. Ideal assembly for intermittent immersion in hard to reach areas.

■ General Purpose Sensors

11. **Delrin® Housing:** 1/2" long x .170" outer diameter thermoplastic. Excellent for environmental controls and applications below 100°C.

12. **Stainless Steel Rod:** .875" x .156" outer diameter. Good for environmental chamber measurement where corrosive gasses exist.

13. **Gold Anodized Flanged Sensor:** .630" long x .275" outer diameter with a .298" flange diameter. An easy to mount press fitting.

14. **ABS Housing:** .476" long x .230" outer diameter. Black thermoplastic and configuration suits it well in air flow temperature measurements.

15. **Polyester Housing:** 1.50" long x .280" outer diameter. Heavy thermoplastic case makes it ideal for applications requiring delayed time responses. Ideal for process controls in refrigeration and heating.

16. **Epoxy Tip Probe:** Durable epoxy encapsulation, small size, fast time response, versatility and low cost make this sensor universally accepted. Assembly size will vary with wire and thermistor choice.

17. **Pipe Sensor:** .625" long with a cut-out radius of .250" suits this nylon thermoplastic as an ideal pipe sensor. Extensive use is seen in environmental and water heating/cooling systems.

■ Surface Sensors

21. **Ring Tongue Lugs:** Surface mount with a #4, #6, #8 or #10 screw. Excellent for measurement and control of surfaces where fast time responses are necessary.

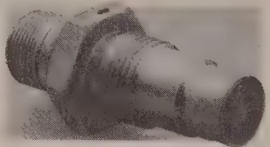
22. **Heat Sink Sensors:** Available in brass, aluminum or stainless steel with various threads. A durable and practical surface sensor, especially where shock and vibration are present.

23. **Rectangular Block Sensors:** Aluminum blocks for measurement and control of large surface areas. Easily mountable with #6 screws.

ELMWOOD SENSORS

WHERE RELIABILITY IS BUILT IN.

PRECISION THERMOSTATS

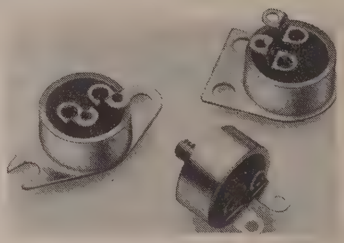


When applications call for precise specifications, Elmwood has a full line of Precision Thermostats with a variety of mounting and package configurations available. For narrow or wide differentials. When accuracy and reliability is serious business, you can count on these high quality thermostats.

APPLICATIONS:
- Aerospace & Avionics
- Medical Equipment
- Power Supplies
- Data Processing Equipment

FEATURES:
- ½" and ¾" Sizes
- Internal and External Design Options
- Variable Probe Lengths and Connecting Methods Available

AEROSPACE/ MILITARY THERMOSTATS



Designed to meet the requirements of the aerospace industry and exceed the criteria of MIL-S-24236. Elmwood's Aerospace/Military Thermostats are capable of optimum performance in rigid environmental conditions such as extreme temperature, shock and vibration.

APPLICATIONS:
- Satellites
- Aircraft
- Missiles
- Instrumentation

FEATURES:
- QPL Listed
- Small Size and Weight
- Variety of Mounting & Package Configurations Available

½" THERMOSTATS

Designed to open or close on temperature rise, ½" Thermostats operate in an ambient temperature range up to 550°F (287°C). Devices are thermally and mechanically inspected at the factory. Cost-efficient for commerical applications.

APPLICATIONS:
- Small Appliances
- Fire and Smoke Alarms
- Data Processing Equipment

FEATURES:
- Cost Efficient
- Set to Specifications
- UL Recognized, CSA Certified & European Approved

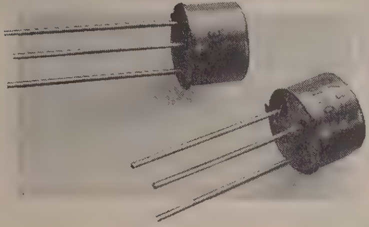
¾" THERMOSTATS

Designed to open and close on temperature rise, ¾" Thermostats are specifically designed to meet the demanding temperature control requirements of a wide range of major appliances and equipment. Thermostats are rated up to 25 Amps-240 Volts and meet UL Standard 353.

APPLICATIONS:
- Major Appliances
- Commerial Appliances
- Data Processing Equipment
- Spa and Hot Tub Equipment

FEATURES:
- 25 Amp Capacity
- Narrow Temp Differential
- Tight Temp Tolerances
- Rugged Construction
- Recognized by UL, CSA and European Approval Agencies

THE WORLD'S FIRST TO-5 THERMAL SWITCH

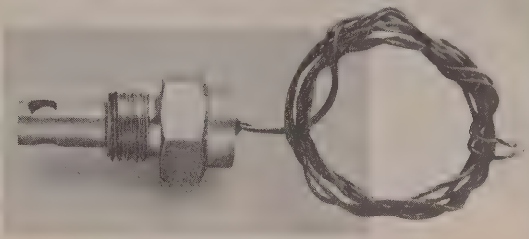


Elmwood's 3600 Series TO-5 Thermostat provides reliable protetion against damage caused by hazardous temperatures on your printed circuit board. Customized configurations are available.

APPLICATIONS:
- Power Supplies
- Logic Boards
- Medical Electronics
- Telecommunications
- Personal Computers

FEATURES:
- Hermetically Sealed/ Wave Solderable
- Switches Up To 1 Amp
- 100% Temperature Tested
- Heat Sink Mounting Brackets Available

THERMISTOR ASSEMBLIES

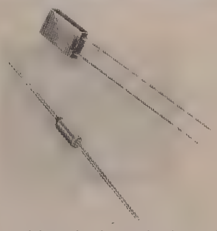


Elmwood's Accumistor Series of thermistor assemblies are available with PTC's and NTC's to meet your needs. Thermistors can be combined for reliable multi-purpose sensing capabilities and as self-regulating heaters in electronics, process control and automative applications.

APPLICATIONS:
- Temperature Setting
- Level & Flow Sensing
- Precision Heating
- Over-Current Protection

FEATURES:
- Packaged Assemblies
- Range: −40°C to 200°C
- Solid State Technology
- Customized Assemblies

THERMAL FUSES AND MOTOR & TRANSFORMER PROTECTORS



Miniature, heat-sensitive devices designed for over temperature protection of electrical appliances and equipment or transformers and fractional horsepower motors. Thermal Fuses are rated to 15 Amps and can be configured to your specifications. Motor and Transformer Protectors have a patented, non-eutectic design, feature an isolated and sealed cap and are rated to 5 Amps. Both are UL Recognized, CSA Certified and meet major international approvals. Immediate off-the-shelf availability in a variety of standard temperatures and leads.

APPLICATIONS:
- Small Appliances
- HVAC
- Major Applicance
- Motor & Transformer

FEATURES:
- Popular Temp Range
- Insulated Case (MTP)
- Customized Assemblies Available

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At Elmwood, our commitment to customer service goes beyond product quality. Our customer service programs are designed to fit your specific needs:

- Redi-Temp—An off-the-shelf program with a one week delivery schedule.
- Elmwood Express—A priority delivery service that puts your rush order on the fast track.
- Design Assistance—Pre-packaged assemblies made to fit your requirements complete with custom brackets, terminals, wiring, connectors, overmolds, etc.
- Lead Time Programs—Production and sample lead times that others try to beat.

And our customers service representatives are trained professionals assigned to you from order entry to order shipment.

No one puts more into thermal sensing than Elmwood. Don't accept anything less.

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- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

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- Electrovert
- Heli-Tube
- Panduit

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- Belden
- Cablewave
- Carol
- Iboco
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- Manhattan
- Quabbin

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NTC and PTC

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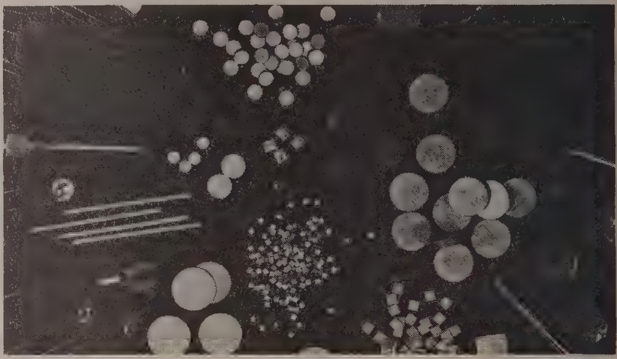
INTRODUCTION

Thermistors are temperature sensitive passive semiconductors which exhibit a large change in electrical resistance when subjected to a relatively minute change in body temperature. Negative temperature coefficient (NTC) thermistors decrease in resistance when subjected to an increase in body temperature. Conversely positive temperature coefficient thermistors (PTC) increase in resistance when subjected to an increase in body temperature. Ketema-Rodan Division manufactures NTC thermistors as well as two basic types of PTC thermistors. The silicon PTC offers a nearly linear positive temperature coefficient of approximately +.7%°/C and the switching PTC thermistor which exhibits a very large increase in resistance (several powers of 10) over a designated temperature range. Their extreme sensitivity to minute temperature changes enables them to perform many unique functions heretofore impossible with standard electronic components.

NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

The NTC devices are available in resistance values from less than 1 ohm to 1 megohm, and in sizes ranging from 0.010 inch cubes to 1 inch diameter discs. Available configurations include: discs, chips, rods, bars, probes, and resistor/thermistor networks. Units can be molded, dip coated, or encapsulated to your specifications, using packaging materials such as epoxy, glass, or high temperature silicon resin.



SURGE-GARD™ INRUSH CURRENT LIMITING DEVICES

Rodan® SURGE-GARD devices are manufactured of a specially-formulated metal oxide ceramic material which is capable of suppressing high inrush current surges. They are especially useful in power supplies (See Fig A) where, due to the extremely low impedance of the capacitor being charged, the bridge is subjected to an exceedingly high current surge at turn-on. The SURGE-GARD, being of relatively high resistance, limits the current for 1 to 2 seconds during which time the device decreases in resistance substantially to a point where its voltage drop is negligible.

Part Number			R @ 25°C (Ohms)	R Tolerance (+/- %)	I_{max} (Amps)	RI_{max} (Ohms)	Max. "D" (Inches)	Max. "T" (Inches)	Lead Dia. (Inches)	NTC Curve
Style A	Style B	Style C								
SG260	SG326		.5	20	30.00	.010	1.250	.200	.040	A
SG415	SG327		.7	25	12.00	.030	.740	.200	.040	A
SG100	SG301		1.0	15	20.00	.015	.900	.300	.040	A
SG405	SG328		1.0	25	30.00	.015	1.250	.250	.040	A
SG416	SG329		1.3	25	8.00	.050	.525	.200	.040	A
SG110	SG302		2.0	15	18.00	.030	.900	.350	.040	A
SG120		SG303	2.5	15	3.00	.150	.600	.250	.032	A
SG130		SG304	2.5	15	7.00	.050	.600	.250	.032	A
SG140		SG305	2.5	15	9.00	.040	.600	.250	.032	A
SG150	SG306		2.5	15	10.00	.040	.900	.300	.040	A
SG160	SG307		2.5	15	15.00	.030	.900	.300	.040	A
SG170	SG308		4.0	15	8.00	.070	.600	.250	.040	A
SG32	SG330		4.0	20	14.00	.050	.900	.350	.040	A
SG180		SG309	5.0	15	2.00	.400	.600	.250	.032	A
SG413			5.0	25	2.80	.250	.530	.200	.025	A
SG190		SG310	5.0	15	4.00	.150	.600	.250	.032	A
SG57		SG331	5.0	10	6.00	.100	.600	.250	.032	A
SG200		SG311	5.0	15	7.00	.070	.600	.250	.032	A
SG44	SG332		5.0	20	8.00	.050	.600	.250	.040	A
SG26	SG333		5.0	15	12.00	.060	.900	.500	.040	A
SG418		SG334	6.0	15	5.00	.150	.600	.270	.032	A
SG210	SG312		7.0	15	4.00	.200	.600	.300	.040	A
SG85	SG335		7.0	25	5.00	.150	.600	.300	.040	A
SG64	SG336		7.0	15	10.00	.080	.950	.500	.040	J
SG13		SG337	10.0	15	2.00	.300	.500	.250	.032	A
SG220		SG313	10.0	15	3.00	.200	.450	.300	.032	A
SG42	SG338		10.0	15	5.00	.200	.600	.350	.040	A
SG27	SG314		10.0	15	6.00	.150	.600	.350	.040	A
SG40	SG72		10.0	20	8.00	.100	.900	.350	.040	J
SG39	SG339		12.0	10	4.00	.220	.500	.350	.040	A
SG23		SG340	15.0	10	2.50	.330	.550	.300	.032	A
SG86			16.0	25	1.70	.600	.530	.300	.025	A
SG414			16.0	25	2.70	.400	.550	.300	.025	A
SG63	SG320		16.0	25	4.00	.250	.750	.250	.040	J
SG230		SG315	20.0	15	1.75	.600	.600	.300	.032	A
SG411		SG341	25.0	25	1.70	.600	.500	.300	.032	A
SG412		SG342	25.0	25	2.40	.400	.500	.300	.032	A
SG38	SG343		30.0	15	3.00	.400	.600	.250	.040	B
SG240		SG316	40.0	15	2.00	.600	.625	.250	.032	B
SG52	SG344		47.0	25	3.00	.500	.770	.240	.040	B
SG16		SG345	60.0	10	1.50	1.000	.600	.250	.032	B
SG250	SG317		120.0	15	3.00	.900	.925	.250	.040	C
SG31	SG346		220.0	20	1.30	1.900	.600	.300	.040	C

For applications requiring ratings not shown, contact Ketema Rodan applications engineering.

1 Other resistance values available upon request.

2 I_{max} = The maximum steady state DC or RMS AC current.

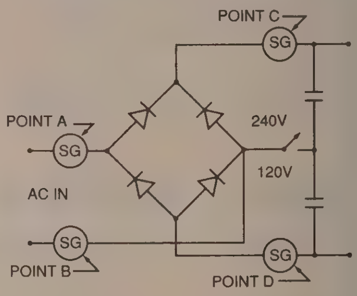
3 * RI_{max} = The approximate resistance under maximum steady state current conditions.

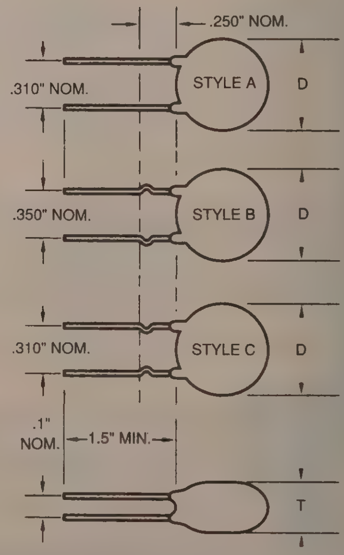
4 **Max Operating Temp** = All Rodan Surge-Gard devices are rated for operation to a maximum ambient temperature of 65°C. If your application requires operation above 65°C ambient, please consult Rodan's applications engineering department.

5 **Recovery Time** = Since Rodan Surge-Gards self-heat due to current flow, which in turn causes a reduction in their resistance, the devices require cool-down time after power is removed. The cool-down time allows the resistance to increase sufficiently to provide the required inrush current limiting. This time varies with the particular device, mounting method and ambient temperature. Usually, a one minute cool-down period is adequate. Selection of capacitor bleeder resistors which will provide a one minute or so bleed down time can eliminate the cool down time requirement.

APPLICATIONS

If the resistance of one Surge-Gard does not provide sufficient inrush current limiting for your application, two or more may be used in series or in separate legs of the supply circuit. Surge-Gards cannot be used in parallel since one unit will tend to conduct nearly all the current available. Surge-Gards may be used in the AC (Point A or B) or the DC (Point C or D) locations in the circuit.





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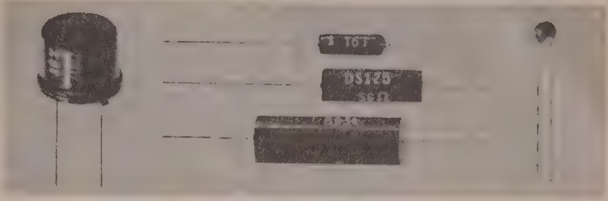
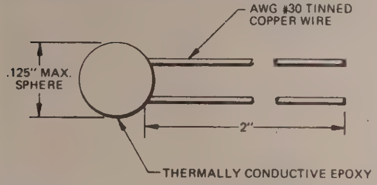
SILICON PTC THERMISTORS

DESCRIPTION

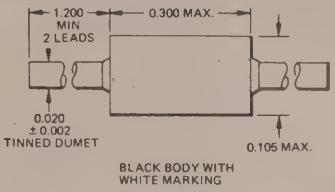
The positive temperature coefficient of resistance is very large: approximately 0.7%/°C, making these units ideal for use in temperature-compensating and sensing applications. Just a few such applications include amplifiers, power supplies, transducers, telemetry, computers, magnetic amplifiers, thermometry, meteorology, temperature regulation and overtemperature protection. Lead material other than standard, such as weldable nickel or gold plated, is available on request.



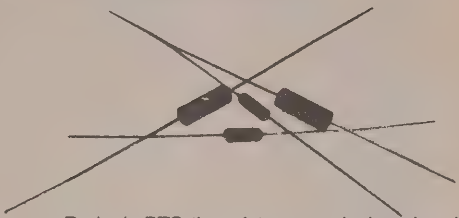
MINIATURE PROBE—DU100


AWG #30 TINNED COPPER WIRE
.125" MAX. SPHERE
2"
THERMALLY CONDUCTIVE EPOXY

GLASS TYPE—DG125


1.200 MIN 2 LEADS
0.300 MAX.
0.020 ± 0.002 TINNED DUMET
0.105 MAX.
BLACK BODY WITH WHITE MARKING

MIL-APPROVED SERIES

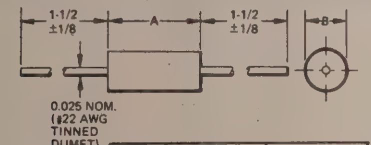


Rodan's PTC thermistors are designed and built to withstand all environmental conditions required by the most stringent Mil specs. They meet or exceed all requirements of MIL-T-23648A for Positive TC Thermistors.

RTH 42 Per MIL-T-23648A/19. Glass, hermetically-sealed type, similar to DG 125 series above.

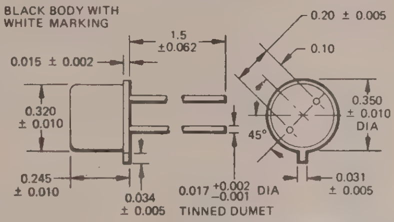
RTH 22 Per MIL-T-23648/9. Molded style, similar to DS 200 series above.

MOLDED TYPES—DS125, DS200, DS250


1-1/2 ±1/8
A
1-1/2 ±1/8
B
0.025 NOM. (#22 AWG TINNED DUMET)
BLACK BODY WITH WHITE MARKING

TYPE	A	B
DS125	0.406 ±0.015	0.140 ±0.015
DS200	0.406 ±0.015	0.140 ±0.015
DS250	0.585 ±0.015	0.200 ±0.015

TRANSISTOR TYPE—DC125


BLACK BODY WITH WHITE MARKING
1.5 ±0.062
0.015 ± 0.002
0.320 ± 0.010
0.245 ± 0.010
0.034 ± 0.005
0.017 +0.002 −0.001 DIA TINNED DUMET
0.20 ± 0.005
0.10
0.350 ± 0.010 DIA
45°
0.031 ± 0.005

ELECTRICAL SPECIFICATIONS

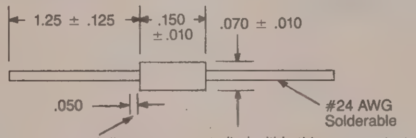
PART NUMBER	WATTAGE RATING @ 100°C	STD RESISTANCE RANGE	THERMAL TIME CONSTANT	OPERATIONAL AMBIENT TEMPERATURE RANGE
DS 125	0.125	10 to 39,000	34.8	−65 to +150
DS 200 (RTH22)	0.250 0.250	10 to 39,000 10 to 10,000	34.8 34.8	−65 to +150 −65 to +150
DS 250	0.250	10 to 39,000	54.0	−65 to +150
DG 125 (RTH42)	0.125	10 to 10,000	60.0	−65 to +125
DC 125	0.125	10 to 10,000	54.0	−65 to +125
DU 100	0.125	10 to 10,000	9.0	−65 to +125
UNIT	WATTS	Ohms	Sec. Max	°C

STANDARD RESISTANCE VALUES

10
12
15
18
22
27
33
39
47
50
56
68
82
100
120
150
180
220
270
330
390
470
500
560
680
820
1000
1200
1500
1800
2200
2700
3300
3900
4700
5000
5600
6800
8200
10,000

Matched pairs or other resistance values available as special devices.

MINI-SENSOR™ HERMETICALLY SEALED NTC THERMISTORS


1.25 ± .125
.150 ± .010
.070 ± .010
.050
#24 AWG Solderable

NOTE: Lead diameter uncontrolled within this area, typical.

DESCRIPTION:

Rodan® Mini Sensor thermistors are small, rugged, hermetically sealed, glass encapsulated (DO-35) devices which are especially useful in applications where extreme temperatures and severe environmental conditions are encountered.

Their high sensitivity makes them especially useful in applications such as temperature measurement, temperature control, liquid level indication, flow measurement and temperature compensation.

These low cost devices exhibit excellent long term stability and repeatability.

Please contact the factory for additional information.

ACCU-CURVE™ INTERCHANGEABLE THERMISTORS R-T CURVE MATCHED

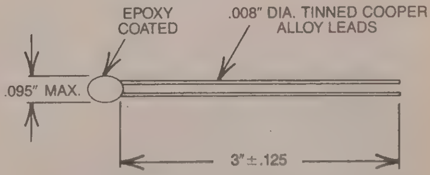
DESCRIPTION

Rodan's Accu-Curve thermistors are small, high quality, low cost, epoxy encapsulated, precision curve matched devices which are available in a variety of electrical parameters. They offer true interchangeability over wide temperature ranges and eliminate the need for individual circuit adjustments or padding. These thermistors provide highly accurate and stable temperature sensing capability for applications such as temperature measurement or compensation.

- Dissipation Constant 1 mW/°C Minimum*
- Time Constant 10 Seconds**

ACCU-CURVE™ Specifications

Resistance* @ 25°C (Ω)	Temperature Tolerance from 0°C to 70°C ±0.2°C Part Number	 ±0.,5°C Part Number	 ±1.0°C Part Number	Color Code
2,252	ACC-001	ACC-011	ACC-021	Brown
3,000	ACC-002	ACC-012	ACC-022	Red
5,000	ACC-003	ACC-013	ACC-023	Orange
10,000	ACC-004	ACC-014	ACC-024	Yellow
30,000	ACW-005	ACW-015	ACW-025	Green
50,000	ACW-006	ACW-016	ACW-026	Blue
100,000	ACW-007	ACW-017	ACW-027	Violet


EPOXY COATED
.008" DIA. TINNED COOPER ALLOY LEADS
.095" MAX.
3"±.125

The above device can be supplied to a wider range of specifications. Please contact the factory for requirements not listed.

***DISSIPATION CONSTANT** represents the amount of power required to raise the temperature of a thermistor 1°C above its ambient, expressed in milliwatts.

****TIME CONSTANT**, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new impressed temperature environment.

KETEMA 2900 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • FAX: 714-630-4131
RODAN DIVISION

STANDARD PTC THERMISTORS

TYPICAL APPLICATIONS

- Over-temperature Protection • Temperature Compensation
- Arc Suppression • Time Delay • Liquid Level Sensing
- Air Flow Sensing • Automatic Color TV Degaussing
- Non-Destructive Fusing • Self-Regulating Heaters
- Single Phase Motor Starting

Resistance-Temperature Curve

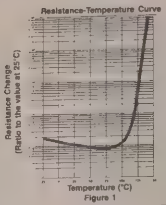
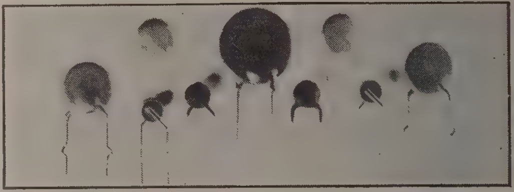
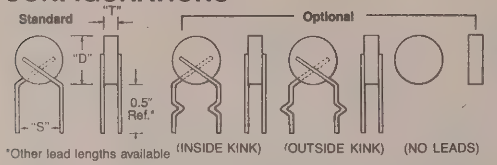


Figure 1



Part Number	Base Resistance R_0 @ 25°C (Ω) ± 30%	Switch Temp. Ts (°C)	Maximum Operating Voltage V_{max}	Dissipation Constant Dc (mW/°C)	Time Constant (Sec.)	Heat Capacity Hc (Watt-Sec./°C)	Reference Dimension (In.) D	T	S	Lead Dia. (In.)
SL5003D-1R8-120	1.8	120	20	12	50	.29	0.50	0.03	0.30	0.025
SL5004D-2R0-120	2	120	25	14	50	.39	0.50	0.04	0.30	0.032
SL4005D-5R0-110	5	110	25	10	45	.31	0.40	0.05	0.30	0.025
SL3505D-7R5-120	7.5	120	50	9	40	.24	0.35	0.05	0.25	0.020
SL5510D-100-110	10	110	132	16	90	1.19	0.55	0.10	0.30	0.025
SL2505D-200-120	20	120	50	7	30	.12	0.25	0.05	0.20	0.020
SL5010D-250-065	25	65	132	15	80	.98	0.50	0.10	0.30	0.025
SL4010D-500-110	50	110	132	12	60	.63	0.40	0.10	0.30	0.025
SL2005D-101-040	100	40	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-050	100	50	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-060	100	60	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-070	100	70	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-080	100	80	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-090	100	90	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-100	100	100	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-110	100	110	50	6	30	.08	0.20	0.05	0.20	0.020
SL3010D-101-110	100	110	132	8	45	.35	0.30	0.10	0.25	0.020
SL2005D-101-120	100	120	50	6	30	.08	0.20	0.05	0.20	0.020
SL2008D-251-120	250	120	150	6	30	.13	0.20	0.08	0.20	0.020
SL2010D-501-120	500	120	250	6	30	.16	0.20	0.10	0.20	0.020
SL2010D-102-110	1000	110	300	6	30	.16	0.20	0.10	0.20	0.020
SL2012D-152-110	1500	110	350	6	30	.19	0.20	0.12	0.20	0.020

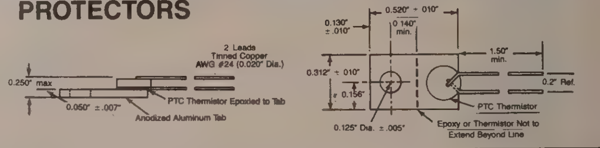
CONFIGURATIONS



*Other lead lengths available

The values for dissipation constant and time constant are for reference only. Mounting method and environmental conditions can affect these parameters.

PTC SURFACE MOUNT OVERTEMPERATURE PROTECTORS



OVER CURRENT PROTECTORS

The PTC over current protector is connected in series with the load which is to be protected. During normal operating conditions, the PTC remains in its low resistance state resulting in negligible attenuation to current flow. When a short circuit or over-current condition occurs, the PTC will switch into its high resistance state thereby limiting the current flow in the circuit to a point well below the normal operating level. When the fault condition is removed, the PTC will return to its low resistance state allowing the current flow to recover to its normal level. Ketema-Rodan Division produces over-current protectors for a whole range of load protection applications.

TYPICAL APPLICATIONS

- Telephone Line Fault Protection • Transformer Protection • FHP Motor Protection • Transistor Protection • Speaker Protection

FEATURES

- Fast Switching
- No Electrical Noise
- Virtually Unlimited Life
- Self Resetting
- No Contacts
- Automatic Operation
- Efficient

Part Number	Base Resistance (Ohms)	Base Resistance Tolerance (±)	Maximum Continuous Voltage	Maximum* Continuous Current (Amps)	Minimum* Switching Current (Amps)	Switch Temp. (Ref.) (°C)	Heat Capacity (Watt-Sec./°C)	Dissipation Constant (mW/°C)	D Max. Dia. (In.)	Lead Dia. (In.)	S Nom. (In.)
SP5504D-1R0-120	1	20%	15	0.60	1.30	120	.48	13	0.60	.032	.3
SP5004D-2R0-120	2	20%	25	0.44	.900	120	.39	12	0.55	.032	.3
SP4004D-3R3-120	3.3	30%	25	.300	.690	120	.25	10	0.45	.025	.3
SP6709D-4R7-110	4.7	20%	132	.290	.650	110	1.59	16	0.70	.032	.3
SP4004D-5R0-110	5	20%	25	.220	.500	110	.25	10	0.45	.025	.3
SP3505D-7R5-120	7.5	30%	50	.180	.400	120	.24	8	0.40	.020	.2
SP5510D-100-110	10	30%	132	.170	.430	110	1.19	13	0.60	.025	.3
SP3505D-100-120	10	30%	50	.150	.350	120	.24	8	0.40	.020	.2
SP2505D-200-120	20	30%	50	.095	.220	120	.12	6	0.30	.020	.2
SP3510D-300-110	30	30%	132	.075	.190	110	.48	8	0.40	.020	.2
SP3010D-500-110	50	30%	132	.055	.140	110	.35	7	0.35	.020	.2
SP3010D-101-110	100	30%	132	.040	.100	110	.35	7	0.35	.020	.2
SP2008D-251-210	250	30%	150	.028	.070	120	.13	7	0.25	.020	.2
SP2010D-501-120	500	30%	250	.020	.050	120	.16	7	0.25	.020	.2
SP2010D-102-110	1000	30%	300	.012	.032	110	.16	7	0.25	.020	.2
SP2012D-152-110	1500	30%	350	.010	.026	110	.19	7	0.25	.020	.2

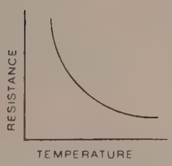
*Maximum Continuous Current (I_{cc})—The maximum amount of current, expressed in AMPS, the PTC must be capable of passing without switching into its high resistance state.

**Minimum Switching Current (I_s)—The minimum amount of current, expressed in AMPS, required to switch the PTC into its high resistance state.

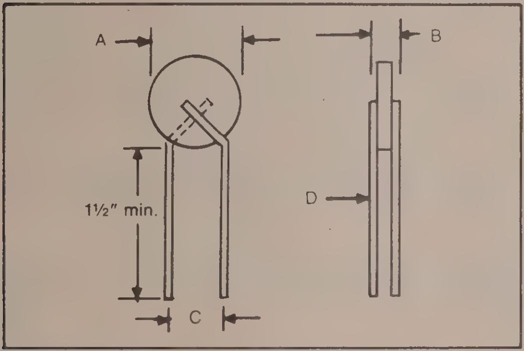
The values for minimum switching current and maximum continuous current are for reference only. Mounting method and environmental conditions can affect these parameters.

Keystone
CARBON COMPANY

DISC TYPE THERMISTORS WITH CROSSED LEADS



NTC (Negative Temperature Coefficient) thermistors decrease in resistance as temperature increases. Their maximum operating temperature is 150°C. Zero-power resistance values at 25°C range from 10 Ω to 250K Ω; other values upon request. Disc thermistors are available with various coatings, lead styles, and resistance tolerances. Contact Keystone Thermistor Engineering or write for catalog.



Keystone Thermistors are distributed by

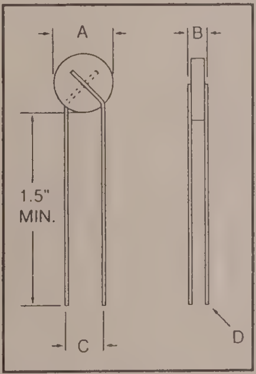
Allied Electronics	1-800-433-5700
Newark Electronics	1-800-367-3573
Digi-Key Corporation	1-800-344-4539
Dexter Corporation	1-800-345-4082
Summit Distributors	1-800-678-6648

KCC TYPE	R_o@ 25°C (Ω)	Tol. ±%	A (in.)	B (in.)	C (in.)	D (AWG)	Dissipation Constant (mW/°C)	Resist.† Ratio	Temp. Coef. @ 25°C (%/°C)
RL1004-65.6-59-D1	100	20	0.110	0.120	0.100	26	2.5	5.6	-3.42
RL1003-312-73-D1	500	10	0.110	0.110	0.100	26	2.5	6.9	-3.83
RL1007-624-73-D1	1,000	10	0.110	0.150	0.100	26	2.8	6.9	-3.83
RL1003-1157-95-D1	2,000	10	0.110	0.110	0.100	26	2.8	9.2	-4.43
RL1003-1746-97-D1	3,000	10	0.110	0.110	0.100	26	2.5	9.1	-4.40
RL1004-2910-97-D1	5,000	10	0.110	0.120	0.100	26	2.5	9.1	-4.40
RL1009-5820-97-D1	10,000	10	0.110	0.170	0.100	26	3.0	9.1	-4.40
RL1005-5744-103-D1	10,000	10	0.110	0.130	0.100	26	2.5	9.6	-4.49
RL1007-13.8K-120-D1	25,000	10	0.110	0.150	0.100	26	2.8	11.4	-4.84
RL1003-26.7K-140-D1	50,000	10	0.110	0.110	0.100	26	2.5	12.9	-5.08
RL1006-53.4K-140-D1	100,000	10	0.110	0.140	0.100	26	2.7	12.9	-5.08
RL1004-104.7K-155-D1	200,000	10	0.110	0.120	0.100	26	2.5	13.8	-5.23
RL1006-135.2K-138-D1	250,000	10	0.110	0.140	0.100	26	2.7	12.1	-4.96
RL2004-16.4-59-D1	25	20	0.220	0.130	0.156	24	6.5	5.6	-3.42
RL2007-32.8-59-D1	50	20	0.220	0.160	0.156	24	6.5	5.6	-3.42
RL2003-62.4-73-D1	100	10	0.220	0.120	0.156	24	6.5	6.9	-3.83
RL2006-125-73-D1	200	10	0.220	0.150	0.156	24	6.5	6.9	-3.83
RL2008-187-73-D1	300	10	0.220	0.170	0.156	24	6.5	6.9	-3.83
RL2003-289-95-D1	500	10	0.220	0.120	0.156	24	6.0	9.2	-4.43
RL2004-582-97-D1	1,000	10	0.220	0.130	0.156	24	6.5	9.1	-4.40
RL2007-1164-97-D1	2,000	10	0.220	0.160	0.156	24	6.5	9.1	-4.40
RL2006-1600-103-D1	2,786	10	0.220	0.150	0.156	24	6.5	9.6	-4.49
RL2005-2203-120-D1	4,000	10	0.220	0.140	0.156	24	6.5	11.4	-4.84
RL2006-2753-120-D1	5,000	10	0.220	0.150	0.156	24	6.5	11.4	-4.84
RL2012-5506-120-D1	10,000	10	0.220	0.210	0.156	24	7.2	11.4	-4.84
RL2006-13.3K-140-D1	25,000	10	0.220	0.150	0.156	24	6.5	12.9	-5.08
RL2005-27K-138-D1	50,000	10	0.220	0.140	0.156	24	6.5	12.1	-4.96
RL2008-52.3K-155-D1	100,000	10	0.220	0.170	0.156	24	6.5	13.8	-5.23
RL3004-6.56-59-D1	10	20	0.320	0.130	0.250	24	7.0	5.6	-3.42
RL3504-31.2-73-D1	50	10	0.370	0.130	0.250	24	7.5	6.9	-3.83
RL3006-59.4-85-D1	100	10	0.320	0.150	0.250	24	7.2	8.4	-4.23
RL3004-144-95-D1	250	10	0.320	0.130	0.250	24	7.0	9.2	-4.43
RL3004-291-97-D1	500	10	0.320	0.130	0.250	24	7.0	9.1	-4.40
RL3005-574-103-D1	1,000	10	0.320	0.130	0.250	24	7.0	9.6	-4.49

†Resistance Ratio: Ratio of zero-power resistance @ 0°C to zero-power resistance @ 50°C

Keystone

STANDARD THERMISTORS FOR TEMPERATURE MEASUREMENT



Accuracy ± 1°C (0°C – 120°C)

TYPE	$R_{25°C}$	A MAX. (IN.)	B MAX. (IN.)	C REF. (IN.)	D AWG. (DIA.)	D.C. mW/°C	T.C. SEC.
RL3005-574.0-103-SA	1000	.32	14	.25	24 (.020)	3.5	30
RL2005-1148-103-SA	2000	22	14	15	24 (.020)	2.5	20
RL2006-1600-103-SA	2786	.22	.15	.15	24 (.020)	2.5	20
RL2007-1723-103-SA	3000	.22	16	.15	24 (.020)	2.5	20
RL2008-2010-103-SA	3500	.22	.17	15	24 (.020)	2.5	20
RL1003-2871-103-SA	5000	.11	.11	10	26 (.016)	1.0	10
RL1004-4019-103-SA	7000	11	.12	10	26 (.016)	1.0	10
RL1005-5744-103-SA	10000	.11	.13	10	26 (.016)	1.0	10

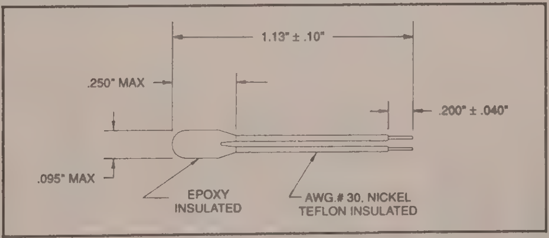
Operating Range: –50°C +150°C
D.C.: Dissipation Constant (mW/°C)

T.C.: Time Constant (Seconds)
*Optional temperature accuracies are available upon request.

Keystone

MINIATURE SENSORS

1°C Accuracy



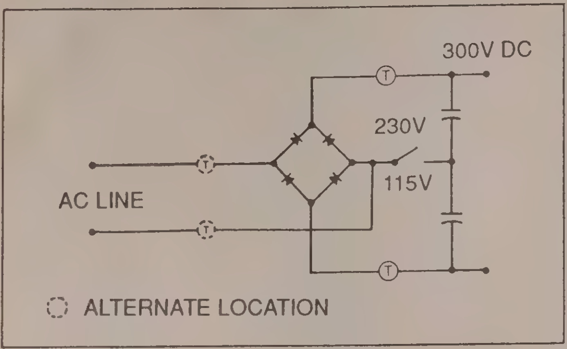
Type	R_o @ 25°C	Temp. Coef. %/°C @ 25°C	Material
RL0503-1248-73-MS	2K	–3.83	MS73
RL0503-2890-95-MS	5K	–4.43	MS95
RL0503-5820-97-MS	10K	–4.40	MS97A
RL0503-17.56K-96-MS	30K	–4.32	MS96
RL0503-27.53K-120-MS	50K	–4.84	MS120
RL0503-55.36K-122-MS	100K	–4.78	MS122

Temperature Accuracy: ±1°C @ 25°C
Dissipation Constant: 1.4 mW/°C

Time Constant: 15 sec.
Operating Range: –50°C to +150°C

KEYSTONE CARBON COMPANY • ST. MARYS, PA 15857 • 814-781-1591 • FAX 814-781-7648

Keystone INRUSH CURRENT LIMITERS



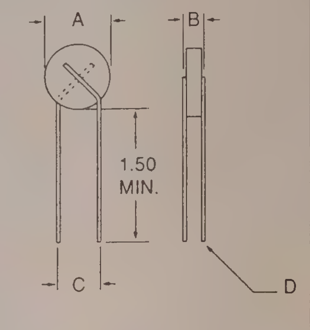


FIG. 1

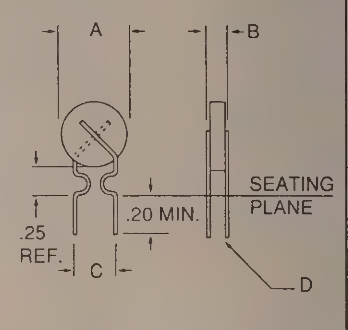


FIG. 2 (SUFFIX A)

The circuit diagram above displays a typical way to limit inrush current.

Protection against extremely high peak inrush current, especially in AC/DC switching power supplies, is now available with Keystone Inrush Current Limiters. These special NTC thermistors effectively control surge currents because the thermal time constant of the current limiter is longer than the electrical time constant (RC) of the thermistor and the capacitor.

All inrush current limiters are insulated with a protective coating. Optional lead designs available upon request.

Note: For Figure 2 design add "A" suffix to type. (Example: CL-10A.)

Type Fig. 1	R_0 @ 25°C ±25% (ohms)	Max.* Steady State Current amps (RMS)	A max. (in.)	B max. (in.)	C ref. (in.)	D (AWG)	C_x (max.)** μ farads		Eqn. Const. for Res. Under Load***			Approx. Res. Under Load at % Max. Rated Current				Diss. Const. (mW/°C)	Time Const. (sec.)
							@ 120 VAC	@ 240 VAC	X	Y	Current Range Min. I./Max. I	25%	50%	75%	100%		
CL-10	0.7	12	0.77	0.22	0.328	18	8200	2000	0.50	-1.18	4.0 ≤ I ≤ 12	.14	.06	.04	.02	25	100
CL-20	1.3	8	0.55	0.21	0.328	18	2400	600	0.60	-1.25	3.0 ≤ I ≤ 8.0	.25	.09	.06	.04	15	60
CL-30	2.5	8	0.77	0.22	0.328	18	6000	1500	0.81	-1.25	2.5 ≤ I ≤ 8.0	.34	.14	.09	.06	25	100
CL-40	5	6	0.77	0.22	0.328	18	5200	1300	1.09	-1.27	1.5 ≤ I ≤ 6.0	.65	.27	.16	.11	25	100
CL-50	7	5	0.77	0.26	0.328	18	5000	1250	1.28	-1.27	1.5 ≤ I ≤ 5.0	.96	.40	.24	.16	25	120
CL-60	10	5	0.77	0.22	0.328	18	5000	1250	1.45	-1.30	1.2 ≤ I ≤ 5.0	1.09	.44	.26	.18	25	100
CL-70	16	4	0.77	0.22	0.328	18	5000	1250	1.55	-1.26	1.0 ≤ I ≤ 4.0	1.55	.65	.39	.27	25	100
CL-80	47	3	0.77	0.22	0.328	18	5000	1250	2.03	-1.29	0.5 ≤ I ≤ 3.0	2.94	1.20	.71	.49	25	100
CL-90	120	2	0.93	0.22	0.328	18	5000	1250	3.04	-1.36	0.5 ≤ I ≤ 2.0	7.80	3.04	1.75	1.18	30	120
CL-100	0.5	16	0.93	0.22	0.328	18	12000	3000	0.44	-1.12	4.0 ≤ I ≤ 16	.09	.04	.03	.02	30	120
CL-110	10	3.2	0.40	0.17	0.250	24	600	150	0.83	-1.29	0.7 ≤ I ≤ 3.2	1.10	.45	.27	.18	8	30
CL-120	10	1.7	0.40	0.17	0.250	24	600	150	0.61	-1.09	0.4 ≤ I ≤ 1.7	1.55	.73	.46	.34	4	90
CL-130	50	1.6	0.45	0.17	0.250	24	600	150	1.45	-1.38	0.4 ≤ I ≤ 1.6	5.13	1.97	1.13	.75	8	30
CL-140	50	1.1	0.45	0.17	0.250	24	600	150	1.01	-1.28	0.2 ≤ I ≤ 1.1	5.27	2.17	1.28	.89	4	90
CL-150	5	4.7	0.55	0.18	0.328	22	1600	400	0.81	-1.26	1.0 ≤ I ≤ 4.7	.66	.27	.16	.11	15	110
CL-160	5	2.8	0.55	0.18	0.328	22	1600	400	0.60	-1.05	0.8 ≤ I ≤ 2.8	.87	.42	.27	.20	9	130
CL-170	16	2.7	0.55	0.18	0.328	22	1600	400	1.18	-1.28	0.5 ≤ I ≤ 2.7	1.95	.80	.48	.33	15	110
CL-180	16	1.7	0.55	0.18	0.328	22	1600	400	0.92	-1.18	0.4 ≤ I ≤ 1.7	2.52	1.11	.69	.49	9	130
CL-190	25	2.4	0.55	0.18	0.328	22	800	170	1.33	-1.34	0.5 ≤ I ≤ 2.4	2.63	1.04	.60	.41	15	110
CL-200	25	1.7	0.55	0.18	0.328	22	800	170	0.95	-1.24	0.4 ≤ I ≤ 1.7	2.74	1.18	.70	.49	9	130
CL-210	30	1.5	0.40	0.20	0.250	24	600	150	1.02	-1.35	0.3 ≤ I ≤ 1.5	3.83	1.50	.87	.60	8	30

* These values are suggested maximums based on the thermistor in 25°C ambient without air flow.

Current ratings can be increased depending on the magnitude of air flow.

** These ratings are suggested maximums. Contact Keystone Engineering Department for assistance in applications exceeding these ratings.

*** To determine the resistance value under load, use $R = XI^Y$ where X and Y are constants in the table above and I is the current (amps).

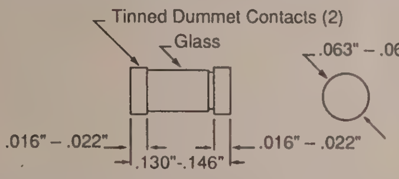
Keystone GLASS ENCAPSULATED THERMISTORS

Keystone glass encapsulated NTC thermistors are tiny pellets of thermistor material hermetically sealed in glass bodies with a controlled amount of selected atmosphere. The hermetic seal makes these parts extremely stable in applications up to 204°C (400°F).

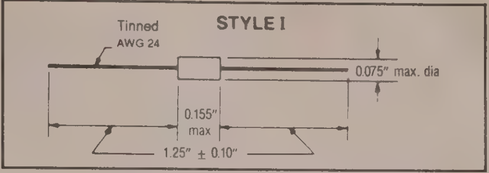
Temperature Range: –50°C to 204°C
Dissipation Constant: 2.0 mW/°C
Time Constant: 3 seconds

Packaging Options Available Upon Request:
Style I — Axial reel tape to EIA RS-296
Style II — Pocket tape to EIA RS-481

STYLE II (SURFACE MOUNT) "MELF"



NOTE: FOR KCC TYPE FOR STYLE II DELETE AL PREFIX AND ADD G100 SUFFIX.



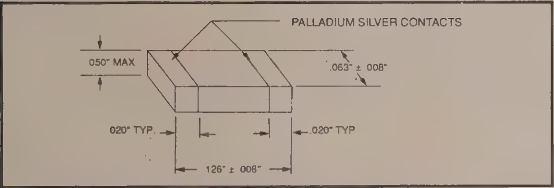
Type	R₀ @ 25°C ± 10%	Temp. Coef. @ 25°C (%/°C)	Material
AL03006-165.9-55-G1	250	–3.34	GE55*
AL03006-331.8-55-G1	500	–3.34	GE55*
AL03006-624-73-G1	1K	–3.83	GE73
AL03006-1248-73-G1	2K	–3.83	GE73
AL03006-1576-101-G1	2786	–4.68	GE101
AL03006-1847-76-G1	3K	–3.85	GE76
AL03006-2463-76-G1	4K	–3.85	GE76
AL03006-3079-76-G1	5K	–3.85	GE76
AL03006-5818-97-G1	10K	–4.41	GE97A
AL03006-11.7K-98-G1	20K	–4.34	GE98
AL03006-17.53K-98-G1	30K	–4.34	GE98
AL03006-29.1K-97-G1	50K	–4.32	GE97B
AL03006-58.2K-97-G1	100K	–4.32	GE97B
AL03006-111.3K-123-G1	200K	–4.71	GE123
AL03006-269.8K-138-G1	500K	–4.99	GE138
AL03006-535K-145-G1	1M	–5.07	GE145

*Maximum operating temperature: 150°C

Keystone SURFACE MOUNT NTC THERMISTORS (EIA 1206 SIZE)

PCB MOUNT:

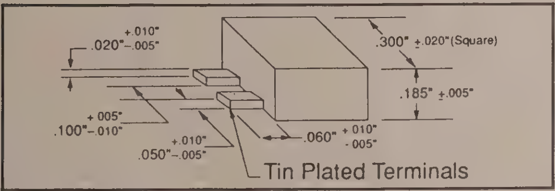
Dissipation Constant: 5mW/°C
Time Constant: 10 sec.



Type	R₀ @ 25°C	Temp. Coef. %/°C @ 25°C	Material
060412-103.5-46-C*	150	–3.02	C46
060412-237.9-49-C*	350	–3.14	C49
060412-656.5-57-C*	1K	–3.43	C57
060312-3120-73-C*	5K	–3.83	C73
060412-6011-84-C*	10K	–4.12	C84
060312-11.57K-95-C*	20K	–4.43	C95
060412-17.46K-97-C*	30K	–4.40	C97A
060412-28.71K-103-C*	50K	–4.49	C103
060412-55.06K-120-C*	100K	–4.84	C120
060312-110.7K-122-C*	200K	–4.78	C122

*Part suffix and resistance tolerance @ 25°C: 1 = ±5%, 2 = ±10%, 3 = ±20%.

Keystone SURFACE MOUNT RESETTABLE FUSE



Molded Housing
Transition Temp: 110°C

Dissipation Constant: 10mW/°C
Time Constant: 80 sec.

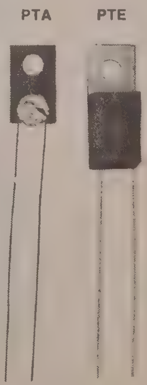
Type Number	R @ 25°C ± 20% (Ω)	Switch Current (amps)		No Switch Current (amps)		Operating Voltage
		0°C	20°C	30°C	55°C	
PTC-52	10	.38	.35	.22	.19	12
PTC-53	25	.25	.22	.14	.12	12
PTC-54	50	.18	.16	.10	.09	24
PTC-55	100	.13	.12	.07	.06	24

Keystone PTC SURFACE TEMPERATURE SENSORS

Resistance @ 25°C: 150Ω max.
Resistance @ Accuracy Temp. (± 5°C): 1000Ω

Max. Oper. Temp.: 150°C
Max. Voltage: 30 VDC

Type Number *Add "A" or "E" for design option	Transition Temp. °C	Accuracy Temp. °C (±5°C)
RL2006-100-30-30-PT*	30	45
RL2006-100-40-30-PT*	40	55
RL2006-100-50-30-PT*	50	65
RL2006-100-60-30-PT*	60	75
RL2006-100-70-30-PT*	70	85
RL2006-100-80-30-PT*	80	95
RL2006-100-90-30-PT*	90	105
RL2006-100-100-30-PT*	100	115
RL2006-100-110-30-PT*	110	125
RL2006-100-120-30-PT*	120	135



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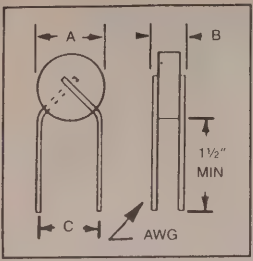

Keystone STANDARD PTC THERMISTORS

The values for Dissipation Constant and Time Constant listed in the table below are reference values. Actual values are a function of mounting, air flow and other factors which affect the PTC's ability to dissipate heat.

Standard PTCs are supplied uninsulated, but can be supplied with an insulation upon request.

Operating Voltage	Type	R @ 25°C ± 30%	Transition Temp °C T_S	Dissipation Constant mW/°C	Time Constant Sec.	"H" Joules/°C	A Max.	B Max.	C Ref.	AWG No.
5	RL6505-.5-110-5-PTO	.5	110	18	70	.8	.70	.16	.33	20
12	RL5305-1-120-12-PTO	1.0	120	14	50	.6	.60	.15	.33	20
	RL5305-2-120-12-PTO	2.0	120	14	50	.6	.60	.16	.33	20
	RL5305-2.5-110-12-PTO	2.5	110	14	50	.6	.60	.16	.33	20
	RL4005-5.0-110-12-PTO	5.0	110	10	40	.3	.45	.15	.25	24
	RL3005-10-110-12-PTO	10.0	110	7	35	.2	.35	.15	.25	24
	RL3005-15-110-12-PTO	15.0	110	7	35	.2	.35	.15	.25	24
	RL2006-20-80-12-PTO	20.0	80	6	30	.1	.25	.15	.15	24
	RL3005-25-110-12-PTO	25.0	110	7	35	.2	.35	.15	.25	24
25	RL7008-1.5-110-25-PTO	1.5	110	18	80	1.5	.75	.18	.33	20
	RL5008-3.0-110-25-PTO	3.0	110	14	50	.8	.55	.18	.33	22
	RL5506-5.0-110-25-PTO	5.0	110	14	50	.7	.60	.16	.33	22
	RL4006-10-110-25-PTO	10.0	110	10	40	.4	.45	.17	.25	24
	RL3006-20-120-25-PTO	20.0	120	7	35	.2	.35	.16	.25	22
	RL3006-30-110-25-PTO	30.0	110	7	35	.2	.35	.15	.25	24
	RL3006-50-30-25-PTO	50.0	30	7	35	.2	.35	.15	.25	24
	RL3006-50-40-25-PTO	50.0	40	7	35	.2	.35	.15	.25	24
	RL3006-50-50-25-PTO	50.0	50	7	35	.2	.35	.15	.25	24
	RL3006-50-60-25-PTO	50.0	60	7	35	.2	.35	.15	.25	24
	RL3006-50-70-25-PTO	50.0	70	7	35	.2	.35	.15	.25	24
	RL3006-50-80-25-PTO	50.0	80	7	35	.2	.35	.15	.25	24
	RL3006-50-90-25-PTO	50.0	90	7	35	.2	.35	.15	.25	24
	RL3006-50-100-25-PTO	50.0	100	7	35	.2	.35	.15	.25	24
	RL3006-50-110-25-PTO	50.0	110	7	35	.2	.35	.15	.25	24
	RL3006-50-120-25-PTO	50.0	120	7	35	.2	.35	.15	.25	24
50	RL5506-5-65-50-PTO	5.0	65	14	50	.7	.60	.18	.33	20
	RL5506-5-110-50-PTO	5.0	110	14	50	.7	.60	.16	.33	22
	RL4508-7-110-50-PTO	7.0	110	12	45	.6	.50	.18	.33	22
	RL4006-10-110-50-PTO	10.0	110	10	40	.4	.45	.17	.25	24
	RL4508-15-110-50-PTO	15.0	110	12	45	.6	.50	.18	.33	22
	RL4508-20-110-50-PTO	20.0	110	12	45	.6	.50	.18	.33	22
	RL4010-50-110-50-PTO	50.0	110	12	60	.6	.45	.20	.33	22
	RL2510-100-110-50-PTO	100.0	110	8	40	.2	.30	.22	.15	22
	RL3312-200-110-50-PTO	200.0	110	9	45	.5	.40	.23	.25	20
	RL2010-500-110-50-PTO	500.0	110	7	40	.2	.25	.18	.15	24
120	RL7510-10-120-120-PTO	10.0	120	20	90	2.2	.80	.23	.33	18
	RL5512-15-110-120-PTO	15.0	110	14	90	1.4	.60	.23	.33	20
	RL6010-20-120-120-PTO	20.0	120	18	90	1.4	.65	.23	.33	20
	RL5510-25-60-120-PTO	25.0	60	15	90	1.2	.60	.22	.33	20
	RL4510-50-120-120-PTO	50.0	120	12	70	.8	.50	.20	.33	22
	RL3510-100-110-120-PTO	100.0	110	11	45	.5	.40	.20	.25	22
	RL2510-200-110-120-PTO	200.0	110	8	40	.2	.30	.20	.15	22
240	RL6315-40-110-240-PTO	40.0	110	18	90	2.3	.65	.27	.33	18
	RL5515-50-65-240-PTO	50.0	65	17	80	1.8	.60	.27	.33	20
	RL6315-50-110-240-PTO	50.0	110	18	90	2.3	.65	.27	.33	18
	RL6015-100-120-240-PTO	100.0	120	18	90	2.1	.65	.27	.33	20
	RL6315-250-110-240-PTO	250.0	110	18	90	2.3	.65	.27	.33	18
	RL6315-500-110-240-PTO	500.0	110	18	90	2.3	.65	.27	.33	18
	RL3020-1000-100-240-PTO	1000.0	100	12	60	.7	.35	.31	.25	20
	RL3020-1500-100-240-PTO	1500.0	100	12	60	.7	.35	.31	.25	20
	RL3020-3000-100-240-PTO	3000.0	100	12	60	.7	.35	.31	.25	20
	RL1710-25K-65-240-PTO	25000.0	65	6	40	.1	.20	.20	.15	24
480	RL7020-1K-100-480-PTO	1000.0	100	18	90	3.8	.75	.32	.33	18
	RL5020-2K-100-480-PTO	2000.0	100	15	80	2.0	.55	.32	.33	18
	RL3020-5K-100-480-PTO	5000.0	100	12	60	.7	.35	.31	.25	20

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Keystone STANDARD PTC RESETTABLE FUSES

KEYSTONE STANDARD PTC RESETTABLE FUSES

Operating Voltage	R25°C ± 20%	Type	Minimum[1] Switch Current		Maximum[2] No-Switch Current		"H" Joules/°C	D.C. mW/°C	A Max.	B Max.	C Ref.	AWG No.
			0°C	20°C	30°C	55°C						
5	.5	RL6505-.5-110-5-PTF	2.32	2.12	1.34	1.02	.8	18	70	16	.33	20
12	1.0	RL5305-1.0-110-12-PTF	1.45	1.32	.84	.64	.6	14	.60	.15	.33	22
	2.5	RL5305-2.5-110-12-PTF	.92	.84	53	.40	.6	14	.60	.16	33	20
	5.0	RL4005-5.0-110-12-PTF	.55	.50	.32	24	3	10	45	.15	.25	24
	10.0	RL3005-10-110-12-PTF	.32	.30	.19	.14	.2	7	.35	.15	.25	24
	25.0	RL3005-25-110-12-PTF	.20	.19	.12	.09	.2	7	.35	.15	25	24
25	1.5	RL7008-1.5-110-25-PTF	1.34	1.22	.77	.59	1.5	18	.75	.18	.33	20
	3.0	RL5008-3.0-110-25-PTF	.84	.76	.48	.37	8	14	.55	.18	.33	22
50	5.0	RL5506-5.0-110-50-PTF	.65	.59	.37	.29	.7	14	.60	16	.33	22
	10.0	RL4006-10-110-50-PTF	39	.35	.22	.17	.4	10	.45	.17	25	24
	25.0	RL4508-25-110-50-PTF	.27	.24	.15	.12	.6	12	.50	18	33	22
	50.0	RL4010-50-110-50-PTF	.19	.17	.11	.08	.6	12	.45	.20	.33	22
	100.0	RL3810-100-110-50-PTF	.13	.12	.08	.06	.6	12	.42	.20	.25	24
	200.0	RL3312-200-110-50-PTF	.09	.08	.05	04	.5	9	.40	23	.25	20
120	10.0	RL7510-10-110-120-PTF	.55	.50	.32	.24	2.2	20	.80	23	.33	20
	20.0	RL6010-20-110-120-PTF	.37	.34	.21	.16	1.4	18	.65	.23	.33	20
	50.0	RL4510-50-110-120-PTF	.19	.17	.11	.08	.8	12	.50	.20	.33	22
	100.0	RL3510-100-110-120-PTF	.13	.12	.07	.06	5	11	40	.20	25	22
240	50.0	RL6315-50-110-240-PTF	.23	.21	.13	.10	2.3	18	.65	.27	.33	18
	100.0	RL6315-100-110-240-PTF	.16	.15	.09	.07	2.3	18	.65	.27	.33	18
	250.0	RL6315-250-110-240-PTF	.10	.09	.06	.05	2.3	18	.65	.27	.33	18

Keystone STANDARD U.L. RECOGNIZED PTC RESETTABLE FUSES

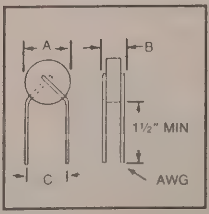
U.L. FILE E82830 — U.L. CATEGORY XGPU2 (THERMISTOR-TYPE DEVICES)

Operating Voltage	R25°C ± 20%	Type	U.L. Style No.	Minimum[1] Switch Current		Maximum[2] No-Switch Current		"H" Joules/°C	D.C. mW/°C	A Max.	B Max.	C Ref.	AWG No.
				0°C	20°C	30°C	55°C						
5	.5	RL6505-.5-110-5-PTU	L/005-NC-0001/B	2.32	2.12	1.34	1.02	.8	18	.70	.16	.33	20
12	1.0	RL5506-1.0-110-12-PTU	L/012-LC-0001/B	1.45	1.32	.84	.64	.7	14	.60	.15	.33	22
	2.5	RL3506-2.5-110-12-PTU	L/012-HC-0003/B	.73	.67	.42	.32	.3	9	.40	.15	.25	24
	5.0	RL2506-5.0-110-12-PTU	L/012-FC-0005/B	.49	.45	.28	.22	.1	8	.30	.15	.15	24
	10.0	RL2006-10-110-12-PTU	L/012-EC-0010/B	.30	.27	.17	.13	.1	6	.25	.15	.15	24
25	1.5	RL7008-1.5-110-25-PTU	L/025-OD-0002/B	1.34	1.22	.77	.59	1.5	18	.75	.18	.33	20
	3.0	RL5008-3.0-110-25-PTU	L/025-KD-0003/B	.84	.76	.48	.37	.8	14	.55	.18	.33	22
50	5.0	RL5508-5.0-110-50-PTU	L/050-LD-0005/B	.65	.59	.37	.29	1.0	14	.60	.17	.33	22
	10.0	RL4008-10-110-50-PTU	L/050-ID-0010/B	.39	.35	.22	.17	.5	10	.45	.17	.25	24
	20.0	RL3008-20-110-50-PTU	L/050-GD-0020/B	.24	.22	.14	.11	.3	8	.35	.16	.25	24
	50.0	RL2008-50-110-50-PTU	L/050-ED-0050/B	.14	.13	.08	.06	.1	7	.25	.16	.15	24
120	10.0	RL7512-10-110-120-PTU	L/120-PF-0010/B	.55	.50	.32	.24	2.7	20	.80	.23	.33	20
	20.0	RL5512-20-110-120-PTU	L/120-LF-0020/B	.32	.30	.19	.14	1.4	14	.60	.23	.33	20
	50.0	RL3512-50-110-120-PTU	L/120-HF-0050/B	.16	.15	.09	.07	.6	9	.40	.22	.25	22
	100.0	RL2512-100-110-120-PTU	L/120-FF-0100/B	.11	.10	.06	05	.3	8	.30	.22	.15	22
240	50.0	RL6320-50-110-240-PTU	L/240-NH-0050/B	.23	.21	.13	.10	3.1	18	.70	.32	.33	18
	100.0	RL4520-100-110-240-PTU	L/240-JH-0100/B	.14	.13	.08	.06	1.6	13	.50	.30	.33	20
	200.0	RL3020-200-110-240-PTU	L/240-GH-0200/B	.08	.07	04	.03	.7	8	.35	.29	.25	22

[1] Minimum Switch Current: The minimum current required to switch the PTC at the ambient indicated.

[2] Maximum No-Switch Current: The maximum current that the PTC can pass without switching at the ambient indicated.

NOTE: The current values and dissipation constant listed are for reference only. Actual values are a function of mounting, air flow, and other factors which affect the PTC's ability to dissipate heat.
All PTCs from higher voltage rating groups can be used for lower voltage applications.



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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	D•2221
Batteries, Product Selection Guide	D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	C•1003
Capacitors, Product Selection Guide	A•1003
Coils, Chokes, Inductors, Product Selection Guide	A•1179
Connectors, Terminals & Sockets, Product Selection Guide	C•1139
Cores, Magnets & Ferrites	A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	A•1326
DC-DC Converters	D•2049
DC Power Supplies, Product Selection Guide	D•1488
Delay Lines, Product Selection Guide	A•1513
Discrete Semiconductors, Product Selection Guide	A•2130
Displays, Readouts, & CRTs, Product Selection Guide	B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	C•1557
Fiber Optics, Product Selection Guide	B•1200
Filters, Power, Product Selection Guide	A•1584
Filters, Signal, Product Selection Guide	A•1617
Instruments, Test & Measuring, Product Selection Guide	D•1215
Interconnection Systems, Product Selection Guide	C•1670
Keyboards & Keypads, Product Selection Guide	B•1818
Lamps, Lights, & Indicators, Product Selection Guide	B•1131
Microwave Components, Product Selection Guide	A•1719
Military Qualified Products List	B•1002
Motors, Drives, & Rotating Components, Product Selection Guide	B•1231
Oscilloscopes, Product Selection Guide	D•1402
Panel Hardware, Product Selection Guide	C•1522
Panel Meters, Analog & Digital, Product Selection Guide	D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	A•2053
Power Supplies, AC, Product Selection Guide	D•2221
Power Supplies, DC, Product Selection Guide	D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	B•1341
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Resistors, Product Selection Guide	A•1859
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Switches, Product Selection Guide	B•1658
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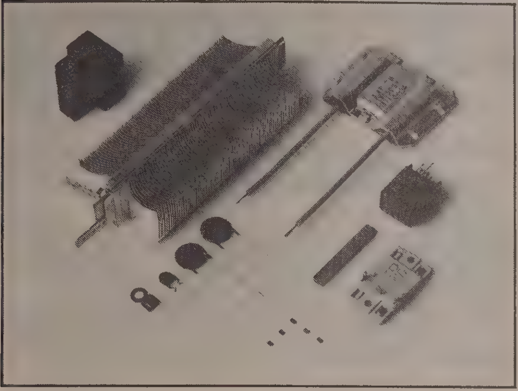
Transducers & Encoders, Product Selection Guide	B•1911
Transformers, Product Selection Guide	A•2229
Wire & Cable, Product Selection Guide	C•1701

posistor® positive temperature coefficient thermistors

muRata ERiE®
MURATA ERIE NORTH AMERICA

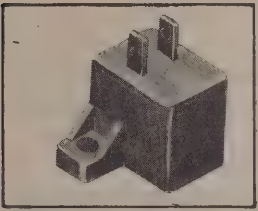


Murata Erie Posistors are positive temperature coefficient thermistors with a very well defined resistance-temperature "knee" and the unique ability to "switch" relatively large amounts of power. They may also be used as self-regulating heating devices at useful power levels and as control devices for high power heaters. Applications include temperature sensing, over temperature and over current protection and motor starting to name a few.

Products utilizing Posistors are extremely safe and reliable and offer all of the design, manufacturing, repair and sales advantages of solid state technology.

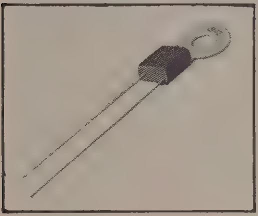
- Compact
- Reduced component count
- Extremely reliable
- "Stepless" temperature control
- Simple repair or replacement
- Long term reliability
- Shock and vibration immunity
- Nonflammable case and insulation available
- No electrical or acoustical noise
- No electrical contacts

FOR MOTOR STARTING



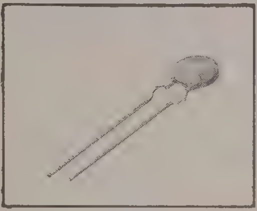
The PTH490/491 Series provides a smooth, solid state electronic starting device for single phase motors utilizing a split-phase starting winding or for PSC motors as a direct replacement for starting capacitors and relays.

FOR SEMICONDUCTOR OVERLOAD PROTECTION



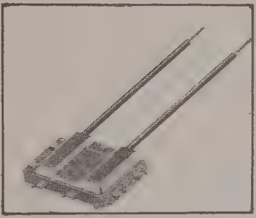
The PTH9M Series senses the case temperature of high power semiconductors and appropriately reduces the power dissipation when dangerous power or current levels are reached by switching to a high resistance state and reducing base bias current. Surface mount Posistors are also available for overheat sensing.

FOR CIRCUIT PROTECTION



The PTH60-63 Series provides overcurrent protection in a variety of applications. When connected in series with the protected device, Posistors limit the circuit current to a predetermined value — above that value they switch to a high resistnace state and limit the current to a safe level.

FOR HIGH POWER HEATING



PTH497 Posistors for heating are self-regulating with fast thermal response and power ratings to 170 watts.

NTC thermistors for temperature sensing

The NTH5D Series offers a wide range of resistance value and B-contants. This makes applications where temperature compensation is required, appropriate for this device.

FEATURES

- Thermally stable with consistent performance
- Highly reliable
- Appropriate for many applications.

Part Number	Resistance 25°C (Ω)	B Constant 25/50°C (°K)	Resistance Temp. Coeff. 25°C (%/°C)
NTH5D221KA	220	3,300	−3.7
NTH5D331KA	330	3,300	−3.7
NTH5D471KA	470	3,500	−3.9
NTH5D681KA	680	3,500	−3.9
NTH5D102KA	1,000	3,800	−4.3
NTH5D152KA	1,500	3,800	−4.3
NTH5D222KA	2,200	3,900	−4.4
NTH5D332KA	3,300	3,900	−4.4
NTH5D472KA	4,700	3,900	−4.4
NTH5D682KA	6,800	4,100	−4.6
NTH5D103KA	10,000	4,100	−4.6
NTH5D153KA	15,000	4,100	−4.6
NTH5D223KA	22,000	4,200	−4.7
NTH5D333KA	33,000	4,200	−4.7
NTH5D473KA	47,000	4,200	−4.7
NTH5D683KA	68,000	4,400	−4.9
NTH5D104KA	100,000	4,400	−4.9
NTH5D154KA	150,000	4,400	−4.9

DIMENSIONS: (mm)
Dia. Max: 6.0
Thick. Max.: 5.0
Lead Space: 5±1.5
Lead Dia.: 0.5
Lead Length: 25 min.

- B-constant deviation: ±10%
- Max. allowable power: 0.56W(25°C)
- Typical dissipation constant: 5.6mW/°C (25°C)
- Thermal time constant: 20sec.
- Operating temp. range: −30 to +125°C

miniature thermistor for temperature sensor

NTH4G series is the world's smallest thermistor that is automatically processed into it's radial-leaded form with our advanced production method. Also available in surface mount NTH5G Series.

FEATURES

- Small deviations in resistance value and B constant make it possible to keep stable electric characteristics.
- Quick responses to temeprature changes enable it to make highly accurate measurements of temperatures.
- Easy to handle and suitable for various applications.
- Fully developed as a temperature sensing device to be fixed to PCB.

Part Number*1	Resistance 25°C(kΩ)	B-Constant*2 25/50°C(k)	Thermal Dissipation Constant	Thermal Time Constant	Operating Temperature Range
NTH4G35A202☐02	2.0	3500	2.1 (mW/°C)	1 Sec. Max. (In Liquid)	−40°C ~125°C
NTH4G37A502☐02	5.0	3700			
NTH4G39A103☐02	10.0	3900			
NTH4G40B203☐01	20.0	4050			
NTH4G41B503☐01	50.0	4150			
NTH4G42B104☐01	100.0	4250			

*1: Letter denoting the resistance tolerance is entered into the box. (F: ±1%, E: ±3%)
*2: B-Constant Tolerance (±1%) Max. Power 210mW

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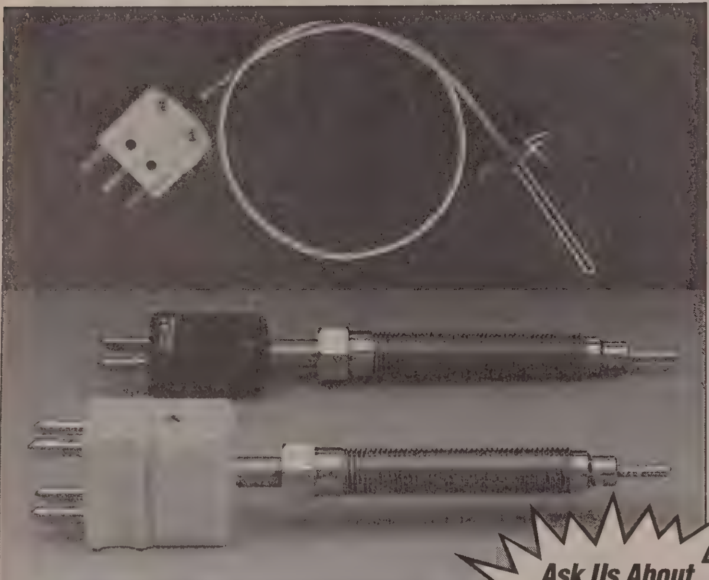

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- ✓ Hundreds of Styles Available
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- ✓ Unique Low-Noise Sensors and Connectors

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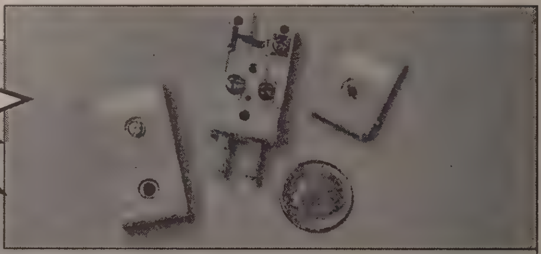
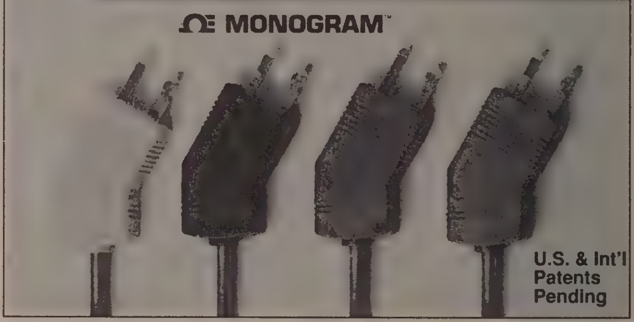


U.S. & Canada Patents. Int'l Patents Pending.



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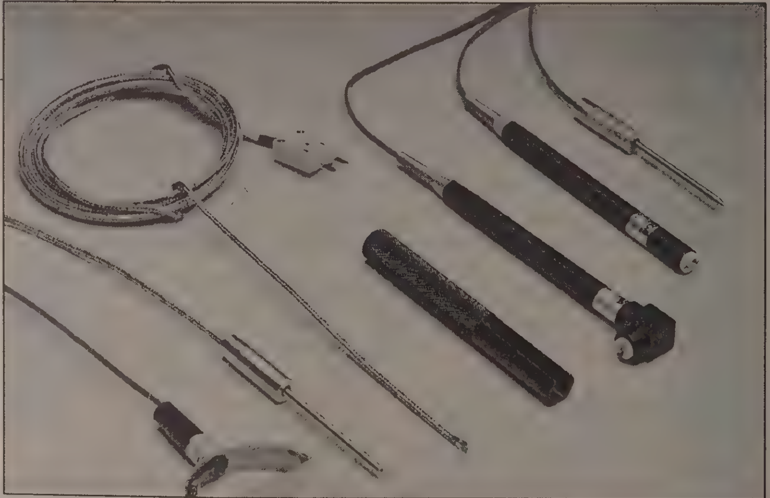

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Philips Components

Discrete Products Division

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POSITIVE TEMPERATURE COEFFICIENT (PTC) THERMISTORS

Uses temperature sensors, overload protection and degaussing control

SENSORS

Series	Body Size	Style	Resistance (ohms @ 25°C)	Switch Temp (°C)	Max Voltage
2322 660 91xxx	6.0 mm	coated disc, radial leads	50 to 250	6 to 115	25 DC
2322 661 91xxx	7.5 mm	coated disc, radial leads	30 to 50	25 to 110	40 DC
2322 662 91xxx	10.8 mm	coated disc, radial leads	36 to 50	115	180 DC
2322 662 93xxx	12.6 mm	coated disc, radial leads	45 to 120	75 to 120	265 RMS
2322 671 91xxx	1.7 mm	chip	120 max	60 to 140	25 DC
2322 671 91xxx	1.5 mm	chip	120 max	60 to 140	25 DC
2322 671 911xx	4.0 mm	coated chip, copper leads	120 max	60 to 140	25 DC
2322 671 912xx	n/a	ring terminal mounted	120 max	60 to 150	25 DC
2322 672 91xxx	3.5 mm	coated disc, radial leads	30 to 250	70 to 150	25 DC
2322 672 91xxx	3.4 mm	bare disc	30 to 250	70 to 150	25 DC

(xxx) defines switch temperature

DEGAUSSER CONTROLS

Series	Minimum Inrush Current (A)	Maximum Residual Current (>180 sec)	Resistance (ohms @ 25°C)	Coil Impedance	Max Voltage (RMS)
2322 662 96xxx	5.4 to 25	1 mA to 50 mA	5 to 36	5.4 to 25 ohms	140 to 270

OVERLOAD PROTECTION

Series	Style	Resistance (ohms) (@ 25°C)	Non-Trip Current (mA @ 25°C)	Trip Current (mA @ 25°C)	Tswitch (°C)	Max Voltage
2322 660 5xxx2	coated disc, radial leads	28.0 to 240.0	47 to 130	70 to 195	140	145
2322 660 5xxx3	coated disc, radial leads	56.0 to 3000.0	11 to 95	17 to 143	140	265
2322 661 1xxxx	bare disc, radial leads	18.0 to 280.0	42 to 193	61 to 274	120	56 to 265
2322 661 5xxx1	coated disc, radial leads	1.9 to 5.0	320 to 540	480 to 810	140	30
2322 661 5xxx2	coated disc, radial leads	8.0 to 19.0	170 to 270	255 to 405	140	145
2322 661 5xxx3	coated disc, radial leads	18.0 to 48.0	110 to 190	165 to 285	140	265
2322 662 1xxxx	bare disc, radial leads	6.5 to 26.0	154 to 348	220 to 493	120	56 to 265
2322 662 5xxx1	coated disc, radial leads	0.9 to 1.7	610 to 920	915 to 1380	140	30
2322 662 5xxx2	coated disc, radial leads	3.8 to 6.7	320 to 450	480 to 675	140	145
2322 662 5xxx3	coated disc, radial leads	8.4 to 17.0	210 to 320	315 to 480	140	265
2322 663 1xxxx	bare disc, radial leads	2.6 to 10.0	284 to 606	402 to 808	120	56 to 265
2322 663 5xxx1	coated disc, radial leads	0.5 to 0.7	1170 to 1390	1755 to 2085	140	30
2322 663 5xxx2	coated disc, radial leads	2.1 to 2.9	600 to 710	900 to 1065	140	145
2322 663 5xxx3	coated disc, radial leads	4.4 to 6.6	400 to 490	600 to 735	140	265
2322 664 1xxxx	bare disc, radial leads	1.6 to 7.0	426 to 878	603 to 1242	120	56 to 265
2322 664 5xxx1	coated disc, radial leads	0.3 to 0.4	1770 to 2050	2655 to 3075	140	30
2322 664 5xxx2	coated disc, radial leads	1.3 to 1.7	880 to 1000	1320 to 1500	140	145
2322 664 5xxx3	coated disc, radial leads	2.8 to 4.0	590 to 700	855 to 1050	140	265

(xxxx) defines non-trip current. Most series available on tape & reel or bare disc.

CAPACITIVE HUMIDITY SENSOR

Series	Style	Capacitance @ 25°C, 43% RH	Humidity Range
2322 691 90001	pin mount, plastic housing	122 pF ±15%	10 to 90%

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METAL OXIDE VARISTORS

UL File E-98144; CSA File LR-86645-1; VDE/CECC File 14480-4790-1001/AIF
Transient voltage suppression discs. Available in bulk, tape & reel, with straight, kink or flange leads.

Series	Disc Size	V_{rms}	V_{dc}	Joules	Max i surge	Capacitance (@ 1 KHz)
2322 592 xxxxx	5 mm	14 to 460	18 to 615	0.5 to 21	100A to 400 A	30 pF to 1,300 pF
2322 593 xxxxx	7 mm	14 to 460	18 to 615	1.7 to 63	250 A to 1,200 A	75 pF to 2,800 pF
2322 594 xxxxx	10 mm	14 to 550	18 to 745	4.3 to 98	500 A to 2,500 A	120 pF to 6,000 pF
2322 595 xxxxx	14 mm	14 to 550	18 to 745	5.4 to 160	1,000 A to 4,500 A	180 pF to 15,00 pF

(xxxxx) defines packaging and AC voltage rating (V_{rms})

NEGATIVE TEMPERATURE COEFFICIENT (NTC) THERMISTORS

Used for inrush current limiting and temperature sensing

SENSORS

Series	Body Size	Style	Resistance (ohms @ 25°C)	Dissipation	Temp Range (°C)	Tolerance (± %)
2322 610 0xxxx	8.70 mm	ceramic disc	4 to 33	1 watt	– 25 to + 125	10,20
2322 610 1xxxx	9.40 mm	coated disc, radial leads	4 to 33	1 watt	– 25 to + 125	10,20
2322 633 5xxxx	3.70 mm	MELF, glass encapsulated	10 K to 500 K	100 mW	– 55 to + 155	5,10
2322 633 8xxxx	1.85 mm	axial leads, glass	10 K to 500 K	100 mW	– 40 to + 155	5,10
2322 640 5xxxx	3.80 mm	coated chip, nickel leads	2.2 K to 470 K	100 mW	– 40 to + 150	1,2,3,5
2322 640 6xxxx	3.80 mm	coated chip, copper leads	2.2 K to 470 K	500 mW	– 40 to + 150	1,2,5,10
2322 640 7xxxx	8.00 mm	aluminum stud mount	2.7 K to 470 K	500 mW	– 40 to + 150	5,10
2322 640 900xx	10.00 mm	steel watertight housing	2.7 K to 12 K	250 mW	– 40 to + 150	5,10
2322 642 6xxxx	5.30 mm	coated disc, radial leads	3.3 to 1500	500 mW	– 40 to + 150	5,10
2322 642 7xxxx	8.00 mm	aluminum stud mount	3.3 to 1500	500 mW	– 40 to —150	5,10
2322 645 0xxxx	4.00 mm	coated disc, radial leads	5.0 K to 10 K	100 mW	– 40 to + 150	5,10

(xxxxx) defines packaging, resistance (at 25°C) and tolerance

INRUSH CURRENT LIMITERS

Series	Style	Resistance (ohms at 25°C)	Current (A)
2322 653 61xxx	coated disc, radial leads	5.0 to 20.0	2 to 4
2322 654 61xxx	coated disc, radial leads	2.5 to 7.0	3 to 8
2322 655 61xxx	coated disc, radial leads	5.0 to 10.0	6 to 8
2322 656 61xxx	coated disc, radial leads	2.0 to 8.5	13 to 15

(xxx) defines resistance (at 25°C)

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MAXIMUM CURRENT CAPACITY— CONDUCTORS

	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum						
Size, AWG	Single-wire	Wire-bundled	Single-wire	Wire-bundled		60°C	80°C		
30	. . .	. . .	. . .	. . .	. . .	0.2	0.4	. . .	0.20
28	. . .	. . .	. . .	. . .	. . .	0.4	0.6	. . .	0.32
26	. . .	. . .	. . .	. . .	. . .	0.6	1.0	. . .	0.51
24	. . .	. . .	. . .	. . .	. . .	1.0	1.6	. . .	0.81
22	9	5	. . .	. . .	. . .	1.6	2.5	. . .	1.28
20	11	7.5	. . .	. . .	. . .	2.5	4.0	3	2.04
18	16	10	. . .	. . .	6	4.0	6.0	5	3.24
16	22	13	. . .	. . .	10	6.0	10.0	7	5.16
14	32	17	. . .	. . .	20	10.0	16.0	15	8.22
12	41	23	. . .	. . .	30	16.0	26.0	20	13.05
10	55	33	. . .	. . .	35	. . .	. . .	25	20.8
8	73	46	58	36	50	. . .	. . .	35	33.0
6	101	60	86	51	70	. . .	. . .	50	52.6
4	135	80	108	64	90	. . .	. . .	70	83.4
2	181	100	149	82	125	. . .	. . .	90	132.8
1	211	125	177	105	150	. . .	. . .	100	167.5
0	245	150	204	125	200	. . .	. . .	125	212.0
00	283	175	237	146	225	. . .	. . .	150	266.0
000	328	200	. . .	. . .	275	. . .	. . .	175	336.0
0000	380	225	. . .	. . .	325	. . .	. . .	225	424.0

THERMOSTATS

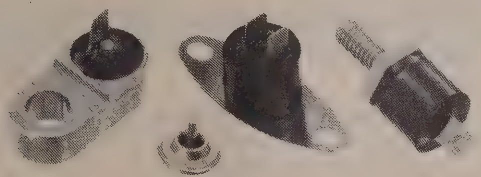
Accurate. Reliable. In standard and custom design. Contact Philips Technologies, Airpax Protector Group, Husky Park, Frederick MD 21701. (301) 663-5141. Fax (301) 698-0624.

Series 5003—Low-Profile Thermostat

Extremely thin, lightweight, wafer-type thermal switch that provides fast, positive response, excellent repeat reliability, good shock and vibration resistance over a wide operating range.

Features:

- Overall depth is only .250".
- Operating temperature range from 15°F to 350°F.
- OPR or CLR contacts are available.
- 120 VAC 5 amp, 240 VAC 3 amp.
- Weight 2.3 grams.
- Variety of mountings and terminations available.
- Environmental sealing available.
- Approval: Ⓒ ЯU



Series 5011—Low-Cost, Grounded Case Thermostat

A very low-cost thermostat that will meet a number of exacting requirements for shock and vibration resistance. It is hermetically sealed and offers fast response. Plug, wire-lead, isolated base and ¼ -20 studmountings are available.

Features:

- Low-cost, grounded unit or optional isolated case.
- Operating temperature range from 140°F to 525°F.
- Many mounting packages available: 120 VAC isolated case only, 32 VDC grounded case, 3 amp resistive.

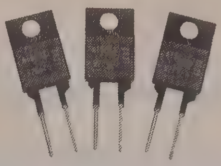
Series 6600—PC Board-Mountable Thermostat

A miniature bimetallic snap-acting thermostat in an 8-pin N8A Dual In-Line Package. Single pole/single throw switch assembly available in either normally closed, open on rising temperature or normally open, close on rising temperature configurations. Compatible with auto-insertion equipment, the Series 6600 will withstand wave soldering and board washing operations. Typical uses include turning on an indicator light, changing the speed of a fan or switching on a control circuit.

Features:

- Operating temperature range 40°C to 120°C.
- 1 amp 48 VDC switching capability.
- Standard 8-pin N8A Dual In-Line Package for auto-insertion compatibility.
- OPR or CLR contacts available.
- Sealed to withstand wave solder and board washing.
- Approval: Ⓒ ЯU VDE

A Philips Electronics North America Company

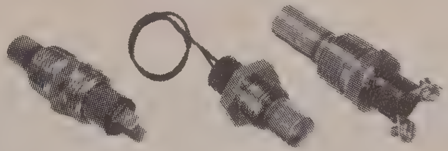


Series 6700—Surface Sensing Thermostat

This miniature, bimetallic, snap-acting thermostat conforms to the International product package standard Y220/T0220. Included are gold plated silver cross bar contacts rated for 100,000 cycles at 5 VDC, 1mA resistive and 30,000 cycles at 48 VDC/120 VAC, 1 amp resistive. Ideally suited for power supply heat sink applications.

Features:

- Operating temperature range. 40°C to 130°C.
- T0-220 packaging—compatible with high-speed automated assembly equipment.
- Epoxy sealed for wave soldering and cleaning.
- Approval: VDE pending, Ⓒ ЯU

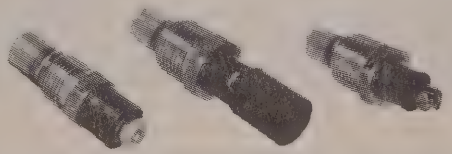


Series 5100—Isolated Case Thermostat

This two-terminal, immersion-type hermetically sealed thermostat can be used on water-cooled engines, hydraulic systems, degreasers, industrial air compressors and tanks where liquids are heated. Its isolated contact is designed to switch 110 VAC within your control circuitry. It offers rapid response to liquid or air temperature.

Features:

- Hermetically sealed.
- All stainless T.I.G. construction.
- Operating temperature range from 35°F to 500°F.
- 120 VAC 3 amp/240 VAC 1.5 amp resistive models available.
- Approval: Ⓒ ЯU



Series 5020—Hermetically Sealed Thermostat

This snap-action hermetically sealed temperature control is designed for use wherever a sealed unit and high vibration resistance are required. Protects engines from damage from overheating by sensing high water or oil temperatures. Snap-action disc located in the very tip of the probe assures rapid and true response to liquid temperature. The all-welded construction (and grounded case) of this sealed thermostat ensures meeting Thermal Shock Specifications of MIL-STD-202, Method 107, Test Condition B. The tube will withstand a Pressure Exposure Limit of 1500 PSI. Insulation Resistance of 50 megohms minimum at 500 VDC.

Features:

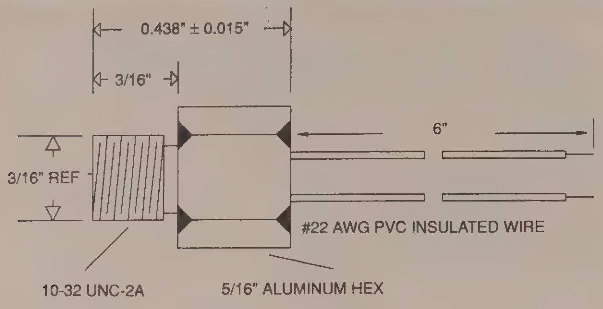
- Hermetically sealed.
- Grounded case.
- Operating temperature range from 35°F to 500°F.
- 32 VDC, 3 amp.
- 5020 13 Conforms to MIL-12285/1.

PHILIPS

Quality Thermistor, Inc.

2147 CENTURION PLACE, BOISE, IDAHO 83709
208/377-3373 • FAX: 208/376-4754 • 800/554-4QTI (4784)

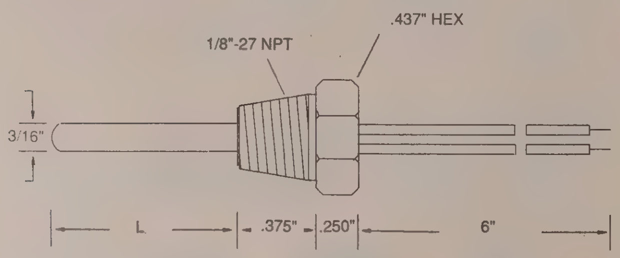
Probes


0.438" ± 0.015"
3/16"
3/16" REF
6"
#22 AWG PVC INSULATED WIRE
10-32 UNC-2A
5/16" ALUMINUM HEX

QTF:

Aluminum heat sink sensor. Great for applications where shock and vibration are present.

- Resistance: 10K Ohm @ 25°C
- R-T Curve: "Z" –4.4% NTC
- Temp. Tolerance: ±.2°C (0° to 70°C)
- Time Constant: 3.6 Seconds (Air)

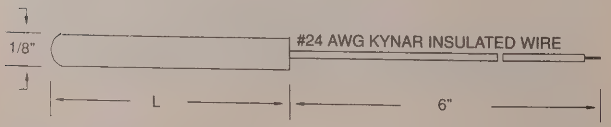

.437" HEX
1/8"-27 NPT
3/16"
L
.375"
.250"
6"

QTP (L):

Durable stainless steel probe with NPT HEX fitting. Ideal for measuring liquid/air in enclosed environments

- Resistance: 10K Ohm @ 25°C
- R-T Curve: "Z" –4.4% NTC
- Temp. Tolerance: ±.2°C (0° to 70°C)
- Time Constant: 3.6 Seconds (Air)

When ordering, specify "L" as length of tube portion.

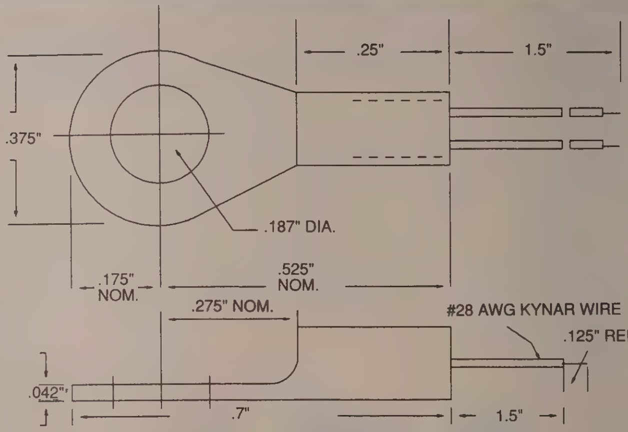

1/8"
#24 AWG KYNAR INSULATED WIRE
L
6"

QTR (L):

Durable general purpose stainless steel immersion probe.

- Resistance: 10K Ohm @ 25°C
- R-T Curve: "Z" –4.4% NTC
- Temp. Tolerance: ±.2°C (0° to 70°C)
- Time Constant: 3.6 Seconds (Air)

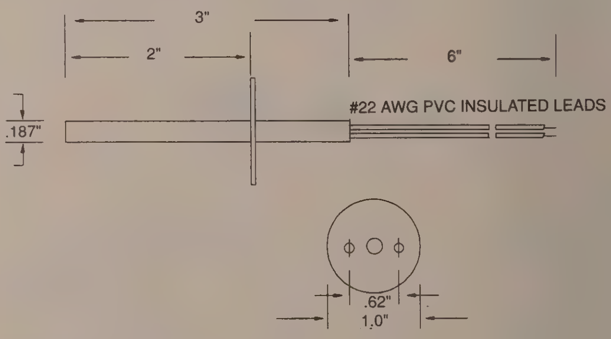
When ordering, specify "L" as length of probe.


.25"
1.5"
.375"
.187" DIA.
.175" NOM.
.525" NOM.
.275" NOM.
#28 AWG KYNAR WIRE
.125" REF
.042"
.7"
1.5"

QTRL-1:

Ring tongue lug probe. Excellent for control and measurement of any flat surface.

- Resistance: 10K Ohm @ 25°C
- R-T Curve: "Z" –4.4% NTC
- Temp. Tolerance: ±.2°C (0° to 70°C)
- Time Constant: 3.6 Seconds (Air)


3"
2"
6"
#22 AWG PVC INSULATED LEADS
.187"
.62"
1.0"

QTA-1:

Stainless steel probe with flange. Available in open tip (QTA-1) for air measurement, and closed (QTA-2) for liquid measurement.

- Resistance: 10K Ohm @ 25°C
- R-T Curve: "Z" –4.4% NTC
- Temp. Tolerance: ±.2°C (0° to 70°C)
- Time Constant: 3.6 Seconds (Air)

Quality Thermistor, Inc.

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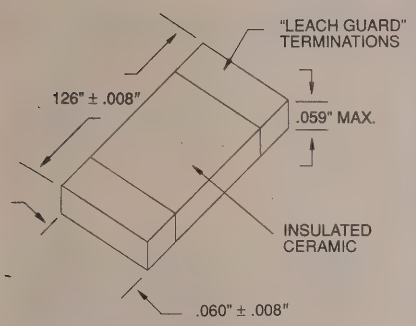
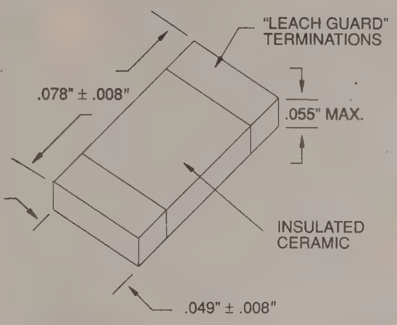
NTC Surface Mount Thermistors

QT1206:


"LEACH GUARD" TERMINATIONS
126" ± .008"
.059" MAX.
INSULATED CERAMIC
.060" ± .008"

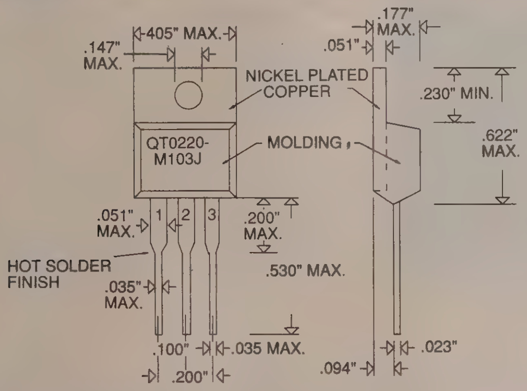
QT0805:


"LEACH GUARD" TERMINATIONS
.078" ± .008"
.055" MAX.
INSULATED CERAMIC
.049" ± .008"

- **Standard Package Sizes:** 0805, 1005, 1206
- **Solder Leach Resistant Terminations**
- **R25C Values:** 1.0K Ohm to 10.0 Meg Ohm
- **R25C Tolerances:** F(1%), G(2%), J(5%), K(10%)
- **Meets or Exceeds MIL-T-23648 Where Applicable**
- **Ideal for Automated Pick and Place**
- **Packaging:** 8mm Tape and Reel or Waffle Pack

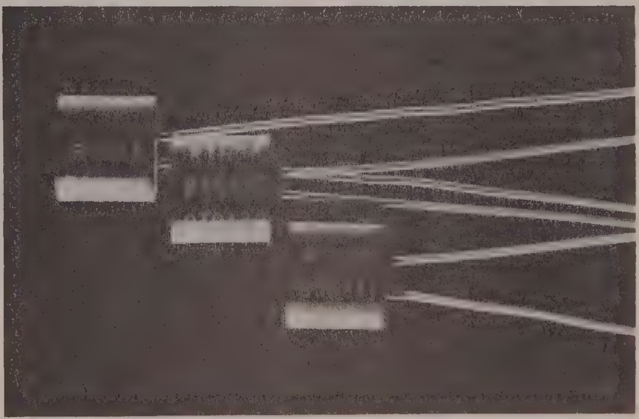
Discrete NTC and PTC Power Thermistors

QT0220:


.405" MAX.
.147" MAX.
.177" MAX.
.051"
NICKEL PLATED COPPER
.230" MIN.
QT0220-M103J
MOLDING
.622" MAX.
.051" MAX.
1
2
3
.200" MAX.
HOT SOLDER FINISH
.035" MAX.
.530" MAX.
.100"
.035 MAX.
.200"
.094"
.023"

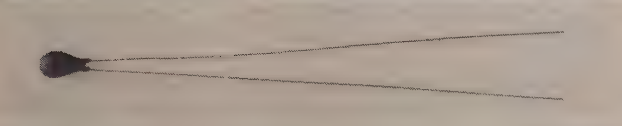
Industry standard T0220 Packaging. Ideal for automated insertion processes. Allows for thermistor use in high power applications, such as current limiting.

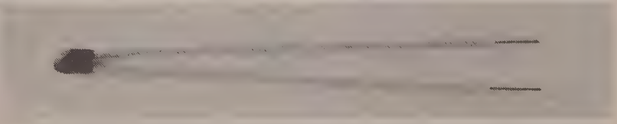
RTH06:

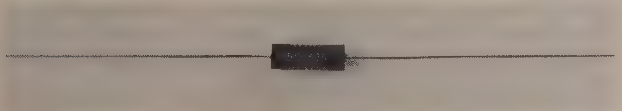


- MIL-T-23648/1 Qualified

NTC and PTC Discrete Thermistors*







NTC:

- **MIL-T-23648:** RTH44 (/20) and RTH06 (/1), Equivalents to RTH16 (/6).
- **Commercial:** Precision Interchangeable Tolerances to ±0.2 Degree Celsius. Point Match Tolerances to ±0.1 Degree Celsius.
- **Packaging:** Available in Tape and Reeled, Glass Hermetically Sealed D07 and D035 and Radial Leaded Epoxy Coated Units.

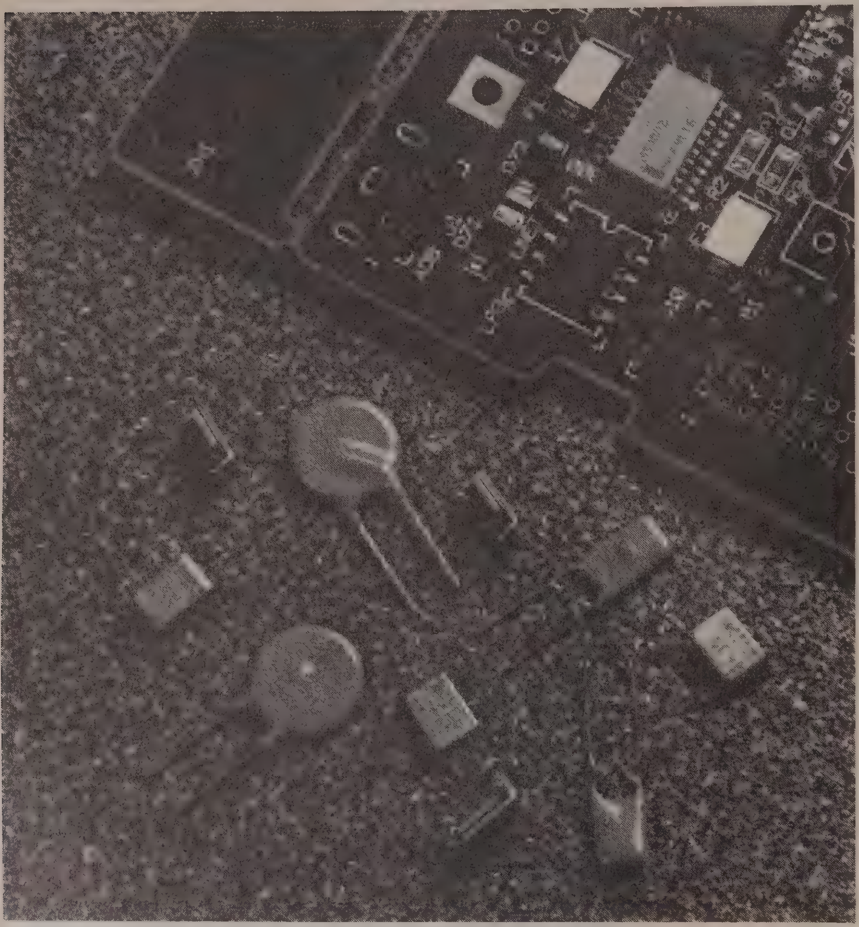
PTC:

- **MIL-T-23648:** RTH22 (/9) and RTH42 (/19)
- **Commercial:** Precision tolerances to ±1% in D07 package (QTG12), Axial Leaded Molded, Miniature D035 and Radial Leaded Discretes available in 5% and 10% Tolerances.
- **Features:** Exhibit a Linear +0.7% Change in Resistance

*Dimensions Vary with Value and R/T Curve. Hundreds of Combinations Available.

Raychem

PolySwitch® **Resettable** Fuse Devices



PolySwitch® "Resettable fuses" protect the DC Power Circuit and provide fail safe protection against short circuit of the motherboard.

PolySwitch devices are used in a variety of applications:

- Instrumentation and control
- Security systems
- Medical equipment
- Batteries
- Computers and peripherals
- Audio visual equipment
- Toys
- Telecommunications networks
- Modems
- Transformers

PolySwitch devices have distinct advantages over other methods of circuit protection:

- Remotely resettable, they can automatically reset themselves thousands of times, thus eliminating unnecessary product downtime.
- Low resistance means low voltage drops in power circuits.
- UL, TUV, and CSA recognized components.
- Radial-leaded and surface-mount packaging make installation easy.

PolySwitch circuit protection devices protect electrical and electronic circuits against excessive current, voltage, and temperature. Like fuses and circuit breakers, PolySwitch devices interrupt the flow of dangerously high currents, whether due to excessive voltage or to a fault condition within the circuit. But unlike fuses and circuit breakers, PolySwitch circuit protectors automatically reset themselves after the fault that caused them to trip is corrected.

PolySwitch devices are positive temperature coefficient (PTC) resistors that rapidly increase resistance in response to excessive currents or temperature. When the current flowing through a PolySwitch circuit protector is within its maximum rating, its "base" resistance is very low. If the current rises above its rated current, the PolySwitch device's resistance abruptly rises. Then, as circuit resistance is increased, the current decreases until thermal equilibrium is achieved.

Depending upon the PolySwitch model and the amount of current, the trip time required to reduce the current can be as short as one-tenth of a second. Once power to the protected circuit is removed, the PolySwitch device's resistance begins to drop towards its normal value, in essence resetting the device so that normal operation can resume when the fault is corrected and the power reapplied.

See Our Additional Data Pages In Sections A • 4800 - B • 4300 - D • 3900

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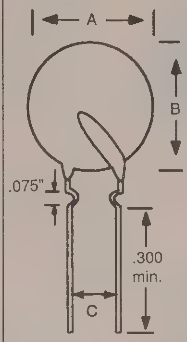
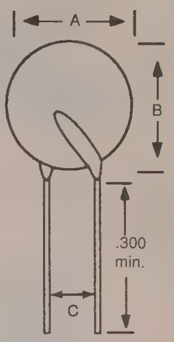
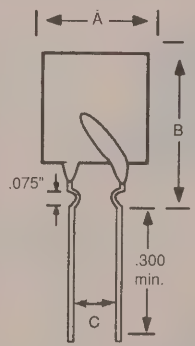
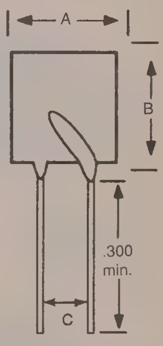
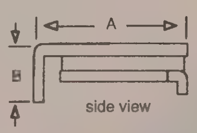
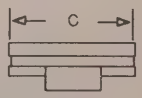
Raychem

PolySwitch® **Resettable** Fuse Devices

Part Number	Maximum Voltage	Rated Current (20°) (amps)			Max. Initial R (ohms)	Recognized By	Max. Dim.		Typ.	Diagram
		Hold	Trip	Max			A	B	C	
RXE010	60	0.10	0.20	40	4.50	UL, TUV, CSA	.29	.50	.231	 RXE010-RXE090  RXE110-RXE375
RXE017	60	0.17	0.34	40	5.20	UL, TUV, CSA	.29	.50	.231	
RXE020	60	0.20	0.40	40	2.84	UL, TUV, CSA	.29	.48	.231	
RXE025	60	0.25	0.50	40	1.94	UL, TUV, CSA	.29	.50	.231	
RXE030	60	0.30	0.60	40	1.36	UL, TUV, CSA	.29	.51	.231	
RXE040	60	0.40	0.80	40	0.85	UL, TUV, CSA	.30	.53	.231	
RXE050	60	0.50	1.00	40	0.76	UL, TUV, CSA	.31	.54	.231	
RXE065	60	0.65	1.30	40	0.48	UL, TUV, CSA	.38	.57	.231	
RXE075	60	0.75	1.50	40	0.39	UL, TUV, CSA	.41	.60	.231	
RXE090	60	0.90	1.80	40	0.30	UL, TUV, CSA	.46	.62	.231	
RXE110	50	1.10	2.20	40	0.24	UL, TUV, CSA	.51	.71	.231	
RXE135	50	1.35	2.70	40	0.19	UL, TUV, CSA	.57	.77	.231	
RXE160	50	1.60	3.20	40	0.14	UL, TUV, CSA	.64	.84	.231	
RXE185	50	1.85	3.70	40	0.12	UL, TUV, CSA	.70	.90	.231	
RXE250	50	2.50	5.00	40	0.08	UL, TUV, CSA	.84	1.04	.431	
RXE300	50	3.00	6.00	40	0.06	UL, TUV, CSA	.98	1.18	.431	
RXE375	50	3.75	7.50	40	0.04	UL, TUV, CSA	1.12	1.32	.431	

RUE090	30	0.90	1.80	40	0.12	UL, Pend CSA	.26	.48	.200	 RUE090-RUE250  RUE300-RUE900
RUE110	30	1.10	2.20	40	0.10	UL, Pend CSA	.26	.56	.200	
RUE135	30	1.35	2.70	40	0.08	UL, Pend CSA	.35	.53	.200	
RUE160	30	1.60	3.20	40	0.07	UL, Pend CSA	.35	.60	.200	
RUE185	30	1.85	3.70	40	0.06	UL, Pend CSA	.40	.62	.200	
RUE250	30	2.50	5.00	40	0.04	UL, Pend CSA	.45	.72	.200	
RUE300	30	3.00	6.00	40	0.05	UL, Pend CSA	.45	.68	.200	
RUE400	30	4.00	8.00	40	0.03	UL, Pend CSA	.55	.79	.200	
RUE500	30	5.00	10.00	40	0.03	UL, Pend CSA	.55	.98	.400	
RUE600	30	6.00	12.00	40	0.02	UL, Pend CSA	.65	.98	.400	
RUE700	30	7.00	14.00	40	0.02	UL, Pend CSA	.75	1.05	.400	
RUE800	30	8.00	16.00	40	0.02	UL, Pend CSA	.85	1.15	.400	
RUE900	30	9.00	18.00	40	0.01	UL, Pend CSA	.95	1.17	.400	

SMD030	60	0.30	0.60	10	2.40	UL, TUV, CSA	.31	.125	.21	 side view  end view
SMD050	60	0.50	1.00	10	0.70	UL, TUV, CSA	.31	.125	.21	
SMD075	30	0.75	1.50	40	0.50	UL, TUV, CSA	.31	.125	.21	
SMD100	30	1.10	2.20	40	0.24	UL, TUV, CSA	.31	.118	.21	
SMD125	15	1.25	2.50	40	0.14	Pend UL & TUV	.31	.118	.21	
SMD150	15	1.50	3.00	40	0.12	UL, TUV, CSA	.37	.118	.26	

See Our Additional Data Pages In Sections A • 4800 - B • 4300 - D • 3900

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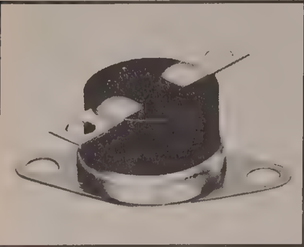
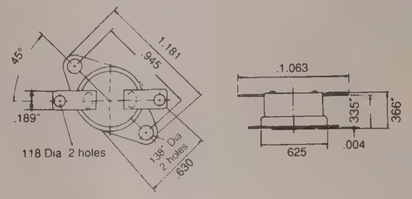
SELCO THERMOSTATS

STOCK 1/2" DISC THERMOSTATS

Selco model numbers SC, SO, SC-A, SO-A and SO-AM are still available. Consult Selco.

CA AND OA (602-S) THERMOSTATS



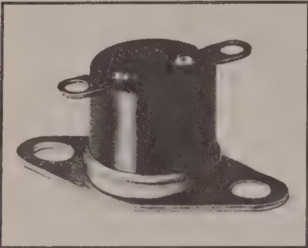

45°
1.181
.945
.189"
118 Dia 2 holes
138" Dia 2 holes
.630
.1.063
335"
366"
625
.004

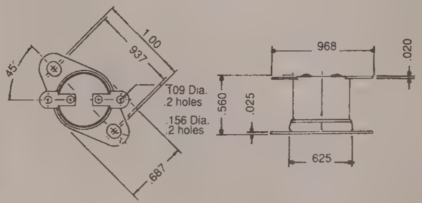
U.L. ELECTRICAL RATINGS
- 125VAC, 15 Amps, Resistive
- 250VAC, 8 Amps, Resistive
- 100,000 Cycles

TEMPERATURE RANGE
- 60 Degrees F. to 302 Degrees F.

APPROVALS
- U.L. File No. E145478(S) Guide XAPX2
- CSA File No. LR63201
- VDE File No. 69046
- DEMKO File No. DK-45

SSC-A AND SSO-A THERMOSTATS



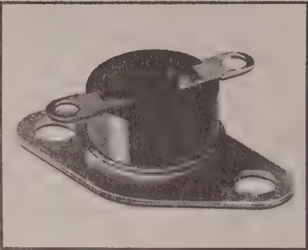

45°
1.00
937
T09 Dia.
.2 holes
.156 Dia.
.2 holes
.687
968
.020
.560
.025
625

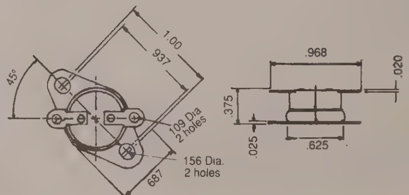
U.L. ELECTRICAL RATINGS
- 120VAC, 15 Amps, Resistive
- 240VAC, 10 Amps, Resistive
- 100,000 Cycles

TEMPERATURE RANGE
- 35 Degrees F. to 350 Degrees F.

APPROVALS
- U.L. File No. E23581, Guide XAPX2
- CSA File No. 12619
- VDE File No. 15357-4510-1001
- BEAB-0080

SSC AND SSO THERMOSTATS



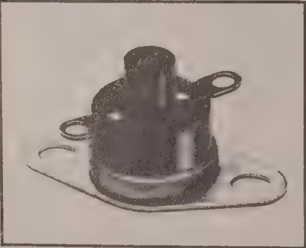

45°
1.00
937
109 Dia
2 holes
156 Dia.
2 holes
687
.968
.020
.375
.025
.625

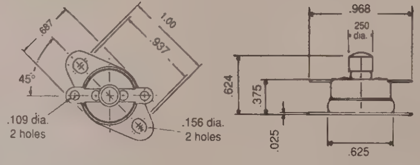
U.L. ELECTRICAL RATINGS
- 120VAC, 15 Amps, Resistive
- 240VAC, 10 Amps, Resistive
- 100,000 Cycles

TEMPERATURE RANGE
- 35 Degrees F. to 350 Degrees F.

APPROVALS
- U.L. File No. MH6883, E23581, Guide XAPX2
- CSA File No. 12619
- AGA File No. 22-2E, 23-3D

SSO-M MANUAL RESET THERMOSTATS




.687
1.00
.937
45°
.109 dia.
2 holes
.156 dia.
2 holes
.968
250
dia.
.624
.375
.025
.625

U.L. ELECTRICAL RATINGS
- 120VAC, 15 Amps, Resistive • 240VAC, 10 Amps, Resistive
- 6,000 Cycles

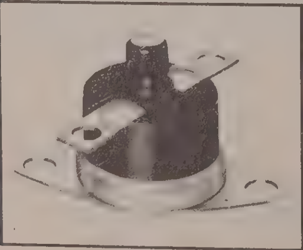
TEMPERATURE RANGE
- 100 Degrees F. to 350 Degrees F.

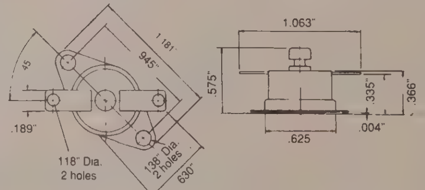
MANUAL RESET
- 30 Degrees F. Below Actual Opening Temperature

AUTOMATIC RESET
- 75 Degrees F. or less

APPROVALS
- U.L. File No. E23581, Guide XAPX2 • CSA File No. 12619

OAM (603-S) MANUAL RESET THERMOSTATS




45
1.181"
945"
.189"
118" Dia.
2 holes
138" Dia.
2 holes
630"
1.063"
.575"
.335"
.366"
.625
.004"

U.L. ELECTRICAL RATINGS
- 125VAC, 15 Amps, Resistive
- 250VAC, 8 Amps, Resistive • 6,000 Cycles

TEMPERATURE RANGE
- 125 Degrees F. to 302 Degrees F.

MANUAL RESET
- 72 Degrees F. or less

AUTOMATIC RESET
- 14 Degrees F.

APPROVALS
- U.L. File No. E145478(S) Guide XAPX2

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SELCO THERMOSTATS

MODELS AVAILABLE FROM STOCK - STANDARD CONSTRUCTION UNLESS NOTED

Selco model numbers SC, SO, SC-A, SO-A and SO-AM are still available. Consult Selco.

CA, OA & OAM	SSC-A, SSO-A	SSC,SSO & SSOM	SET POINT	ACTION AT SET POINT	DIFFERENTIAL
—	—	SSO-35 (1)	35F. ± 5F.	Open	15F.
OA-60 (2)	—	SSO-60 (2)	60F. ± 5F.	Open	20F.
CA-60	—	—	60F. ± 7F.	Close	20F.
OA-80	—	—	80F. ± 5F.	Open	30F.
OA-85	—	—	85F. ± 5F.	Open	15F.
—	—	SSC-85	85F. ± 7F.	Close	15F.
OA-100	SSO-100A	—	100F. ± 5F.	Open	30F.
CA-100	—	—	100F. ± 7F.	Close	30F.
OA-110	—	SSO-110	110F. ± 5F.	Open	30F.
CA-110	—	—	110F. ± 7F.	Close	30F.
OA-120	SSO-120-A	—	120F. ± 5F.	Open	30F.
CA-120	SSC-120-A	—	120F. ± 7F.	Close	30F.
OA-130	SSO-130-A	—	130F. ± 5F.	Open	30F.
OA-140	—	—	140F. ± 5F.	Open	30F.
CA-140	—	SSC-140	140F. ± 7F.	Close	30F.
CA-140-QC(3)	—	—	140F. ± 7F.	Close	30F.
OA-150	—	—	150F. ± 5F.	Open	30F.
OA-150-QCC(4)	—	—	150F. ± 5F.	Open	30F.
OA-160	SSO-160-A	—	160F. ± 5F.	Open	30F.
CA-160	—	—	160F. ± 7F.	Close	30F.
OA-170	SSO-170-A	—	170F. ± 5F.	Open	30F.
CA-170-QC(3)	—	—	170F. ± 7F.	Close	30F.
OA-175	SSO-175-A	—	175F. ± 5F.	Open	15F.
OA-175-QC(4)	—	—	175F. ± 5F.	Open	30F.
OA-180	SSO-180-A	—	180F. ± 5F.	Open	30F.
OA-180-QC(5)	—	—	180F. ± 5F.	Open	30F.
CA-180	—	SSC-180	180F. ± 7F.	Close	30F.
OA-190	SSO-190-A	SSO-190	190F. ± 5F.	Open	30F.
OA-194-QCC(3)	—	—	194F. ± 5F.	Open	41F.
OA-190-QC(4)	—	—	190F. ± 5F.	Open	18F.
CA-190-QC(3)	—	—	190F. ± 7F.	Close	18F.
OA-194M	—	—	194F. ± 7F.	Open	manual-reset
OA-200	—	—	200F. ± 5F.	Open	30F.
CA-200	SSC-200-A	—	200F. ± 7F.	Close	30F.
CA-205	—	—	205F. ± 8F.	Close	30F.
OA-210	—	—	210F. ± 6F.	Open	30F.
OA-220	—	—	220F. ± 6F.	Open	30F.
CA-225	—	—	225F. ± 8F.	Close	30F.
OA-230	—	—	230F. ± 6F.	Open	30F.
CA-240	—	—	240F. ± 10F.	Close	100F.
OA-250	SSO-250-A	—	250F. ± 7F.	Open	30F.
OA-250M	—	SSO-250M	250F. ± 10F.	Open	manual-reset
CA-270	—	—	270F. ± 7F.	Open	30F.
OA-280	—	—	280F. ± 7F.	Open	30F.
OA-300	SSO-300-A	—	300F. ± 7F.	Open	30F.

(1) Has .250 turned up quick connects, no bracket.
(2) Freeze point thermostat — closes before 32f. on drop.
(3) Has .250 turned up quick connects 90° to mounting hole centerline.
(4) Has .250 turned up quick connects 45° to mounting hole centerline.
(5) Has 3/16" horiz. quick connects — 45° to mounting hole centerline.

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Sensor Scientific, inc.

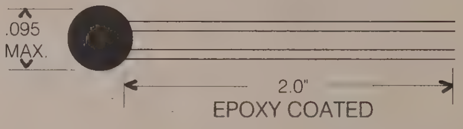
NTC THERMISTORS

INTERCHANGEABLE WAFER THERMISTORS 0 TO 70 C

Resistance vs. Temperature Conversion Chart

TEMP. Deg. C.	CURVE C 2252 ohms @ 25 °C. Resistance	CURVE C 3000 ohms @ 25 °C. Resistance	CURVE C 5000 ohms @ 25 °C. Resistance	CURVE C 10000 ohms @ 25 °C. Resistance	CURVE D 30000 ohms @ 25 °C. Resistance	CURVE D 50000 ohms @ 25 °C. Resistance	CURVE D 100000 ohms @ 25 °C. Resistance
-40	75,680	100,800	168,000	336,100	1,221,000	2,036,000	4,071,000
-30	39,810	53,040	88,390	176,800	623,600	1,039,000	2,079,000
-20	21,840	29,100	48,500	97,000	332,000	553,400	1,107,000
-10	12,454	16,590	27,650	55,300	183,700	306,200	612,400
0	7,353	9,795	16,325	32,650	105,300	175,500	351,000
10	4,482	5,971	9,951	19,903	62,340	103,900	207,800
20	2,813	3,748	6,247	12,493	38,020	63,360	126,700
25	2,252	3,000	5,000	10,000	30,000	50,000	100,000
30	1,814	2,417	4,028	8,056	23,830	39,710	79,430
40	1,199	1,598	2,663	5,325	15,318	25,530	51,060
50	811	1,080	1,801	3,601	10,080	16,800	33,600
60	560	746	1,244	2,487	6,778	11,297	22,590
70	395	526	876	1,752	4,651	7,751	15,502
80	283	377	628	1,256	3,251	5,418	10,837
90	206	275	458	916	2,313	3,854	7,708
100	153	204	339	678	1,672	2,786	5,573
110	115	153	255	510	1,227	2,045	4,090
120	87	117	194	388	914	1,523	3,045
130	67	90	150	300	689	1,149	2,297
140	53	70	117	234	526	877	1,754
150	42	55	92	185	407	678	1,356

Sensor Scientific has developed a low cost interchangeable wafer thermistor product line. These highly reliable units provide a resistance temperature curve that can be matched over a range of 0° to 70° C. This means that a matched replacement thermistor can be purchased several years from now with the identical R/T curve as the original thermistor.



PART NUMBER +/- 0.2 DEG. C. TOLERANCE	PART NUMBER +/- 0.5 DEG. C. TOLERANCE	PART NUMBER +/- 1.0 DEG. C. TOLERANCE	R_o @ 25 °C Ohms	LEAD DIAMETER	R. vs. T. CURVE
WM222C	WN222C	WP222C	**2,252**	**0.0126**	**C**
WM302C	WN302C	WP302C	**3,000**	**0.0126**	**C**
WM502C	WN502C	WP502C	**5,000**	**0.0126**	**C**
WM103C	WN103C	WP103C	**10,000**	**0.0126**	**C**
WM303D	WN303D	WP303D	**30,000**	**0.008**	**D**
WM503D	WN503D	WP503D	**50,000**	**0.008**	**D**
WM104D	WN104D	WP104D	**100,000**	**0.008**	**D**

OPTIONS:

Customized Lead Configurations
Non-Standard Resistance Values
Non-Standard Tolerances
Non-Standard Operating Ranges

Time Constant: 4 to 7 seconds typical (varies with resistance value)
Dissipation Constant: 1.0 to 3.5 mw/Deg. C. typical (varies with resistance value)
Maximum Operating Temperature: 150 Deg. C.*

*Maximum stability will be achieved if operating temperature does not exceed 95 Deg. C..

Sensor Scientific, inc.

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Sensor Scientific, inc.

NTC THERMISTORS

TEMPERATURE ASSEMBLIES

Sensor Scientific manufactures many different types of thermistor assemblies. The housing drawings in this section are offered as a guide to assist the engineer in designing a complete thermistor assembly that meets his project needs best.

The housing material specified in most of the drawings is stainless steel. If the requirements are such that other material would be preferable, brass and aluminium are also available.

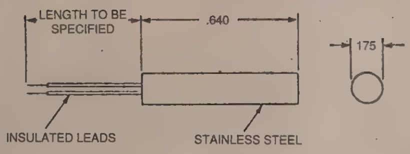
The basic element in these assemblies is the thermistor. **Sensor Scientific** manufactures a complete line of thermistors. The glass probe thermistor and the wafer thermistor are units that are typically used in these assemblies.

Sensor Scientific has trained application engineers who will assist you in the design and selection of the thermistor assembly that best meets your needs. Our probes have been designed to maximize sensitivity and stability. They are also constructed to minimize the risk of damage due to operation and handling.

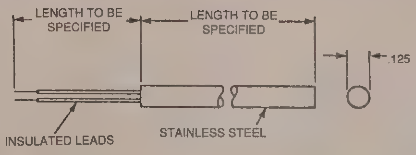
All assembly work is performed by carefully trained and supervised individuals. All units are extensively tested throughout the manufacturing process to insure that customers receive the highest quality thermistor assemblies.

These designs represent a small fraction of the hundreds of custom designs available from **Sensor Scientific.** *If you have something different in mind, give us a call!*

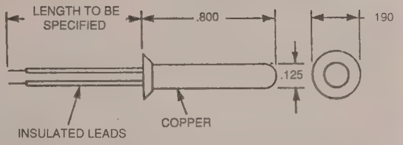
SERIES 10


LENGTH TO BE SPECIFIED
.640
175
INSULATED LEADS
STAINLESS STEEL

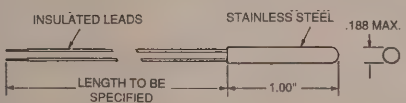
SERIES 11


LENGTH TO BE SPECIFIED
LENGTH TO BE SPECIFIED
.125
INSULATED LEADS
STAINLESS STEEL

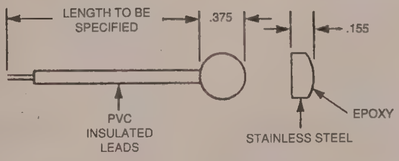
SERIES 20


LENGTH TO BE SPECIFIED
.800
190
.125
INSULATED LEADS
COPPER

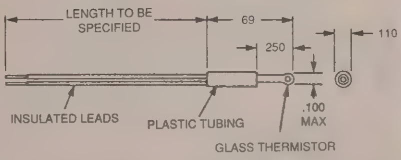
SERIES 21


INSULATED LEADS
STAINLESS STEEL
.188 MAX.
LENGTH TO BE SPECIFIED
1.00"

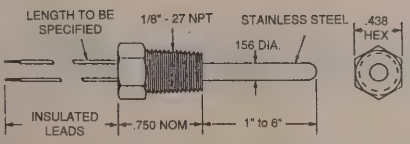
SERIES 30


LENGTH TO BE SPECIFIED
.375
.155
EPOXY
PVC INSULATED LEADS
STAINLESS STEEL

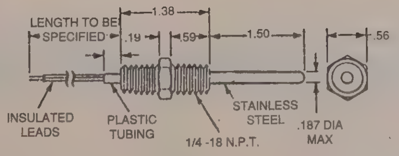
SERIES 40


LENGTH TO BE SPECIFIED
69
250
110
INSULATED LEADS
PLASTIC TUBING
.100 MAX
GLASS THERMISTOR

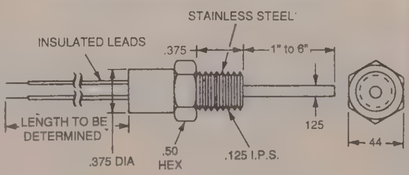
SERIES 50


LENGTH TO BE SPECIFIED
1/8" - 27 NPT
STAINLESS STEEL
.438 HEX
156 DIA.
INSULATED LEADS
.750 NOM
1" to 6"

SERIES 51


1.38
LENGTH TO BE SPECIFIED
.19
.59
1.50
.56
INSULATED LEADS
PLASTIC TUBING
STAINLESS STEEL
.187 DIA MAX
1/4 -18 N.P.T.

SERIES 52


STAINLESS STEEL
INSULATED LEADS
.375
1" to 6"
LENGTH TO BE DETERMINED
125
.375 DIA
.50 HEX
.125 I.P.S.
44

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NTC THERMISTORS

SMALL BEAD & GLASS PROBE NTC THERMISTORS

Sensor Scientific, inc. Small Bead NTC Thermistors offer the advantages of small size and mass, fast response time, extreme sensitivity to current and voltage changes, and high stability. Typical applications include: biomedical assemblies, fluid flow and fluid level measurement, thermal conductivity measurement, and gas analysis.

Resistance @ 25 Deg. C.	Part Number	Figure	Resistance Ratio 25 / 125 Deg. C.	Temperature Coefficient @ 25 Deg. C.
2,000	S14A20225	A	13.5	-3.4%/Deg. C.
2,000	S14B20225	B	13.5	-3.4%/Deg. C.
5,000	S14A50225	A	17.3	-3.7%/Deg. C.
5,000	S14B50225	B	17.3	-3.7%/Deg. C.
10,000	S14A10325	A	19.9	-3.9%/Deg. C.
10,000	S14B10325	B	19.9	-3.9%/Deg. C.
100,000	S14A10425	A	29.4	-4.4%/Deg. C.
100,000	S14B10425	B	29.4	-4.4%/Deg. C.

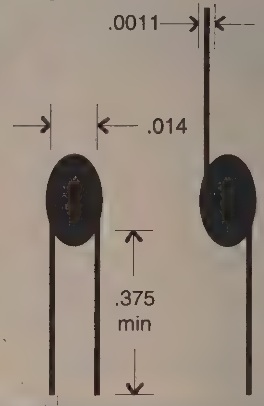
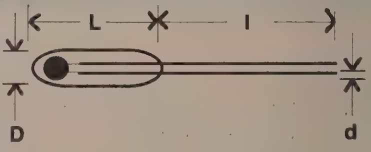


Fig. A Fig. B

- Standard resistance tolerance is +/- 25% @ 25 Deg. C. Other tolerances include +/- 1, 2, 5, 10, and 20%.
- Other resistance values are available.
- Maximum operating temperature for optimal stability is 300 Deg. C. Intermittent operation to 550 Deg. C. is possible.
- Lead Material is Platinum Alloy.
- Time constant (in still air): 1.0 sec. Dissipation Constant (in still air): 0.10mW/Deg. C.
- Custom Assemblies are available.

Sensor Scientific, inc. Glass Probe NTC Thermistors are extremely useful in applications where high stability and ruggedness is required. The availability of 4 standard outer diameters offers the designer the flexibility to fit the thermistor to the design, rather than compromising the design to accomodate the thermistor. The .043" diameter part offers the ruggedness of a glass probe thermistor and the small size advantages of a bead thermistor, without the handling problems.

Resistance @ 25 Deg. C.	Part Number	Resistance Ratio 25 / 125 Deg. C.	Temperature Coefficient @ 25 Deg. C.
2,000	SP___A202201/2	19.9	-3.9%/Deg. C.
5,000	SP___A502201/2	19.9	-3.9%/Deg. C.
10,000	SP___A103201/2	29.4	-4.4%/Deg. C.
50,000	SP___A503201/2	31.7	-4.5%/Deg. C.
100,000	SP___A104201/2	38.1	-4.7%/Deg. C.
250,000	SP___A254201/2	38.1	-4.7%/Deg. C.



- To specify max. diameter in mils, replace "___" with 43, 60, 80, or 100.
- Standard resistance tolerance is +/- 20% @ 25 Deg. C. Other tolerances available include +/- 1, 2, 5, 10, and 15%.
- Other resistance values are available.
- Standard glass length for the 60, 80, & 100 probes is 0.5". Other lengths available include 0.25, 1.0, 1.5, and 2.0 inches.
- Maximum operating temperature for optimal stability is 300 Deg. C. Intermittent operation to 550 Deg. C. is possible.
- Standard Lead Material is Tinned Dumet.
- Custom Assemblies are available.

Maximum Diameter D	Length L	Lead Length l	Lead Diameter d	Time Constant (Sec., in still air)	Dissipation Constant (mW/Deg. C.)
0.043"	0.1"	2.0" min.	0.0080"	5	0.4
0.060"	0.5"	2.0" min.	0.0080"	10	0.7
0.080"	0.5"	2.0" min.	0.0126"	15	0.8
0.100"	0.5"	2.0" min.	0.0126"	21	1

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NTC THERMISTORS

"400 SERIES" THERMISTOR PROBES

Sensor Scientific's "400 SERIES" *standard* was developed to satisfy the critical needs of the biomedical industry. These precision assemblies offer + / - 0.1 Deg. C. interchangeability over the critical biomedical temperature range of 31 to 45 Deg. C. (0 to 70 Deg. C. range available as an option). The most widely used configurations are depicted below. If a standard configuration is not appropriate, custom designs are available.

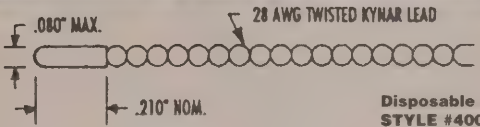
"400 SERIES" Resistance vs.Temperature

Temp. Deg. C.	Resistance Ohms
0.00	7,353
1.00	6,988
2.00	6,643
3.00	6,318
4.00	6,010
5.00	5,719
6.00	5,444
7.00	5,183
8.00	4,937
9.00	4,703
10.00	4,482
11.00	4,273
12.00	4,074
13.00	3,886
14.00	3,708
15.00	3,539
16.00	3,378
17.00	3,226
18.00	3,081
19.00	2,944
20.00	2,813
21.00	2,690
22.00	2,572
23.00	2,460
24.00	2,353
25.00	2,252
26.00	2,156
27.00	2,064
28.00	1,977
29.00	1,893
30.00	1,814
31.00	1,739
32.00	1,667
33.00	1,598
34.00	1,533
35.00	1,471
36.00	1,411
37.00	1,354
38.00	1,300
39.00	1,249
40.00	1,199
41.00	1,152
42.00	1,107
43.00	1,064
44.00	1,023
45.00	984
46.00	946
47.00	910
48.00	875
49.00	843
50.00	811
51.00	781
52.00	752
53.00	724
54.00	698
55.00	672
56.00	648
57.00	625
58.00	602
59.00	581
60.00	560
61.00	540
62.00	521
63.00	503
64.00	486
65.00	469
66.00	453
67.00	437
68.00	423
69.00	408
70.00	395

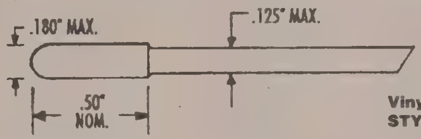
OPTIONS:

- "Non-standard tolerances (+ / - 0.05, + / - 0.2 or + / - 0.5 Deg. C.)
- "Non-standard" operating temperature ranges
- Customized probe, lead, and termination configurations

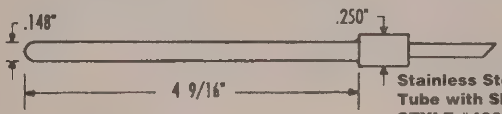
STANDARD PROBE ASSEMBLIES


.080" MAX.
28 AWG TWISTED KYNAR LEAD
.210" NOM.

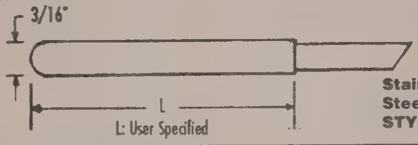
Disposable
STYLE #400D


.180" MAX.
.125" MAX.
.50" NOM.

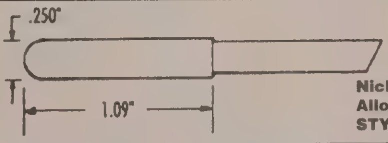
Vinyl Tip
STYLE #401


.148"
.250"
4 9/16"

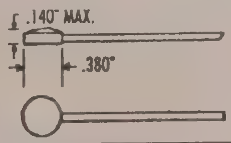
Stainless Steel Tube with Sheath
STYLE #403


3/16"
L
L: User Specified

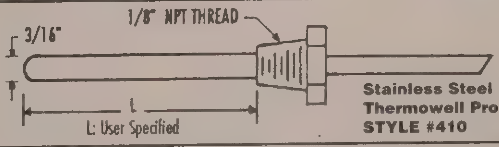
Stainless Steel Tube
STYLE #404SS



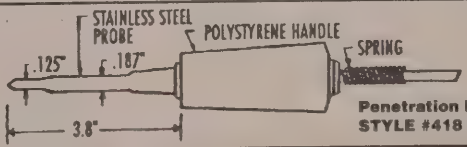
Nickel-Silver Alloy Tube
STYLE #404NS



"Banjo" Style Surface Probe
STYLE #409


1/8" NPT THREAD
3/16"
L
L: User Specified

Stainless Steel Thermowell Probe
STYLE #410


STAINLESS STEEL PROBE
POLYSTYRENE HANDLE
SPRING
.125"
.187"
3.8"

Penetration Probe
STYLE #418

Sensor Scientific, inc.

6 Kings Bridge Road, Fairfield, New Jersey 07004 (201) 227-7790 Fax (201) 227-8063

CALL TOLL FREE 1 (800) 524-1610

eem

MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

THERMODISC®

TEMPERATURE CONTROLS

Product Overview

Therm-O-Disc bimetal disc temperature controls are widely used in the appliance, HVAC and many other industries. They are powered by bimetal discs which open or close a set of electrical contacts when a predetermined temperature is reached.

Therm-O-Disc temperature controls combine reliability and performance with high volume production methods for maximum value at a low cost. Many terminals and mounting arrangements are available for application flexibility. These products are approved by most major testing agencies around the world.

In addition to the products shown, Therm-O-Disc offers a variety of other products designed to meet unique applications. We have the expertise and experience to custom design products to meet your application for temperature sensing and control, electric power control, water flow control and pressure control.

This chart contains an overview of some of the most widely used Therm-O-Disc products. Products with similar attributes are grouped so you may compare their features.

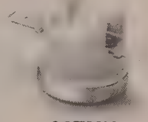
Control Chart

Series	Type	General Description	Calibration Range °C	Calibration Range °F	Maximum Electrical Ratings	
					Volts	Res. Amp.
General Purpose	36T	½" Disc Multi-Purpose Control	2-220	35-428	120	15
	60T	¾" Disc Multi-Purpose Control	−18-177	0-350	240	25
	64T	¾" Disc DPST Control	−18-177	0-350	240	25
	49T	¾" Disc High Temperature Control	27-288	80-550	240	25
	69T	¾" Disc Heater Biased Control	−18-82	0-180	240	25
	37T	¾" Disc Moisture Resistant Control	−29-149	−20-300	120	10
	14T	1" Disc Moisture Resistant Control	−18-105	0-221	240	25
Special Purpose	58T	Adjustable Control	−1-66	30-150	277	25
	79T	Adjustable Control with Thermal Cutoff	−1-66	30-150	277	25
	74T	¾" Disc Adjustable Control	43-121	110-250	240	25
	59T/	Electric Water Heater Control	43-93	110-200	250	30
	66T	Electric Water Heater Limit	38-104	100-220	277	40
	12S/14S/15S	Sequencer/Time Delay Relay	N/A	N/A	277	25
	10H	Linear Limit	66-149	150-300	277	25
	18T/19T	Glass Top Range Limiter Hot Light Indicator	500-750 75-150	932-1382 193-328	277 240	10 1
	10RS	Radiant Sensor	163 Max	325 Max	120	5.75
	10M	Fractional H.P. Motor Protector	80-150	176-302	120	36
	20M	Fractional H.P. Motor Protector	80-150	176-302	240	37
	14M	Hermetic Motor Protector	80-150	176-302	240	37
	30M	Manual Reset Motor Protector	80-150	176-302	240	37
	83T	Printed Circuit Board Control	30-120	86-248	48 (DC)	0.05
	Reed Switch	Temperature Sensitive Magnetic Reed Switch	−18-79	0-175	120	15
	44T	Low Voltage Control	49-149	120-300	1 (DC)	1
	HLX	High Capacity Limit	49-149	120-300	480	50
	75TF	Combination Control and Limit	27-177	80-350	600	25
Microtemp® Thermal Cutoffs	TCO	"One-Shot" Thermal Fuse	60-240	140-464	250	25

36T Series ½" Bimetal Disc

36T
Manual Reset

36T


36TMH

36T—The 36T is the industry standard ½" bimetal disc thermostat for controlling or limiting temperature in appliances, HVAC and office equipment. It is available with automatic or manual reset switching action. A single operation version may be specified for applications requiring "one shot" protection. Board mount, surface, air stream and stud mount configurations are available.

36TMH—Typically used in coffee makers and tea kettles, the 36TMH is a ceramic version of our 36T. It is also available with a variety of mounting brackets and terminal configurations.

36T General Electrical Ratings* and Worldwide Test Agency Recognitions

Thermostat Type	Maximum Temperature	Cycles	Inductive Amperes		Pilot Duty VA	Resistive Amperes	Volts Ac	Recognized By
			FLA	LRA				
Automatic Reset Standard Construction	350°F 350°F 350°F	100,000 100,000 6,000	3 1.5 15(.75PF)-	12 6	125 125 —	15 10 —	120 240 120	U.L.
Automatic Reset—High Temp Construction	428°F 428°F	100,000 100,000	— —	— —	— —	15 10	120 240	
Manual Reset	350°F 350°F	6,000 6,000	5 1.5	25 6	125 125	15 10	120 240	
Single Operation	350°F 350°F 310°F	1 1 1	10	60 — —	— — —	— 15 25	240 240 120	
Automatic Reset—Standard Construction	350°F 350°F	100,000 100,000	3 1.5	12 6	125 125	15 10	120 240	C.S.A.
Automatic Reset—High Temp. Construction	400°F 400°F	100,000 100,000	— —	— —	— —	15 10	120 240	
Manual Reset	350°F 350°F	6,000 6,000	5.5 1.5	20.5 6	125 125	15 10	120 240	
Automatic Reset Auto Reset—High Temp Construction Manual Reset	175°C 220°C 175°C	100,000 100,000 200	— — —	— — —	— — —	10 10 10	250 250 250	NEMKO
Automatic Reset Manual Reset	175°C 175°C	10,000 15	1.66 1.66	— —	— —	10 10	250 250	SEMKO
Automatic Reset Manual Reset	175°C 175°C	100,000 15	— —	— —	— —	10 10	250 250	SEV
Automatic Reset Auto Reset High Temp. Con.	175°C 220°C	60,000 100,000	— —	— —	— —	10 10	250 250	BEAB
Automatic Reset Manual Reset	175°C 175°C	100,000 20	1.66 1.66	— —	— —	10 10	250 250	DEMKO, UTE
Automatic Reset	175°C	20,000	1.66	—	—	10	250	SETI
Automatic Reset Automatic Reset—High Temp. Construction Manual Reset	175°C 220°C 175°C	100,000 100,000 20	6 6 6	— — —	— — —	10 10 10	250 250 250	VDE
Automatic Reset Manual Reset	175°C 175°C	100,000 200	1.6 1.6	— —	— —	10 10	250 250	KEMA

*For complete ratings, please contact our sales engineering department

For further information on
your specific design
application, contact a
Therm-O-Disc sales engineer
at 419-525-8500.

THERMODISC®
1320 South Main Street, Mansfield, Ohio 44907
Phone: 419-525-8500 Fax: 419-525-8344
Therm-O-Disc, Inc. is a subsidiary of Emerson Electric Co.

EMERSON®

NTC THERMISTORS

H-Series and leadless SMS™ Hermetically Sealed Thermistors are small, rugged and good for use up to 300°C. Their fast response, interchangeability and longterm stability makes both series ideal for temperature sensing and compensation. The leadless SMS™ Thermistor is designed for applications where surface mounting is required. Both sensors are available on tape and reel for automatic mounting

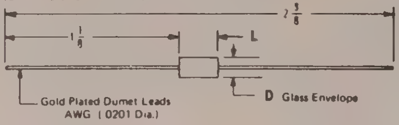
H-SERIES LEADED SENSOR

Typical Characteristics **Catalog Number**

Specification	Test Condition	1H	PIH	UH	2H	4H
Resistance @ 25° C. (OHMS)	Zero Power	3K-100K	3K-100K	3K-100K	2K-5K	200K-1M
Resistance Ratio $\frac{R_{25C}}{R_{125C}}$		29.85	29.85	29.85	19.80	48.78
Maximum Withstand Temperature. °C		-55 to 300	-55 to 300	-55 to 300	-55 to 300	-55 to 300
Operating Temperature Range. °C		-40 to 300	-40 to 300	-40 to 300	-40 to 300	-40 to 300
Interchangeability °C	0-100°C	N/A	1°C	.2°C	N/A	N/A
Stability (change in resistance)	1000 Hours at 100°C	< .1%	< .1%	< .1%	N/A	N/A

OUTLINE DRAWING

(Dimensions in Inches)



GRADE	D	L	AWG
1H (3K-8K)	.095	.170	20
1H (10K-100K)	.070	.150	24
2H (2K-5K)	.070	.150	24
4H (200K-1M)	.070	.150	24

*Dissipation Constant—Free Air
1H (3K-8K)—4mw/°c
1H (10K-100K) — 2H-4H—2mw/°c

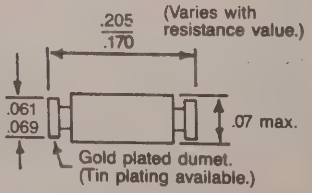
**Time Constant—Stirred Oil
1H (3K-8K)—1.5 sec. max.
1H (10K-100K)—2H-4H—1 sec. max.

SMS™ - SURFACE MOUNT SENSOR

Catalog Number

Typical Characteristics	2S202	2S502	1S103	1S203	1S503	1S104	4S204	4S504	4S105
Zero Power Resistance @ 25°C: OHMS ± 10%	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000
Resistance Ratio: $\frac{R_{25°C}}{R_{125°C}}$	19.80	19.80	29.41	29.41	29.41	29.41	48.78	48.78	48.78
*Dissipation Constant (∂): $\frac{\text{milliwatts}}{°C}$	2	2	2	2	2	2	2	2	2
**Thermal Time Constant (τ):(sec.)	8	8	8	8	8	8	8	8	8
Time Constant with Stirred Oil (sec.)	1	1	1	1	1	1	1	1	1
Maximum Operating Temperature: (°C) (°F)	300 572	300 572	300 572	300 572	300 572	300 572	300 572	300 572	300 572

OUTLINE DRAWING



*The ratio in a 25°C still air ambient, of the power input to raise the Thermistor temperature to 125°C and its temperature rise (125°C-25°C) above ambient.

**Time required for a Thermistor to change 63.2% of the temperature difference between its initial and final body temperature when subjected to a step function change in temperature under zero-power conditions.

Temperature		Resistance Ratio Characteristics		
°C	°F	R_T/R_{25} MULTIPLIER		
		1H-	2H-	4H-
55	-67	95	54	131
-40	-40	34	21 7	45 5
21 5	-6 7	10 5	8 0	13 2
0	32	3 3	2 82	3 71
25	77	1 00	1 00	1 00
37 8	100	58	62	543
50	122	36	41	32
75	167	148	182	114
104 4	220	0595	082	0399
125	257	0335	505	0205
150	302	0180	0300	0101
200	392	00670	0116	00285
250	482	00280	00555	00110
300	572	00140	00291	000454

To find the resistance of a particular H-Series Thermistor at any temperature in this table, multiply its 25°C resistance by the multiplier for that temperature.

THERMODISC®
MIDWEST COMPONENTS PRODUCT GROUP

1320 South Main Street
Mansfield, Ohio 44907-0538
(419) 525-8450
FAX (419) 525-8344

TUFF·SENSORS™

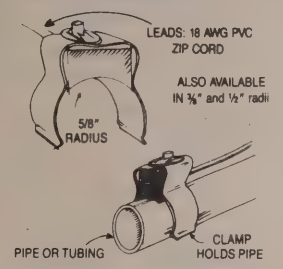
TEMPERATURE SENSORS ENCAPSULATED IN THERMOPLASTIC

TUFF·SENSORS™, a family of thermoplastic molded probes, provide reliable protection against environmental extremes for our line of temperature sensors and switches. Use of high performance plastics creates a temperature probe that resists temperature variations, humidity, chemicals and rough handling.

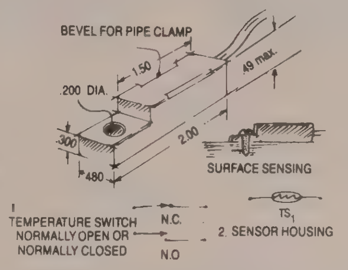
Many standard sizes and shapes are available, with selection of type based on conditions of use.

Custom designs available to your specifications.

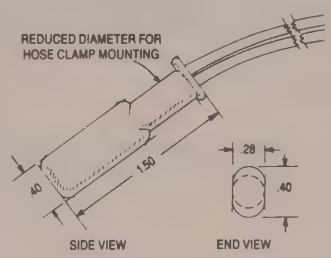
PRECISION SENSOR


LEADS: 18 AWG PVC ZIP CORD
ALSO AVAILABLE IN ⅜" and ½" radii
5/8" RADIUS
PIPE OR TUBING
CLAMP HOLDS PIPE

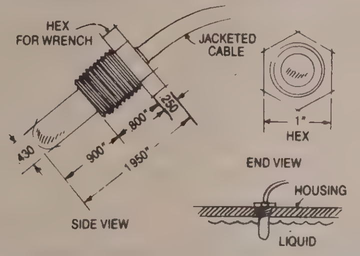
TEMPERATURE SWITCH


BEVEL FOR PIPE CLAMP
.150
.49 max.
.200 DIA.
.300
2.00
.480
SURFACE SENSING
1 TEMPERATURE SWITCH NORMALLY OPEN OR NORMALLY CLOSED
N.C.
N.O
TS1
2. SENSOR HOUSING

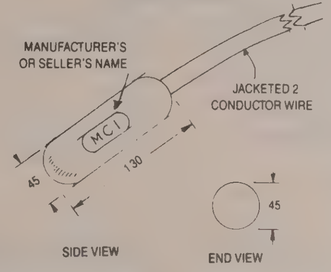
PRECISION SENSOR


REDUCED DIAMETER FOR HOSE CLAMP MOUNTING
.40
1.50
.28
.40
SIDE VIEW
END VIEW

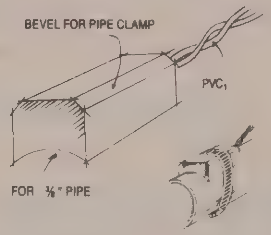
TEMPERATURE SWITCH OR PRECISION SENSOR


HEX FOR WRENCH
JACKETED CABLE
.250
.800"
.900"
.430
1.950"
SIDE VIEW
1" HEX
END VIEW
HOUSING
LIQUID

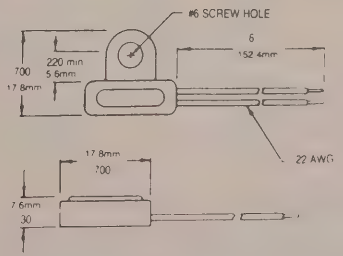
PRECISION SENSOR


MANUFACTURER'S OR SELLER'S NAME
M.C.I.
JACKETED 2 CONDUCTOR WIRE
1.30
.45
.45
SIDE VIEW
END VIEW

PRECISION SENSOR


BEVEL FOR PIPE CLAMP
PVC1
FOR ⅜" PIPE

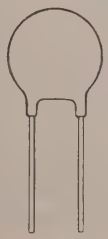
NTC THERMISTORS


#6 SCREW HOLE
.700
17.8mm
.220 min
5.6mm
6
152.4mm
22 AWG
17.8mm
.700
7.6mm
.30

TAB MOUNTED PROTECTORS

Over Temperature Protectors provide shutoff or regulation of expensive Power Transistors and protect against over-heating that occurs from component failure or short conditions. The sensor is an NTC (Negative Temperature Coefficient) device. Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect. Available in resistance packages from 100Ω to 100K in tolerances of .8% to 40%.

INRUSH CURRENT SUPPRESSORS FOR SWITCHING POWER SUPPLIES.



Switching power supplies present high initial currents due to filter capacitor impedance upon turn-on. The use of NTC (Negative Temperature Coefficient) devices limits this current to a low value. After current flow their resistance becomes negligible and offers little voltage drop.

• TEMPERATURE COMPENSATION AND SENSING

Disc Series Thermistors are small rugged Thermistors with close electrical tolerances. Their small mass gives short thermal time constants, yet they are not so small that it is difficult to handle them. The tinned copper leads are easily soldered into electrical circuits.

THERMODISC
MIDWEST COMPONENTS PRODUCT GROUP

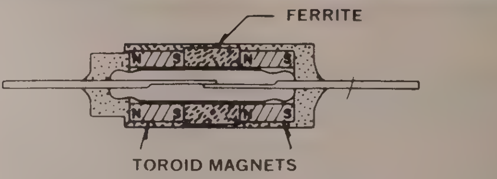
1320 South Main Street
Mansfield, Ohio 44907-0538
(419) 525-8450
FAX (419) 525-8344

TEMPERATURE SENSING SWITCHES

CONVENIENT AND RELIABLE TEMPERATURE CONTROL

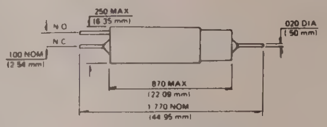
Miniature temperature switches use an electro-ceramic element instead of a bimetallic switch. The Reed Switch Temperature Sensor works on these two principles: a reed switch actuation occurs because of changes in strength of a magnetic field in the vicinity of the contact gap; and certain materials exhibit great changes in magnetic reluctance when the temperature is varied in the vicinity of the material's curie temperature.

The unit has good response time, and is operable in a variety of atmospheres and solutions. Variations in configurations suitable for installation in automotive engine crankcases and automatic transmissions, or mountings for use in computer cabinets are possible. Other applications include oven over-heat alarms; corrosive liquid temperature control, food freezer thaw warning and cooling fan stop indication. This switch replaces many thermally actuated devices now used where increased life is required or protection of the switching contacts from adverse environments is deemed desirable.

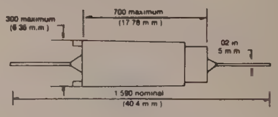


MOLDED SWITCHES

Switches feature small size for fast response. epoxy package resists most chemicals and is good for use up to 115°C. Standard units from 0° to 115°C are available in five degree nominal increments.



SPDT Form C



SPST Form B (NC)
SPST Form A (NO)

SPECIFICATIONS

	ST Form B (NC) SPST Form A (NO)	SPDT Form C
CONTACT RATING	Watts — 10W maximum Volt Amps — 12 V.A. maximum	Watts — 10W maximum Volt Amps — 12 V.A maximum
VOLTAGE	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum
CURRENT	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp maximum	Carry — 1 amp maximum Break — 1 amp maximum Make — .500 amp maximum
OPEN TEMPERATURE — NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum

KEY TO ORDERING:

MTS	*XXX*	*A or B*
Temp Switch	Temp in °C	Form

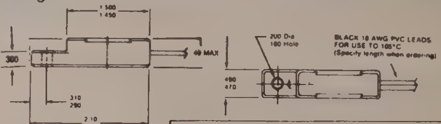
EXAMPLE: MTS 50B

REED SWITCHES—PMS SERIES

Midwest Components Product Group has now packaged the reliable temperature sensing reed switch in a convenient and easy to use housing. The molded plastic body offers the additional advantages of complete moisture and dust protection at an economical price.

This rugged switch can be quickly mounted with a screwdriver. An indentation on the housing also facilitates attachment by ordinary hose clamps or clip hardware supplied by the user. Type A (normally open) or Type B (normally closed) switches may be used in this new package.

CONTACT ARRANGEMENT	SPST Form B (NC)	SPST Form A (NO)
CONTACT RATING	Watts — 10W maximum Volt Amps. — 12 V.A. maximum	Watts — 10W maximum Volt Amps — 12 V.A. maximum
VOLTAGE	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum
CURRENT	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp maximum	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp maximum
SWITCH TEMPERATURE — NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum


1 500
1 450
380
48 MAX
310
290
2 10
2 05
200 Dia
180 Hole
BLACK 18 AWG PVC LEADS FOR USE TO 105°C (Specify length when ordering)
490
470

KEY TO ORDERING

PMS	XXX	A or B	XX
Temp Switch	Temp in °C	Form	Lead Length in Inches

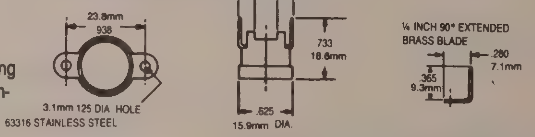
SNAP-ACTION BI-METAL SWITCHES

The electrical switch of the SAS is operated by a thermally-responsive ½inch diameter bimetal disc. The switch is used as a temperature limiting or regulating thermostat. Because of its relatively small size and inexpensive design, it is suitable for a vast array of applications.

Features

Impact Action: The bimetal disc of the SAS is factory calibrated at both its top and bottom temperatures. When the disc, which is dished like a saucer, reaches its calibrated temperature it suddenly snaps through and imparts its kinetic energy to the bumper, then to the contacts. The resulting high speed of contact separation insures long life at high electrical loads, and a minimum of radio and TV interference.

SURFACE MOUNTING BRACKET



SPECIFICATIONS

CONTACT ARRANGEMENT	SPST Form A (NO) or Form B (NC)
CONTACT RATING—AC	Watts—2400 maximum AC Volt Amps—125 V.A maximum AC
CONTACT RATING—DC	Volts Amps—30 V.A maximum DC
VOLTAGE	Volts D.C —120 VDC maximum Volts A.C.—240 VAC maximum
CURRENT—RESISTIVE LOAD	Carry—10 amp maximum AC Carry—.25 amp maximum DC
OPEN TEMPERATURE—NOMINAL	5° increments starting at 0°C
TOLERANCE	± 5°C
RESET DIFFERENTIAL	25° maximum

KEY TO ORDERING

SAS	*XXX*	*A*
Temp Switch	Temp in °C	Form

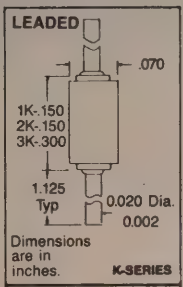
EXAMPLE SAS 50A

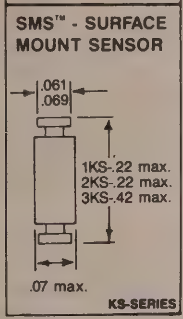
THERMODISC®
MIDWEST COMPONENTS PRODUCT GROUP

1320 South Main Street
Mansfield, Ohio 44907-0538
(419) 525-8450
FAX (419) 525-8344

TEMPSISTOR

TEMPSISTOR®
TEMPERATURE
COMPENSATOR®





The Tempsistor® is a temperature compensator designed to offset the temperature drift of metallic and semi-conductors. Applications include pressure transducers, opto amplifiers, inductive motor controllers, and automatic gain controls. Small size can replace ⅛ watt or resistors.

The Tempsistor® is available in resistances from 10 to 12K ohms at 25°C.

Both devices are available on tape and reel for automated assembly.

Resistance Ratio Temperature Characteristics

Temp.		R / R Multiplier			
		RESISTANCE VALUE (Ohms)			
°C	°F	10-56 Ω	68-820 Ω	1-2.7K Ω	3.3-39K Ω
-25	-13	.73	.65	.65	.61
0	32	.86	.82	.81	.83
25	77	1.00	1.00	1.00	1.00
50	122	1.15	1.21	1.19	1.19
75	167	1.32	1.44	1.39	1.37
100	212	1.49	1.68	1.58	1.52
125	257	1.68	1.94	1.75	
150	302	1.89	2.21		

TEMPSISTOR® SPECIFICATIONS

DISSIPATION CONSTANT - Style 1K and 2K = 2.5 MW/°C Style 3K = 5 MW/°C

TIME CONSTANT - Style 1K and 2K = 8 sec. in still air, 1 sec in rapidly stirred oil. Style 3K = 19 sec. in still air, 2.2 sec. in rapidly stirred oil.

STANDARD ZERO-POWER RESISTANCE VALUES (Ohms) at 25°C AMBIENT TEMPERATURE

10	11	12	13	15	16	18	20	22	24	27	30
100	110	120	130	150	160	180	200	220	240	270	300
1000	1100	1200	1300	1500	1600	1800	2000	2200	2400	2700	3000
10000	11000	12000									
33	36	39	43	47	51	56	62	68	75	82	91
330	360	390	430	470	510	560	620	680	750	820	910
3300	3600	3900	4300	4700	5100	5600	6200	6800	7500	8200	9100

PART NUMBER DESIGNATION: XXX—XXX—X

LEADED DEVICE

SPECIFY ONE OF THREE CHOICES FOR FIRST 2 DIGITS

1K — Resistance range 10-820 Operate Temp. 150°C
2K — Resistance range 1K-3.0 K Operate Temp. 125°C
3K — Resistance range 3.3K-12K Operate Temp. 100°C

SMS™ - SURFACE MOUNT SENSOR

SPECIFY ONE OF THREE CHOICES FOR FIRST 3 DIGITS

1KS — Resistance range 10-820 Operate Temp. 150°C
2KS — Resistance range 1K-3.0K Operate Temp. 125°C
3KS — Resistance range 3.3K-12K Operate Temp. 100°C

NEXT 3 DIGITS DENOTE RESISTANCE VALUE AT 25°C.

1st digit denotes 1st significant figure
2nd digit denotes 2nd significant figure
3rd digit denotes multiplier by the power of 10

LAST DIGIT OF PART NUMBER DENOTES TOLERANCE AT 25°C.

L — ±20% K — ±10% (standard) J — ±5%

EXAMPLE OF PART NUMBER SPECIFICATION (FOR LEADED DEVICE)

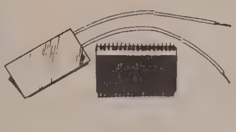
2K — 272 — K
Part would be a .150" long body, 2.7 K ±10% @25°C.

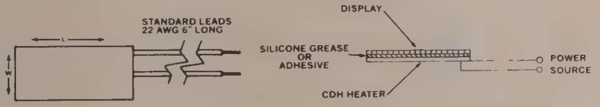
SPECIALTY CERAMICS

SELF REGULATING DISPLAY HEATER

The unique self-regulating heating effects of specially doped ceramics are utilized to create a new type heater for liquid crystal or other temperature sensitive displays. These devices produce heat at cold temperatures and curtail heating at normal or high temperatures. This feature allows its use in battery operated instruments due to low normal current drain Use of this heater allows a broader application of displays by removing the adverse effects of temperature

Heater is attached to reverse side of display with thermally conductive epoxies or silicone adhesives depending upon display's thermal coefficient of expansion or temperature to which it may be subjected Actual performance of the display will depend upon manufacturers specifications





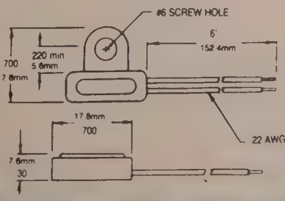
ORDER NUMBER	SIZE* L X W	OPERATING VOLTAGE**	NOMINAL RESISTANCES	
			R@ - 35°C	R@ 50°C
CDH001	2.0" x .9"	12-28 AC or DC	5 OHMS	1500 OHMS MIN
CDH002	3.1" x 1.1"	12-28 AC or DC	3 OHMS	1000 OHMS MIN
CDH003	3.6" x 1 1"	12-28 AC or DC	2 5 OHMS	750 OHMS MIN

*Other sizes available — consult factory

POSITIVE OVER TEMPERATURE PROTECTORS

Therm-O-Discs' Over Temperature Protector provides shutoff or regulation of expensive RF or AF Power Transistors. Protects against over heating that occurs from output stage component failure, antenna breakage, or short conditions.

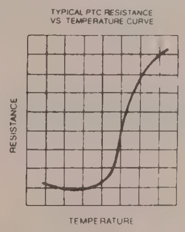
Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect.

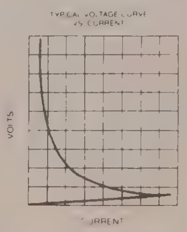


PTC SWITCHING THERMISTORS

THE POSITIVE WAY TO SENSE, MEASURE, CONTROL, REGULATE AND PROTECT.

PTC switching thermistors are thermally sensitive resistors which exhibit large positive increases in resistance with temperature. At customer specified temperatures the resistance rises abruptly from a low value to a high value. This resistance shift is infinitely repeatable and has no hysteresis associated with its action.





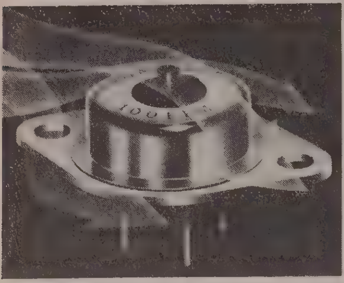
Write for your FREE PRODUCT CATALOG or for immediate answers, call one of our application engineering specialists at 419-525-8450.

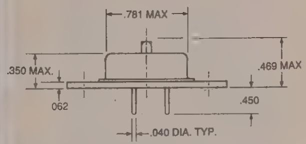
THERMODISC
MIDWEST COMPONENTS PRODUCT GROUP

1320 South Main Street
Mansfield, Ohio 44907-0538
(419) 525-8450
FAX (419) 525-8344

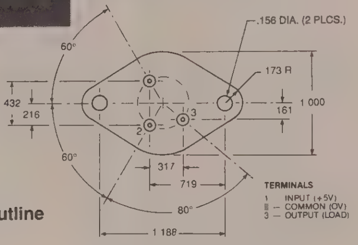
STATE-OF-THE-ART THERMAL MANAGEMENT OF MODERN ELECTRONIC EQUIPMENT

THE WARREN G-V SOLID STATE AIRFLOW SWITCH




.781 MAX
.350 MAX.
.469 MAX
062
.450
.040 DIA. TYP.

SAF1005


60°
.156 DIA. (2 PLCS.)
173 R
432
216
1 000
161
2
3
60°
317
719
80°
1 188
TERMINALS
1 — INPUT (+5V)
2 — COMMON (OV)
3 — OUTPUT (LOAD)

T-03 Outline

The advanced SAF Series Airflow Switch provides early detection and protection from overheating in mainframe computers and peripherals, large power supplies; HVAC applications, medical diagnostic equipment, and other complex electronic systems requiring forced air cooling.

This highly innovative, low profile airflow sensor is also easily mountable directly on the most densely populated circuit boards, on equipment racks with as little as .625 inch spacing between boards, on sockets or bracket mount plenums. All SAF models are complete, self contained sensor/alarm devices – no additional circuitry or signal conditioning as required.

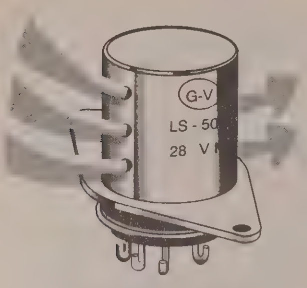
Specifications

Input voltage: +5 VDC (±5%)
Power Dissipation: ½ w max
Output: open collector, solid state, able to sink up to 100 MA to ground, from DC Sources up to 30V
Sensing Range: 50 to 1500 F.P.M.
Sensing Tolerance: ±25 F.P.M. or ±10%, whichever is greater
Ambient Range: +10°C to +60°C ambient temperature compensation curves available
Sensitivity: ±25 F.P.M. from actual setting
Hysteresis: Series SAF1005 (standard Model) is typically 10% of the setting

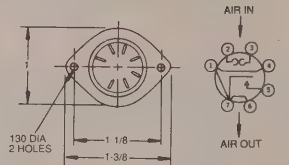
Mounting Accessories

- Military Socket Assembly with leads, no mounting bracket–PN 4-1-261 (Switch not included)
- Bracket only with leads attached to SAF Sensor–PN 4-1-270
- Socket Assembly with mounting bracket and leads–PN 4-1-260

AIR FLOW SENSORS *LS Series*



MILITARY APPLICATIONS


1
130 DIA
2 HOLES
1-1/8
1-3/8
AIR IN
1
2
3
4
5
6
7
AIR OUT

Outline Dimensions

- Available for varied voltage sources
- Built in time delay interval ignores transient airflow interruptions
- Ambient compensated design provides stable performance under wide ambient
- Rugged design meets MIL shock/vibration/ambient requirements
- No additional circuitry required

Specifications

Heater Voltage:	5V., 12 V., 28 V., or 115 V. AC/DC Other voltages available
Input Power:	4 Watts, nominal
Contact Rating:	2 A. resistive up to 115V. AC 1 A. resistive up to 32V. DC
Usable Voltage Range:	± 10% of nominal, voltage variation chart available
Setting:	75 to 1000 F.P.M.
Response Time:	1 to 20 seconds (depending on setting and air velocity prior to stoppage)
Temperature Range:	-55°C-85°C, energized
Vibration:	10g to 500 Hz.
Shock:	50g for 11 msec.

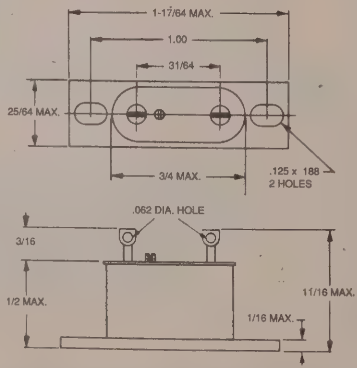
TEMPERATURE SENSORS *Electrical Thermostats*

VE SERIES SURFACE TEMPERATURE SENSOR

VE Surface Temperature Sensors have a unique dual bimetal design which produces larger forces and contact motion than ordinarily found in devices of this size. Intimate coupling between the mounting base and actuating elements produce an exceptionally fast response time. Contact chatter is eliminated and the unit has no resonant points below 2000 Hz.

Specifications

Setting Tolerance:	±5°F (±3°C)
Contact:	SPST open on rise or SPST close on rise 3 A. @ 115 V AC Resistive 1 A. @ 32 V DC Resistive
Vibration:	25 g to 1000 Hz
Shock:	50 g, 11 ms
Temperature Range:	0°C to +150°C


1-17/64 MAX.
1.00
31/64
25/64 MAX.
3/4 MAX.
.125 x 188
2 HOLES
.062 DIA. HOLE
3/16
1/2 MAX.
11/16 MAX.
1/16 MAX.

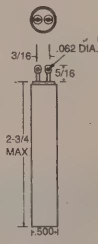
Direct replacement for fenwal Series 32410/32411–The Fenwal Company discontinued this popular surface sensing series in 1987–The Warren GV Series VE Thermostat mounts on the same 1.00" centerline as a direct replacement meeting all electrical and thermal requirements of the former unit.

C-8 SERIES AMBIENT TEMPERATURE SENSORS

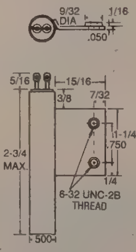
C8 Sensors are based on a differential expansion principle, comparing the expansion or contraction of the outer shell in relation to an internal member that is not affected by temperature. The differential in expansion of these two members is then multiplied by the internal mechanism and transferred as a motion to the contacts. The contacts are built in a separate fused glass header with a minimum current path to reduce self-heating effects.

Specifications

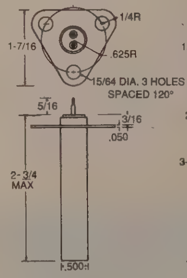
Setting Tolerance:	±5°F (±3°C)
Contact:	SPST open on rise or close on rise Rating: 5A @115 VAC Resistive 1A @ 32 VDC Resistive
Vibration:	10 g to 2000 Hz
Shock:	10 g 11 ms
Temperature Range:	-25°C to +150°C


3/16
.062 DIA. HOLE
5/16
2-3/4
MAX
.500

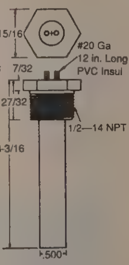
TYPE C8-C


9/32
DIA
1/16
.050
5/16
15/16
3/8
7/32
1-1/4
.750
1/4
2-3/4
MAX.
6-32 UNC-2B
THREAD
.500

TYPE C8-B


1/4R
1-7/16
.625R
15/64 DIA. 3 HOLES
SPACED 120°
5/16
3/16
.050
2-3/4
MAX
.500

TYPE C8-F


15/16
#20 Ga
12 in. Long
PVC Insul
7/32
27/32
1/2—14 NPT
3-3/16
.500

TYPE C8-P

A UNIT OF GENERAL SIGNAL GS

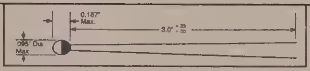
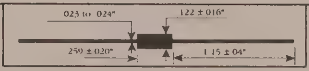
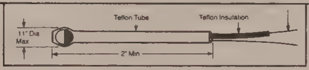
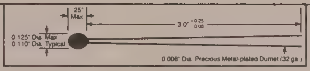
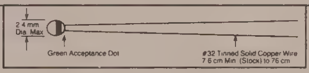
WARREN

1 Apollo Drive • Whippany, New Jersey 07981 • 201-386-1200 • Fax: 201-386-9331

YSI Precision Thermistors

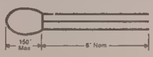
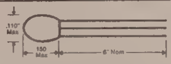
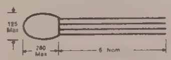
Call us to discuss your application at 800 765-4974. Fax 513 767-9353.

YSI precision thermistors provide accurate, stable temperature measurement, control, indication and compensation. We offer 13 resistance curves in 5 styles for applications ranging from incubators to satellites. Three tolerances are available: ±0.05, ±0.1 and ±0.2°C. Not all resistances and accuracies are available in all styles–please call YSI Customer Service for more information at **800 765-4974.**

		Time Constant Still Air Oil Bath	**Heat Dissipation** Still Air Oil Bath	**Maximum Power** at 25°C at 125°C	**Maximum Temperature**
Epoxy Coat					
YSI 44000 Series	 0.187" Max. 3.0" +.25 -.00 .095" Dia Max	≤ 10 sec ≤ 1 sec	≥ 1 mW/°C ≥ 8 mW/°C	30 mW 1 mW	+150°C
Epoxy Coat with Axial Leads					
YSI 44400 Series	 .023 to .024" .122 ± .016" .259 ± .020" 1.15 ± .04"	≤ 16 sec	≥ 8 mW/°C	30 mW 1 mW	+125°C
Epoxy Coat in Teflon Sleeve					
YSI 44100 Series	 Teflon Tube Teflon Insulation .11" Dia Max 2" Min	≤ 25 sec ≤ 2.5 sec	≥ 1 mW/°C ≥ 8mW/°C	30 mW 1 mW	+150°C
Glass Coat					
YSI 45000 & 46000 Series	 .25" Max 3.0" +0.25 -0.00 0.125" Dia Max 0.110" Dia Typical 0.008" Dia. Precious Metal-plated Dumet (32 ga.)	 ≤ 2.5 sec	≥ 4 mW/°C ≥ 10 mW/°C	50 mW 2 mW	+250°C
Space-Qualified*					
YSI 44900 Series	 2.4 mm Dia. Max Green Acceptance Dot #32 Tinned Solid Copper Wire 7.6 cm Min. (Stock) to 76 cm	≤ 10 sec ≤ 1 sec	≥ 1 mW/°C ≥ 8 mW/°C	30 mW 1 mW	+90°C

YSI Thermilinears Provide Linear Outputs

If you need linear resistance or linear voltage output, specify YSI Thermilinear Components. The linear range and deviation from linearity for each network are listed below. If you don't find what you need, we can design a network for your application.

Network	Range	Deviation	Thermistor Composite
YSI 44201	0 to +100°C	±0.216°C	 .150" Max 6" Nom
YSI 44202	-5 to +45°C	±0.065°C	
YSI 44203	-30 to +50°C	±0.16°C	
YSI 44204	-2 to +38°C	±0.03°C	
YSI 44211A	-55 to +85°C	±1.1°C	 .110" Max .150 Max 6" Nom
YSI 44212	-50 to +50°C	±0.09°C	 .125 Max .280 Max 6" Nom

Employee-Owned

YSI Incorporated
Yellow Springs, Ohio 45387 USA
Phone 513 767-7241•Telex 205437

*Qualified by NASA for extended space flight applications. Goddard Space Flight Center specification GSFC S-311-P-18.

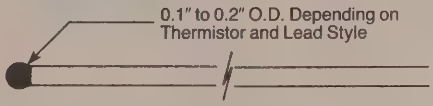
YSI Configure-to-Order Probes

Call us to discuss your application at 800 765-4974. Fax 513 767-9353.

YSI Configure-to-Order thermistor probes provide custom designs for the price of stock items. The probes below are just some of the styles we offer. We'll help you choose a probe style, thermistor resistance and accuracy, lead style and length appropriate for your application. Call us at **800 765-4974.**

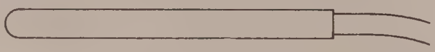
General Purpose

Flat, round or individual leads


0.1" to 0.2" O.D. Depending on Thermistor and Lead Style

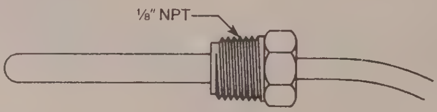
Tubular

1/8", 3/16", 1/4" diameters in stainless steel
3/16" diameter in Pyrex
3/8" diameter in Teflon

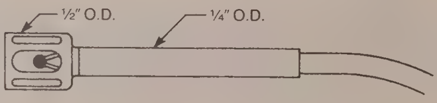


Tubular with Fitting

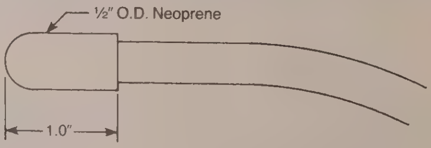
1/8", 3/16", 1/4" diameters



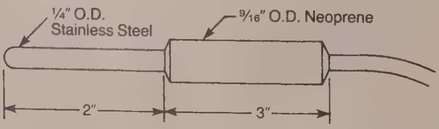
Air Temperature



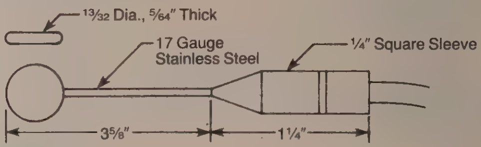
Burial


1/2" O.D. Neoprene
1.0"

Deep-Water

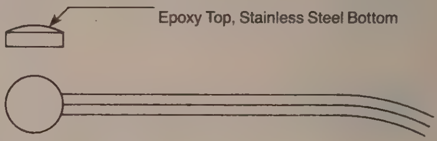

1/4" O.D. Stainless Steel
9/16" O.D. Neoprene
2"
3"

Banjo Surface Temperature

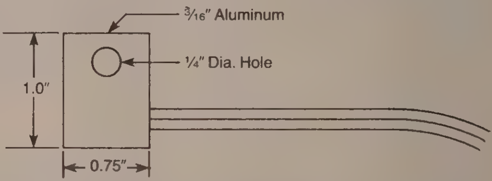

13/32 Dia., 5/64" Thick
17 Gauge Stainless Steel
1/4" Square Sleeve
3 5/8"
1 1/4"

General Surface Temperature

3/8", 3/16" diameters

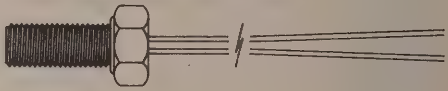

Epoxy Top, Stainless Steel Bottom

Attachable Surface Temperature


3/16" Aluminum
1/4" Dia. Hole
1.0"
0.75"

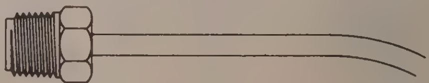
Screw

8-32, 10-32, 1/4-20 in brass or stainless steel



Pipe Plug

1/8", 1/4", 3/8", 1/2" NPT in brass or stainless steel



Employee-Owned

YSI Incorporated
Yellow Springs, Ohio 45387 USA
Phone 513 767-7241•Telex 205437

SENSORS/TRANSDUCERS

Manufacturer	Starting EEM Page No.	Audio	Force/ Weight	Magnetic Field	Pressure	Temperature	Position		Position Velocity	Velocity	Other
							ABS	Displacement			
Approved Purification Corp.	B•1916				√	√		√			
BEI Motion Systems Co.	B•1917						√	√	√	√	
Bourns, Inc.	B•1920				√			√			
F.W. Bell Inc.	B•1918			√							
Canon USA Inc.	B•1924							√			
Clarostat Manufacturing Inc	B•1926										Optical.
Data Instruments	B•1928		√		√		√	√	√		
Dresser Instruments	B•1933				√						
Dynamics Research Corp.	B•1935							√			
Entran Devices	B•1936		√		√						
Farrand Controls	B•1949						√	√	√		
Hermetic Switch Inc.	B•1954			√			√				
Humphrey	B•1956		√		√		√		√		
Micro Mo Electronics	B•1968							√	√	√	
Micro Switch	B•1970			√	√	√					
Morgan-Matroc	B•1974	√	√		√			√	√	√	
Murata Erie North America	B•1976	√				√	√	√		√	
Newport Electronics	B•1978					√		√			
Ocean Motions Co.	B•1980		√				√	√	√	√	Flow rate.
Omega Engineering	B•2004	√	√	√	√	√		√	√		pH, flow, level
Reed Switch Development Co.	B•2006			√	√						
Scientific Columbus	B•2007	√	√	√	√	√	√	√	√	√	
Setra Systems	B•2014		√		√						
Spectrol Electronics Corp.	B•2016	√			√	√	√	√	√		
Wilcoxon Research	B•2025									√	Vibration.

ACCELEROMETERS

Manufacturer	Starting EEM Page No.	Acceleration	Vibration	Shock
Entran Devices	B•1936	√	√	√
Humphrey	B•1956	√	√	√
Morgan-Matroc	B•1974	√	√	
Omega Engineering	B•2004	√		
Setra Systems	B•2014	√	√	√
Vibra-Metrics	B•2024	√	√	
Wilcoxon Research	B•2025	√	√	

TRANSCEIVERS: Ultrasonic

Manufacturer	Starting EEM Page No.	High Resolution	Narrow Beam	Other
Morgan-Matroc	B•1974	√		
Ocean Motions	B•1980	√	√	
Omega Engineering	B•2004	√	√	

ELECTRICAL SENSORS

Manufacturer	Starting EEM Page No.	Current, DC			Current, AC		Power		Power Factor	Phase Angle	Fre-quency	Voltage		Other
		Magni-tude	Level Sensing	Bidirec-tional	Ampl./RMS	Level Sensing	True (W)	Apparent (VAR)				DC	AC	
American Aerospace Controls	B•1914	√	√	√	√	√	√	√			√		√	
Approved Purification Corp.	B•1916		√		√	√						√	√	Sensors: Liquid level, temperature.
F.W. Bell, Inc.	B•1918	√	√	√	√	√								
Bicron Electronics	B•1919				√									
CR Magnetics Inc.	B•1927				√	√	√	√						
GMW	B•1950	√		√										
Hamlin	B•1953		√			√								Magnetic proximity sensors.
Humphrey	B•1956													Angular rate.
LEM Dynamp	B•1963	√	√	√	√	√	√	√				√	√	
LEM U.S.A. Inc.	B•1964	√		√	√							√	√	
Micro Switch	B•1970	√	√	√								√	√	
Murata Erie North America	B•1976													Motion, IR.
Ohio Semitronics	B•1982	√	√	√	√	√	√	√	√	√	√	√	√	
Omega Engineering	B•2004	√	√	√	√	√	√	√	√	√	√	√	√	
Reed Switch Development Co.	B•2006	√	√	√	√	√								
Scientific Columbus	B•2007	√	√	√	√	√	√	√	√	√	√	√	√	
Setra Systems	B•2014	√		√								√		
Spectrol Electronics Corp.	B•2016	√	√	√	√	√				√				

ENCODERS, SHAFT ANGLE

Manufacturer	Starting EEM Page No.	Optical			Contact			Other
		Abs.	Diff.	Incr.	Abs.	Diff.	Incr.	
BEI Motion Systems Co.	B•1917	√	√	√				Fiber-optic.
Bourns, Inc.	B•1920			√			√	
Canon USA Inc.	B•1924			√				
Clarostat Manufacturing Inc.	B•1926	√	√	√	√	√	√	
Data Technology	B•1931			√			√	
Dynamics Research Corp.	B•1935			√				
IVO Industries	B•1960	√	√	√				
Lucas Ledex	B•1967	√		√				
Micro Mo Electronics	B•1968			√				
Oak Grigsby Inc.	B•1979	√		√				
U.S. Digital Corp.	B•2019			√				

MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11					Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11		Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		First Hexadecimal Digit
			12				12	12		12	12	12		12	12					Zone Punches
				11				11	11	11		11	11	11		11				
					0		0		0	0	0		0	0			0			
			9	9	9	9	9	9	9	9										
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	Digit Punches	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1	
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1	
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2	
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3	
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4	
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5	
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6	
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7	
1000	8	8		CAN							h	q	y		H	Q	Y	8	8	
1001	9	8-1		EM							;	r	z		I	R	Z	9	9	
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2	
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3	
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4	
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5	
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6	
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7	
			12				12				12	12		12	12	12		12		Zone Punches
				11				11				11	11	11		11	11	11		
					0				0		0		0	0	0		0	0		
			9	9	9	9									9	9	9	9		

Card Hole Patterns

① 12-0-9-8-1
② 12-11-9-8-1
③ 11-0-9-8-1
④ 12-11-0-9-8-1
⑤ No-Punches
⑥ 12
⑦ 11
⑧ 12-11-0
⑨ 12-0
⑩ 11-0
⑪ 0-8-2
⑫ 0
⑬ 0-1
⑭ 11-0-9-1
⑮ 12-11

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

AAC American Aerospace Controls Inc.

570 SMITH STREET, FARMINGDALE, NEW YORK 11735 ☐ PHONE: (516) 694-5100 ☐ FAX: (516) 694-6739

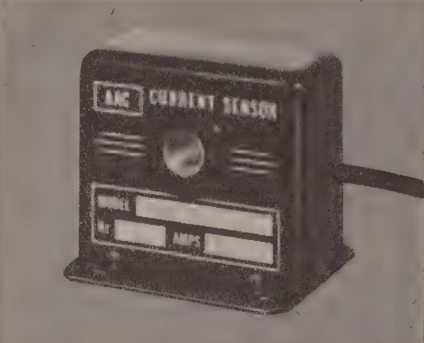


Figure 1 Size: 2 1/16″ x 2″ x 1 3/4″

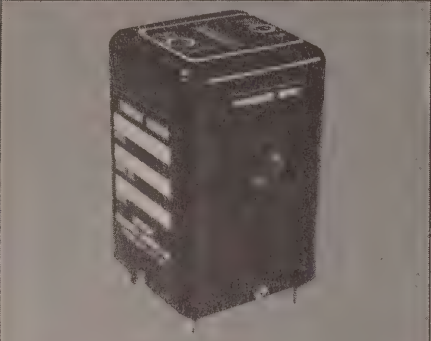


Figure 2 Size: 2 11/16″ x 1 5/8″ x 1 5/8″

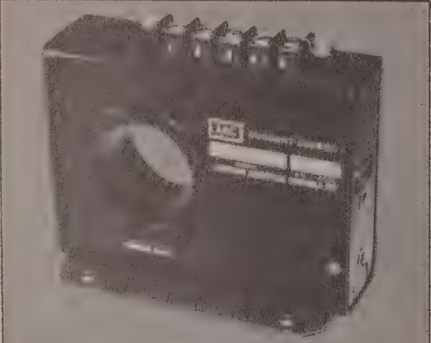


Figure 3 Size: 3 1/2″ x 4 1/4″ x 2 3/16″

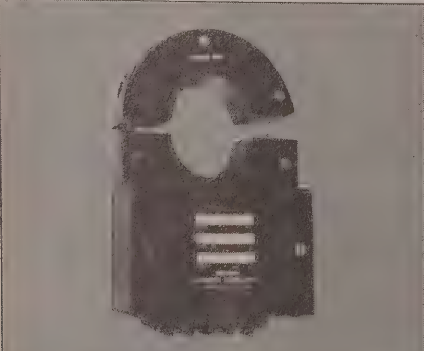


Figure 4 Size: 5″ x 3 1/4″ x 1 9/16″

AC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
1002M1	0.25, 0.5, 1, 5, 10, 20, 25, 50, 100, 150, 200, 250Aac @ 400Hz	+5Vdc	0.5%FS	10ms	5
1012	0.25, 0.5, 1, 5, 10, 20, 25, 50, 100, 150, 200, 250Aac @ 60Hz	+5Vdc	0.5%FS	50ms	—
C	1, 2, 5, 10, 20Aac (In-line connection)	+1mAdc	0.25%FS	400ms	6
S383	2, 5, 10, 15, 20, 25, 30, 40, 50, 75, 100, 200, 250Aac @ 60Hz	4-20mAdc	0.5%FS	200ms	—
1004	2, 5, 10, 20, 50, 100, 150, 200, 250, 300Aac @ 400Hz	+5Vdc	0.5%FS	150ms	5
1003AM1	2, 5, 10, 15, 20, 25, 30, 50, 75, 100Aac @ 60Hz	+5Vdc	1%FS	150ms	1
1003AM2	30, 50, 75, 100, 150, 200, 250Aac @ 60Hz	+5Vdc	1%FS	150ms	—
1005	2, 5, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300Aac @ 60Hz	+5Vdc	1%FS	80ms	—
1006	10, 25, 50, 100, 200, 400, 500, 600, 800, 1000Aac @ 60Hz	+5Vdc	0.5%FS	130ms	—
1006X	10, 25, 50, 100, 200, 400, 500, 600, 800, 1000Aac @ 60Hz	4-20mAdc	0.5%FS	130ms	—
S461(1001)	100, 150, 250, 500, 750, 1000, 1500, 2000, 2500, 3000Aac	+5Vdc	1%FS	100ms	4

DC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
904B	0.1, 0.2, 0.5, 1, 2, 5mAdc (In-line connection)	+5Vdc	1%FS	50ms	—
903B	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	5
S403	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	5
936	10, 20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	100ms	3
S218-903	100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	—
937	10, 20, 30, 50, 100Adc	+5Vdc	2%FS	200μs	—
913A	10, 20, 25, 30, 40, 50, 75, 100Adc	+5Vdc	1%FS	1ms	2
913B	10, 20, 25, 30, 40, 50, 75, 100Adc	+5Vdc	1%FS	1ms	5
950	10, 20, 30, 40, 50Adc	+5Vdc	0.5%FS	10ms	5
952	100, 200, 250, 300, 400, 500, 600, 750Adc	+5Vdc	0.5%FS	50μs	5
S465(S338)	150, 250, 500, 750, 1000, 1500, 2000, 2500Adc	4-20mAdc	1%FS	200μs	4
S444(S347)	200, 225, 250 300 500 750 1000 1500 2000 2500Adc	+5Vdc	1%FS	200μs	4

BIDIRECTIONAL CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S263	± 5, 10, 20, 50, 100, 200, 500mA & ± 1, 2, 5A	± 5V	2%FS	40μs	—
905B	± 50, 100, 200, 500mA & ± 1, 2, 5A	± 5V	1 %FS	50ms	5
925B	± 10, 20, 50, 100A	± 5V	1%FS	1ms	5
S273-925	± 25, 50, 100A	± 5V	1%FS	40μs	5
910	± 25, 50, 100, 150, 200, 250A	± 250mV	2%FS	5μs	—
907	± 25, 50, 100, 150, 200, 250, 300A	± 5V	2%FS	100μs	—
907A	± 25, 50, 100, 150, 200, 250, 300A	± 5V	2%FS	40μs	—
908	± 25, 50, 100, 150, 200A	± 250mV	2%FS	5μs	—
927B	± 50, 100, 150, 200, 250, 300, 500, 750, 1000A	± 5V	1%FS	100μs	5
942	± 100, 200, 300, 400, 500, 600, 800, 1000, 1500, 2000A	± 5V	1%FS	100μs	3
909	± 100, 150, 250, 500, 750, 1000, 1500, 2500, 5000A	± 250mV	1%FS	200μs	4
9000	± 150, 250, 500, 750, 1000, 1500, 2000, 2500A	± 5V	1%FS	200μs	4

CURRENT, VOLTAGE, POWER AND FREQUENCY TRANSDUCERS

CALL 516-694-5100

AC & DC CURRENT LEVEL DETECTORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
870	1, 2, 5, 10, 15, 20, 50, 100, 150, 200, 250, 300Aac	RELAY	0.5%FS	500ms	8
S212-850	500mAac (75Aac Overload)	RELAY	±75mAac	200ms	5
901B	20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5V & SW	1%FS	50ms	–
S204-800	100, 150mAdc & 2, 3, 5Adc (10Adc Overload)	RELAY	10%FS	3ms	5
S58-800	200mAdc (10Adc Overload)	SWITCH	N/A	1ms	–
S201-800	1Adc (100Adc Overload)	RELAY	±150mAdc	200ms	5

AC VOLTAGE SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
108	130, 150, 270, 500, 600Vac @47-420Hz (0 to FS)	+5Vdc	0.5%FS	200ms	—
108X	130, 150, 270, 500, 600Vac @57-63Hz (0 to FS)	4-20mAdc	0.5%FS	300ms	—
S190-108	130, 150, 270, 300, 600Vac @47-63Hz (0 to FS)	+10Vdc	2%FS	200ms	—
V	150, 300, 500Vac @47-1000Hz (0 to FS)	+1mAdc	0.25%FS	400ms	6
V-X	150, 300, 500Vac @47-1000Hz (0 to FS)	4-20mAdc	0.5%FS	400ms	6
101M3	90-150Vac @60Hz (Suppressed Zero)	+5Vdc	0.5%FS	17ms	—
102M3	90-175Vac, 105-130Vac or 175-225Vac @400Hz*	+5Vdc	0.5%FS	3ms	—
105	390-490Vac, 430-530Vac or 455-505Vac @60Hz*	+5Vdc	0.5%FS	17ms	—
109	120, 125, 135, 240, 250, 270Vac @60Hz*	+1mAdc	0.5%Vmax	300ms	—

*Suppressed Zero

WATT & VAR TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT POWER RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
415A/416A	1-200KW 120, 220 or 440Vac	+5Vdc	2%FS	400ms	8
S217-413	2-80KW 220 & 440Vac	+5Vdc	2%FS	400ms	8
S73-413	0-100KW (0 to 150Vac or 0 to 300Vac)	+5Vdc	2%FS	400ms	8
W106	0.5-2KW (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W206	1-4KW (2 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W256	1-4KW (2½ ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W306	1-4KW (3 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
Q106	0.5-2K VAR (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
407	0.3-60KW dc 12-240Vdc & 25-250Adc	250mV	2%FS	5µs	–
401	2.7-150KW dc 18-150Vdc & 150-1000Adc	250mV	2.5%FS	200µs	4

FREQUENCY TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT FREQUENCY RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S343	360 to 440Hz (102-127Vac or 200-250Vac)	+5Vdc	±0.8Hz	250ms	–
S350L	100, 200, 300, 500, 1K, 2K, 3K, 5K, 10K & 20K Hz	+5Vdc	0.25%FS	3-300ms	–

__AAC__ manufactures Current, Voltage, Power and Frequency Transducers for Industrial, Military and Space Applications. Send for complete catalog. Our Application Engineering Staff is available to assist you. Phone: (516) 694-5100. FAX: (516) 694-6739

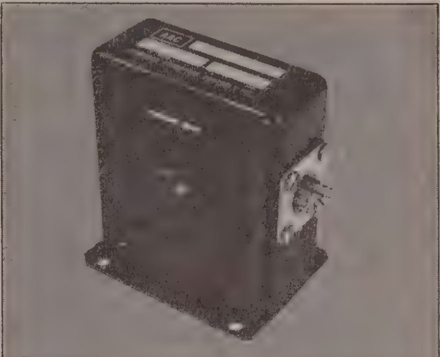


Figure 5 Size: 2⅞" x 2$^{9}/_{16}$" x 2"

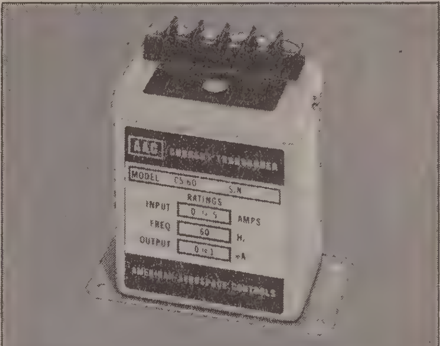


Figure 6 Size: 4" x 4" x 2"

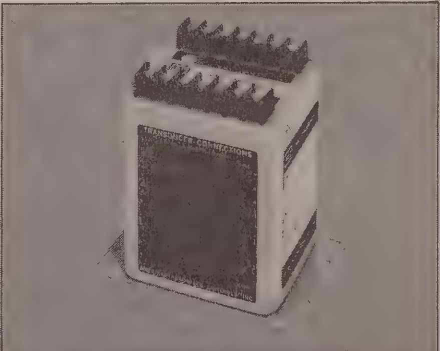


Figure 7 Size: 5$^{7}/_{16}$" x 5⅛" x 3⅜"

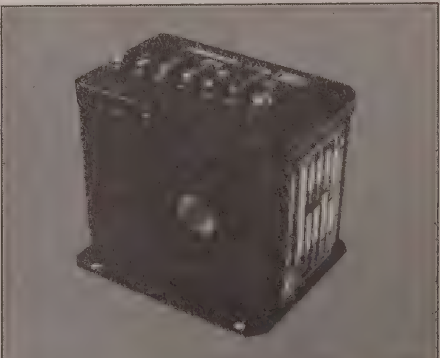
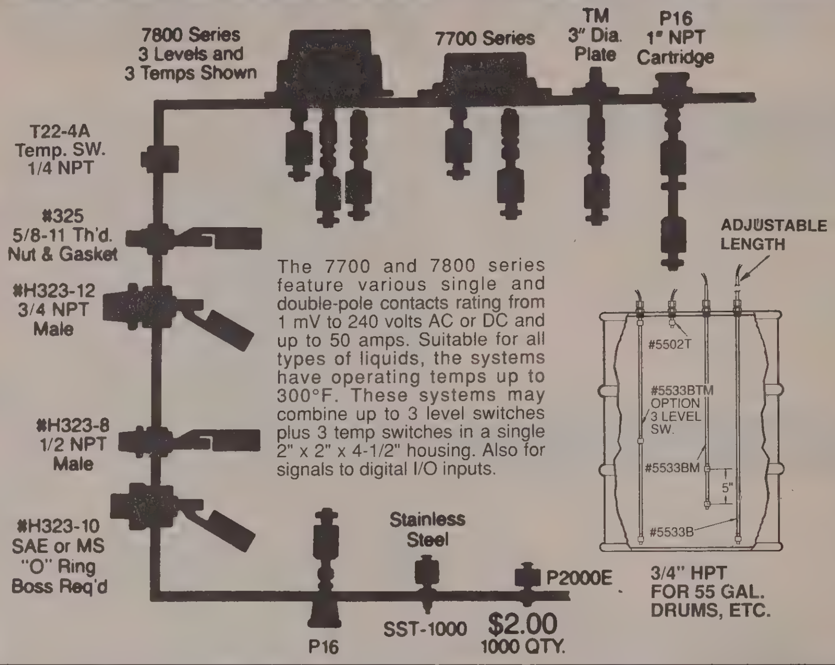


Figure 8 Size: 4" x 4⅛" x 3⅜"

MANUFACTURERS OF TEMPERATURE AND LIQUID LEVEL SENSORS & SYSTEMS FOR ALL INDUSTRIES & BUDGETS


7800 Series
3 Levels and
3 Temps Shown
7700 Series
TM
3" Dia.
Plate
P16
1" NPT
Cartridge
T22-4A
Temp. SW.
1/4 NPT
#325
5/8-11 Th'd.
Nut & Gasket
#H323-12
3/4 NPT
Male
#H323-8
1/2 NPT
Male
#H323-10
SAE or MS
"O" Ring
Boss Req'd
ADJUSTABLE
LENGTH
#5502T
#5533BTM
OPTION
3 LEVEL
SW.
#5533BM
5"
#5533B
Stainless
Steel
P2000E
3/4" HPT
FOR 55 GAL.
DRUMS, ETC.
SST-1000
$2.00
1000 QTY.
P16

The 7700 and 7800 series feature various single and double-pole contacts rating from 1 mV to 240 volts AC or DC and up to 50 amps. Suitable for all types of liquids, the systems have operating temps up to 300°F. These systems may combine up to 3 level switches plus 3 temp switches in a single 2" x 2" x 4-1/2" housing. Also for signals to digital I/O inputs.

Hundreds of Combinations From Stock—Up To Six Sensors In A Single Housing

Manufacturers & Designers of:

- Combination Temperature and Level Switches and Controls
- Liquid Level Switches
- Temperature Sensors & Thermocouple Assembly
- Single, Double and Triple Assy's
- Standard or Custom and Military Options
- Used in Medical, Industrial, Marine, Mobile, Chemical & Food Processing, etc.
- Used to Monitor Electronic Sensors at Hi-Lo Points, Switch Repeatability ±.005

MODEL	DESCRIPTION - PARTIAL LIST SHOWN	LIST
TL-008	COMBINATION TEMP/LEVEL SENSOR, VERTICAL MOUNT	54.00
TL323	COMBINATION TEMP/LEVEL SENSOR, HORIZONTAL MOUNT	56.00
L2400	LIQUID LEVEL SWITCH, VERTICAL, MT. 1.5 AMP	29.59
LH012	LIQUID LEVEL SWITCH, VERTICAL, MT. 100 WATT	35.75
H325	NYLON 66 LEVEL SWITCH, HORIZONTAL, 1.5 AMP	21.00
SST1000	LEVEL SWITCH, STAINLESS STEEL FLOAT AND STEM	29.59
P2000	LEVEL SWITCH, ALL POLYPROPYLENE FOR FOOD, CHEM., ETC.	7.90
H323	LEVEL SWITCH, HORIZONTAL, STEEL MOUNT THREADS	32.90
T-22-4A	TEMP. SWITCH, 600 PSI OPER., 1/4 NPT MOUNTING	23.00
T6006	TEMP. SWITCH, 5000 PSI OPER., 3/8 NPT MOUNTING	26.08
TT-2208	DOUBLE TEMPERATURE. SWITCH, 1/2 NPT MOUNTING	59.00
3T-2258	TRIPLE TEMPERATURE. SWITCH, 1/2 NPT MOUNTING	87.00
7700 AND 7800 SERIES-COMPLETE WITH HOUSING, EXCEEDS NEMA 3R, 4, 12 AND 13		
L7701	LIQUID LEVEL SWITCH, ASSY., HEAVY DUTY	56.00
LL7702	DOUBLE LEVEL SWITCH, ASSEMBLY, H.D. HOUSING	86.00
3L7703	TRIPLE LEVEL SWITCH, ASSEMBLE, H.D. HOUSING	115.00
TL7708	COMBINATION TEMPERATURE AND LEVEL SWITCHES	81.00
L7701R	LEVEL CONTROL, DPDT CONTACTS, 10 AMPS AT 115V	65.52
3T3L7800	TRIPLE TEMPERATURE AND TRIPLE LEVEL CONTROL	187.00
LL7800RR	DOUBLE LEVEL & TWO DPDT CONTACTS TO 50 AMP, INRUSH	159.00

CONTACT FACTORY FOR ENGINEERING INFORMATION AND DISTRIBUTOR DISCOUNTS

APCO TEL: 203-357-0141 FAX: 203-356-1697

APPROVED PURIFICATION CORP.–1088R Hope Street, Stamford, Connecticut 06907

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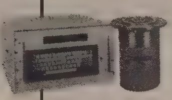
PRECISION SERVOS, AEROSPACE AND DEFENSE

High resolution (to 2^{25} or 33,554,432 bits-per-turn) and high accuracy optical rotary encoders, motor-encoders, and rate/position control servo systems for space, military and high accuracy industrial applications.



Custom engineering capability devoted to unique design solutions for precision servo systems.

Quality system to meet MIL-Q-9858A and NHB-5300.4 (1B), electronic workmanship standards to MIL-STD-2000 and NHB-5300.4 (3A-1) and reliability system to meet MIL-STD-785B and NHB-5300.4 (1A-1).

Typical applications: Aerospace and military programs, precision servo systems, pointing/tracking gimbal systems and precision indexing.

PRECISION SYSTEMS
and SPACE DIVISION
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Little Rock, AR 72203
501-851-4000
FAX 501-851-5476

HIGH-PERFORMANCE ENCODERS, AEROSPACE AND DEFENSE

Ultra small MicroSeries® absolute encoders in solid shaft and pancake thru-hole configurations with resolutions from 13 to 21 bits for fire control, communications terminals and surveillance radars.

Digisec® absolute and incremental encoders with thru-holes to 8″ and resolutions to 24 bits for radars, optical trackers, and telescopes.

Absolute and incremental encoders in housed and un-housed configurations to meet highest reliability and performance requirements for space flight use.

Production complies with quality requirements of MIL-Q-9858A and NHB-5300.4 (1B).

Typical applications: Tactical weapons, space programs, range instrumentation and telescopes.

PRECISION SYSTEMS
and SPACE DIVISION
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Needham Heights, MA 02194
617-455-1414
FAX 617-455-6514

ENCODERS, DEFENSE AND INDUSTRIAL

Higher resolution incremental encoders for defense and industrial requirements. Single and multi-turn absolute encoders in the range of 512 to 65,536 counts-per-turn.

Production and quality systems comply with MIL-I-45208 and when required, Soldering Specification MIL-STD-2000.

Products also include instrument grade trackballs, rotating polygon scanners and fiber optic encoders. Fiber optic versions of most encoders can be produced to satisfy high temperature and high noise immunity requirements.

Typical applications: Antennas, fire control, FLIR scanning systems, robotics, process control, machine tool, medical systems and factory automation.

CHATSWORTH
ENCODER DIVISION
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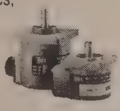
Chatsworth, CA 91311
818-341-6161
FAX 818-882-4553

OPTICAL ENCODERS, INDUSTRIAL

Industrial encoders designed for the abusive machine tool environment. Rugged cast housing, heavy-duty shaft and bearings. Available in models that are sealed against liquid entry and for shaft loads up to 200 lbs. and 200G shocks.

Guaranteed 30-day delivery or sooner on standard model encoders; 2-day delivery on express series encoders. Over 160 resolutions in stock – up to 50,000 CPT incremental. Many mechanical and electrical options are available. 2 year limited warranty.

Typical applications: Process control, factory automation, robotics, machine tool, instrumentation, lumber and oil field machinery.



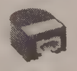
INDUSTRIAL
ENCODER DIVISION
7230 Hollister Avenue
Goleta, CA 93117
1-800-350-ASAP or 805-968-0782
FAX 805-968-3154

OPTICAL ENCODERS, HIGH VOLUME OEMs

Small and low-cost modular, kit and light duty enclosed encoders. Perfect for the high volume OEM in computer peripheral, office and factory automation, medical instrument and related markets.

Self-contained 1.2″, 1.5″ and 2.1″ modular encoders with resolutions up to 1024 PPR. Kit encoders up to 2.1″ and 1024 PPR. Products easy to install and forgiving of dynamic axial shaft movement. Motor commutation signals available.

1.1″, 1.5″ and 2.0″ enclosed encoders combine low cost and high performance for light duty service. Resolutions up to 2540 PPR available in 2.0″ package.



Typical applications: Servo motors, tape drivers, printers, plotters, medical equipment and instrumentation.

COMPUTER
PRODUCTS DIVISION
1755-B La Costa Meadows Drive
San Marcos, CA 92069
1-800-ENCODER or 619-471-2600
FAX 619-471-2675

BRUSHLESS MOTORS, ACTUATORS, SPECIALTY ELECTROMAGNETICS

Linear and rotary actuators, brushless DC motors, and specialty electromagnetic devices. Reliable, long-life brushless DC motors offer improved performance characteristics and advantages over comparably sized PM DC brush motors.

Voice coil actuators pack power, speed and precise control into limited stroke motion. Specialty electromagnetic devices including AC motors and clutches are also available.

Typical applications: Motors for medical devices including centrifuges, surgical equipment, and scanners; actuators for optical systems and vibration dampers.

KIMCO
MAGNETICS DIVISION
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For Further Information or Quote Call The Division that Matches Your Application.

BEI Motion Systems Company supplies precision electronic and electro-mechanical motion control components and systems for a wide range of applications including computer controlled machines, military, aerospace equipment and factory automation. For information on our products and services, call the division that matches your application, or contact our corporate offices.

BEI

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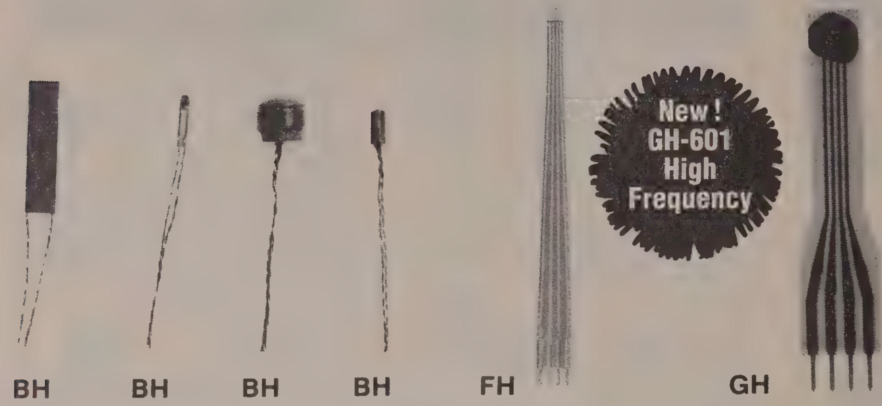
Hall Generators



- **Cryogenic/High Field**
- **Magnetic Field Measurements**
- **Electrical Power Measurements**
- **Guidance Systems**
- **Brushless dc Motors**
- **Proximity Sensors**
- **Watt-hour Meters**

DESCRIPTION

The F.W. Bell series of Hall effect magnetic field sensors consists of 30 standard models designed to meet the requirements of most magnetic field measurement applications. The sensors are small, solid-state devices. They produce a voltage which is proportional to the product of the control current and the magnetic field component normal to the Hall active area. Each unit has four electrical connections. Two carry the control current (I_C) and the other two supply the Hall voltage (V_H).

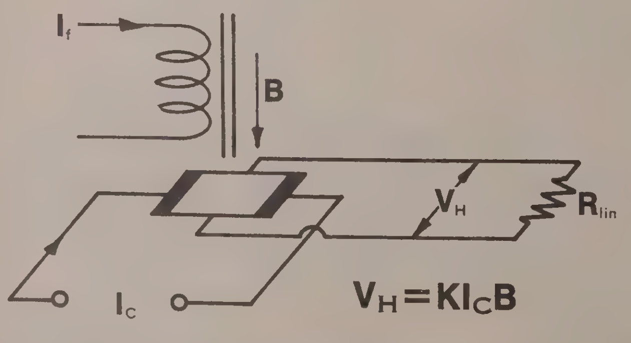
These models are built in various configurations to measure axial, transverse, and tangential magnetic field components. Their operating characteristics permit virtually any application: frequency, dc to MHz; magnetic flux density, milligauss to kilogauss; linearity to 0.1%; temperature, –269°C to +100°C.

MODELS

BH-200
General Purpose
Transverse
BH-201
Ultra-Thin
Transverse
BH-202
Small Axial
BH-203
General Purpose
Axial
BH-204
Midget Axial
BH-205
Midget Transverse
BH-206
High Sensitivity
Transverse
BH-207
High Resolution
Tangential
BH-208
Ultra-Midget Axial
BH-700
Low Cost
Transverse
BH-701
High Linearity
Transverse
BH-702
Ferrite Imbedded
BH-703
3-Axis
FH-301, -302, -500
Thin Film
GH-600
High Output
GH-601
High Frequency
BHT/BHA-900
High Field
BHT/BHA-910
High Linearity
BHT/BHA-921
High Field/
Cryogenic

SPECIFICATIONS

	BH	FH	GH
Control Current, I_C	100-200 mA	15-30 mA	10 mA dc
Input Resistance, R_{in}	1-6 ohms	20-80 ohms	450-900 ohms
Output Resistance, R_{out}	1-6 ohms	50-200 ohms	1,000 ohms
Magnetic Sensitivity, λB	5-70 mV/kG	10-200 mV/kG	50-120 mV/kG



This schmetic representation illustrates both the measuring and multiplying capabilities of a Hall generator. By holding I_C constant, V_H becomes a direct function of B, the magnetic flux density. If both I_C and B are variable, V_H is proportional to the product of the two functions. Holding B and I_C constant, V_H becomes a function of the angle between B and the plane of the Hall Generator active area.

Special units are available to fit your application.

F.W. BELL

6120 Hanging Moss Road, Orlando, FL 32807
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CURRENT SENSORS CURRENT TRANSFORMERS

BICRON™

"Excellence Through Teamwork"

BICRON'S Current Sensors are designed to provide a programmable voltage output proportional to the input current.

The current sensor is readily interfaced to computer I/O hardware, or other control and monitoring configurations.

Functions such as: UNDER CURRENT, OVER CURRENT, PEAK CURRENT, monitoring, indicating, or controlling are easily accomplished with few additional components.

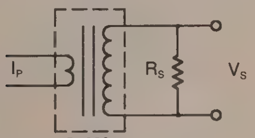
Uses range from simple LED current indicators to vector sumation of primary currents providing applications for current controller, warning devices, trip-out systems, phase balance and more.

STANDARD PRODUCT

Specifications:

CATALOG NUMBER **B5303**

- Frequency Range 50/60 Hz
- Dielectric Strength 1500 VRMS (winding to surface)
- Class A Temperature Rated
- Leads #24 AWG – 12″ Long



B5303

- Electrical Performance
  Vs = 2 • Ip • Rs • 10^{-4}
  Vs = Output Voltage (up to 10 Volts RMS)
  Ip = Input Current (Specify up to 200A)
  Rs = Programmable Burden Resistor (User Supplied)
- Mechanical Dimensions
  O.D. = 2.0″
  I.D. = .7″
  H.T. = .8″

Data subject to change without notice.

BICRON, established in 1964, is a manufacturer of "Standard" and "Modified Standard" current transformers and toroidal power transformers. The Total Quality Management process at BICRON has allowed us to be certified suppliers to numerous customers.

IMPORTANT ADVANTAGES FOR YOUR PRODUCT

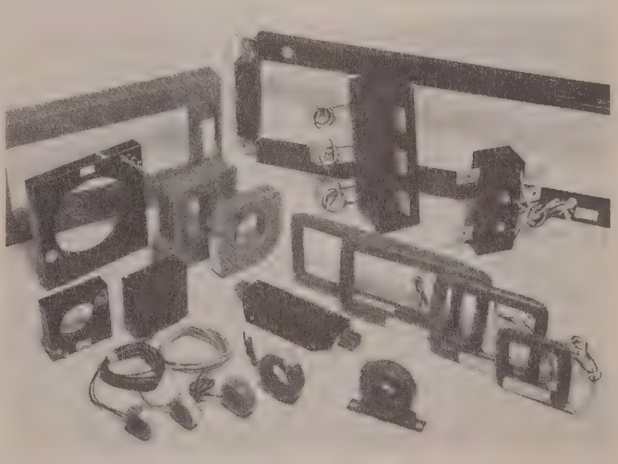
- Non-Contact Measurement of Current
- Current Range up to 200 AMPS (Ip)
- Programmable Voltage Output (Vs)
- Programmable Burden Resistor (Rs)
- Accuracies to .1%
- Overload Capacity > 300 AMPS

FOR YOUR DESIGN

- Customized Transformers
- Current or Voltage Outputs
- Dimensional Flexibility
- Mounting Variety
- Personal Indepth Commitment

EASY TO SPECIFY CUSTOM CURRENT TRANSFORMERS

Ask Us About Our "MODIFIED STANDARD", Part Of BICRON'S Commitment to You.



Current Transformers:

A selection of products produced for many of our OEM customers.

FOR TECHNICAL ASSISTANCE

AND ADDITIONAL LITERATURE

CALL 203/824-5125
FAX 203/824-1137

Bicron Electronics Co.
50 Barlow Street
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BOURNS INC

BOURNS, INC., • 1200 COLUMBIA AVENUE, RIVERSIDE, CA 92507-2114
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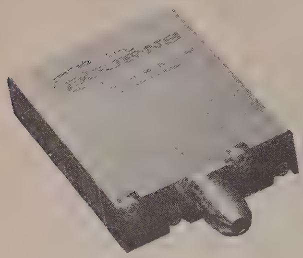
DIGITAL SAPPHIRE SENSOR™



Model 3000 Series

Bourns® Pressure Transducers

- 0.05% Accuracy
- Corrosion resistant sensor
- Hysteresis free operation
- Long term stability
- Operates in high shock and vibration
- Digital output

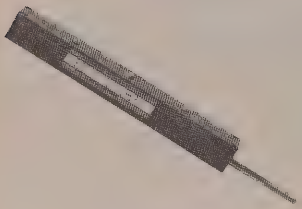
Performance
Pressure Ranges...0-20 PSIA
0-130 PSIA
0-650 PSIA
Accuracy...±0.050% FS
Linearity...±0.020% FS
Repeatability...±0.015% FS
Hysteresis...±0.015% FS
Thermal Effects
Zero...±0.10% per 100°F
Span...±0.10% per 100°F
Stability...±0.05% per six months
Frequency Response...10Hz, single pole low pass filter
Overpressure...150% FS
Burst Pressure...250% FS

Mechanical Characteristics
Size
O-Ring...2.0" X 2.6" X 0.60"
NPT or MS Fitting...2.0" X 3.3" X 0.60"
Weight...Less than 7 ounces
Pressure Connection...O-ring seal
MS 33656-4G 1/8 NPT
Electrical Connection...Mates with MS55302/62A20L

Electrical Characteristics
Output Digital...Modified RS 423
RS 232 (optional)
Power Supplies
High Level...±15 VDC
Low Level...+5 VDC
Current Requirements
±15 VDC...<40 mA
+5 VDC...<80 mA
Insulation Resistance...>50 megohms @ 50 VDC

Environmental Conditions
Operating Temperature
Military...-40°F to +210°F
Commercial...+32°F to +158°F
Storage Temperature..-65°F to +250°F
Shock...50G, 5msec
Vibration...6G, 10 Hz to 3 KHz
Humidity...Hermetically sealed
Media Compatibility...All liquids and gases compatible with 15-5 PH SST, Nickel and Sapphire

LINEAR POSITION TRANSDUCER



Model 108

Bourns® Linear Position Transducers

- Rugged design
- Self-lubricating bushings
- High temperature operation
- Stainless steel shaft
- Precious metal contacts
- Free shaft rotation
- AC or DC

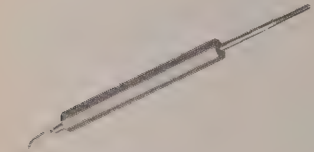
Specifications
Standard Ranges..1.25, 2.25, 4.00, 6.00 inches
Standard Resistances..1K, 2K, 5K, 10K ohms (±10%)
Independent Linearity
...±0.5% of range
End Sets
...±2.5%, 2.5% to 97.5% of range
Resolution...0.0013 to 0.0047 inches
Power Rating
@ 70°F...2.5 watts/inch
@ 350°F...0.1 watts/inch
Operating Temperature Range
...-65°F to +350°F
Insulation Resistance...50 megohms @ 50 VDC, room ambient
Backlash...Negligible
Shaft Actuating Force
At ambient...6 oz.
At temperature extremes...16 oz.
Life...1 million full range cycles
Shock...50G for 6.5 msecs.
Vibration...15G, 20-20,000 Hz

Model 141

Bourns® Linear Position Transducers

- Compact, lightweight, long life
- Infinite resolution (optional)
- Low noise
- Meets Mil spec environments
- Free shaft rotation
- AC or DC
- No backlash

Specifications
Standard Ranges...3/16, 1/4, 5/16, 3/8, 7/16 inches
Standard Resistances..1K, 2K, 5K, 10K ohms (±10%)
Independent Linearity...±1% of range
End Sets
...±2.5%, 2.5% to 97.5% of range
Resolution...0.001 inch (typical)
Power Rating
...0.8 watts/inch @ 70°F
Operating Temperature Range
...-67°F to +250°F
Insulation Resistance...50 megohms @ 500 VDC
Backlash...Negligible
Shaft Actuating Force...4 oz. max @ 70°F
Life...500,000 cycles
Shock...50G for 6.5 msecs.
Vibration...20G, 20-20,000 Hz
Acceleration...100G



Model 175

Bourns® Linear Position Transducers

- Very high temperature operation
- Free shaft rotation
- Negligible backlash
- Voltage ratio output
- Low temperature coefficient
- Meets Mil spec requirements
- Oil submersible (option)
- Long Life

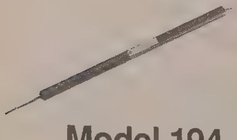
Specifications
Standard Ranges...1.0, 2.0, 4.0 6.0 inches
Standard Resistances..1K, 2K, 5K, 10K ohms (±10%)
Independent Linearity...±0.5% of range
End Sets
...±2.5%, 2.5% to 97.5% of range
Resolution...0.0013 to 0.0047 inches
Power Rating
@ 70°F...1.0 watts/inch
@ 500°F...0.1 watts/inch
Operating Temperature Range
...-65°F to +500°F
Insulation Resistance...50 megohms @ 50 VDC, room ambient
Backlash...Negligible
Shaft Actuating Force
At ambient...8 oz.
At temperature extremes...16 oz.
Life...1 million full range cycles
Shock...50G for 11 msecs.
Vibration...15G, 20-20,000 Hz

Model 184

Bourns® Linear Position Transducers

- Compact, lightweight
- O-ring seal
- Infinite resolution
- Low noise
- Free shaft rotation
- Self-lubricating bushings

Specifications
Standard Ranges...1, 2, 3, 4, 6 inches
Standard Resistances
...500 to 2,000 ohms/inch, (±10%)
Independent Linearity...±1% of range
End Sets
...±2.5%, 2.5% to 97.5% of range
Resolution...Continuous
Power Rating
@ 70°F...0.5 watts/inch
@ 225°F...0.1 watts/inch
Operating Temperature Range
...-65°F to +225°F
Insulation Resistance...50 megohms @ 500 VDC
Backlash...Negligible
Shaft Actuating Force...20 oz. max
Life...1 million full range cycles, 40 million dither cycles 10% max. resistance change
Shock...15G for 11 ±1 msec with no discontinuities
Vibration...25G, 20-20,000 Hz ±0.05% VR change max.
Acceleration...100G



Model 194

Bourns® Linear Position Transducers

- Continuous resolution
- Long life
- Threaded shaft
- Sand, dust, and fungus protection
- Negligible backlash
- Dual output available

Specifications
Standard Ranges
...8, 12, 16, 20 and 24 inches
Standard Resistances
...500 ohms/inch, (±10%)
Independent Linearity...±1.0% of range
End Sets
...±1.5%, 1.5% to 98.5% of range
Resolution...Continuous
Power Rating
@ 70°F...0.5 watts/inch
@ 225°F...0.1 watts/inch
Operating Temperature Range
...-65°F to +225°F
Insulation Resistance..100 megohms @ 50 VDC, room temperature
Backlash...Negligible
Shaft Actuating Force...16 oz. over temperature range
Life...100,000 full range cycles,
Shock...50G for 11 ±1 msec
Vibration....20G, 20-20,000 Hz, ±5% VR

Specifications are typical. Contact factory for special requirements.

BOURNS INC

BOURNS, INC., • 1200 COLUMBIA AVENUE, RIVERSIDE, CA 92507-2114
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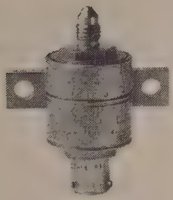
POTENTIOMETRIC PRESSURE TRANSDUCER



Model 441

Bourns® Pressure Transducers

- Small size
- Rugged
- Fast response
- Low price
- Hermetically sealed
- Reliable

Specifications are typical. Contact factory for special requirements.
*Registered trademark of International Nickel Co.
Specifications are subject to change without notice.

Specifications

Standard Ranges ....5-500 PSIA
Overpressure Limits...150% of range
Standard Resistances
.................2K, 5K, 7.5K, 10K ohms
Linearity
To 10 PSIA ....±1.5%
To 500 PSIA ....±1.2%
Operating Temperature Range
..............................-65°F to +165°F
Thermal Sensitivity ±0.01% per 100°F
Resolution ....0.3% nominal
Power Rating
@ 165°F ....0.25 watts
Output..........................Voltage ratio
Shock ....50 G for 11 ±1 ms
Vibration .....0.25" single amplitude, 5-2000 Hz with no discontinuities
Acceleration..............±0.03% per G up to 40 Gs, steady state
Media ...Compatible with Ni-Span C*
Electrical Connection PT1H-8-4P
End Sets
.........±2%, 2.5% to 97.5% of range

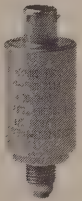
Model 443

Bourns® Pressure Transducers

- Small size
- Fast response
- Low price
- Hermetically sealed
- Meets Mil spec environments
- Voltage ratio output proportional to pressure

Specifications

Standard Ranges ....15-500 PSIA
Overpressure Limits...150% of range
Standard Resistances
.......2K, 5K, 7.5K, 10K ohms (±10%)
Linearity ....±1.5% of range
To 500 PSIA ....±1.2%
Operating Temperature Range
..............................-65°F to +165°F
Thermal Sensitivity ±0.01% per 100°F
Insulation Resistance ..50 Megohms @ 200 VDC
Resolution ....0.3% nominal
Power Rating
@ 165°F ....0.25 watts
Output.........................Voltage ratio proportional to pressure
Shock ....35G for 11 ±1 msec
Vibration .....0.25" single amplitude, 5-2000 Hz with no discontinuities
Acceleration..............±0.03% per G up to 40G, steady state
Media....Compatible with Ni-Span C*
Electrical Connection PT1H-8-4P
End Sets
.........±2%, 2.5% to 97.5% of range



Model 745

Bourns® Pressure Transducers

- High shock rating
- Small size
- Rugged
- Simplicity of design
- Hermetically sealed
- Potentiometric data element

Specifications

Standard Ranges
.........0-500 through 0-10,000 PSIA
Overpressure Limits
.......150% of range, 10,000 PSI max.
Burst Pressure...........200% of range 10,000 PSI max.
Linearity
To 5,000 PSI...........................±1%
To 10,000 PSI.......................±1.3%
Operating Temperature Range
.............................-65°F to +250°F
Thermal Sensitivity ....±0.01% /°F
Insulation Resistance
...............50 megohms @ 500 VDC
Resolution ....0.4% typical
Life ....25,000 full scale cycles
Input Impedance.....2,000 ohms ±10%
Power Rating
@ 165°F ....1.5 watts
Output.........................Voltage ratio
Shock ....100G for 11 ±1 msec with no discontinuities
Vibration
..........55-2000 Hz @ 35G, ±1% VR
Media ...Compatible with silver braze and Ni-Span C*
End Sets
.........±2%, 2.5% to 97.5% of range

Model 5316

Bourns® Pressure Transducers

- Rugged
- Simplicity of design
- Reliable
- Potentiometric data element
- Low cost
- AC or DC

Specifications

Standard Ranges
...........0-100 through 0-5,000 PSIG
Overpressure Limits ....150% of range
Burst Pressure...........200% of range
Linearity ....±1.5% of range
Operating Temperature Range
..............................-65°F to +212°F
Insulation Resistance .....50 Megohms @ 500 VDC @ 70°F
Resolution....<0.6% of range (nominal)
Input Impedance.....2,000 ±10% ohms
Power Rating @ 70°F.......0.5 watts
Output.........................Voltage ratio proportional to pressure
Vibration ....5G, 5-2000 Hz
Shock ....50G 11 msec
Life ....25,000 cycles
Media ....Any gas or fluid compatible with brass
End Sets
......±2.5%, 2.5% to 97.5% of range

Model 5386

Bourns® Pressure Transducers

- Rugged
- Simplicity of design
- Reliable
- Potentiometric data element (continuous resolution)
- Low cost
- AC or DC

Specifications

Standard Ranges
...........0-100 through 0-5,000 PSIG
Overpressure Limits ....150% of range
Burst Pressure...........200% of range
Linearity ....±1.5% of range
Operating Temperature Range
..............................-65°F to +212°F
Insulation Resistance
...50 megohms @ 500 VDC @ 70°F
Resolution....................Continuous
Input Impedance.....2,000 ohms ±10%
Power Rating
@ 70°F ....0.5 watts
Output.........................Voltage ratio proportional to pressure
Vibration ....5G, 5-2000 Hz
Shock ....50G 11 msec
Life ....25,000 cycles
Media ....Any gas or fluid compatible with brass
End Sets
......±2.5%, 2.5% to 97.5% of range

Model 5543

Bourns® Pressure Transducers

- Small size
- Rugged
- Low price
- Hermetically sealed
- Long life
- Voltage ratio output proportional to pressure

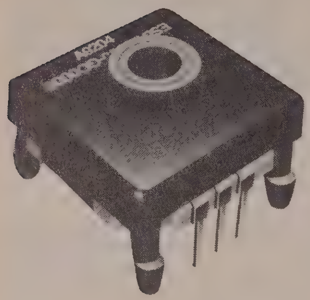
Specifications

Standard Ranges
........................15-400 PSIA, PSIG
Overpressure Limits ....200% of range
Standard Resistances
..............................1K ohms, (10%)
Linearity ....±2.0% of range
Operating Temperature Range
..............................-20°F to +180°F
Thermal Sensitivity.........±0.01%/°F
Insulation Resistance.....50 Megohms @ 200 VDC at room temperature
Resolution....................Continuous
Power Rating @ 180°F....0.1 watts
Output.........................Voltage ratio proportional to pressure
Vibration ....10-1000 Hz, 20G, ±10% VR, 1000-2000 Hz with no discontinuities
Media.......Compatible with Ni-Span C*
End Sets
.........±2%, 2.5% to 97.5% of range

Specifications are typical. Contact factory for special requirements.

BOURNS INC
BOURNS, INC., • 1400 NORTH 1000 WEST STREET, LOGAN, UTAH 84321
(801) 750-7200 • FAX: (801) 750-7253

SNAP-IN SHAFTLESS ENCODER



Shaftless Contacting Encoder

- **Snap-in PC board mount**
- **Long operating life**
- **Incremental output**
- **Up to 24 full quadrature outputs per revolution**

Electrical Characteristics

Output
.................2-bit gray code, Channel A leads Channel B by 90° electrically turning clockwise (CW)

Closed Circuit Resistance
.........................5 ohms maximum

Open Circuit Resistance
...................100K ohms minimum

Contact Rating
.................10 milliamp @ 10 VDC or 0.1 watt maximum

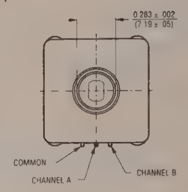
Insulation Resistance (500 VDC)
............1,000 megohms minimum

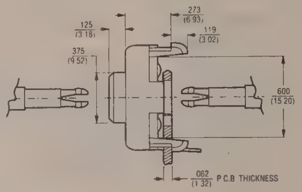
Dielectric Withstanding Voltage
............MIL-STD-202 Method 301
Sea Level
...................1,000 VAC minimum

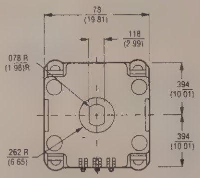
Electrical Travel
..................................Continuous

Contact Bounce (15 RPM)
..............5 milliseconds maximum

RPM (Operating)
............................120 maximum


0.283 ± .002
(7.19 ± .05)
COMMON
CHANNEL A
CHANNEL B

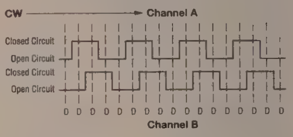

125
(3 18)
375
(9 52)
273
(6 93)
119
(3 02)
600
(15 20)
062
(1 32)
P C.B THICKNESS


78
(19 81)
118
(2 99)
078 R
(1 98)R
394
(10 01)
394
(10 01)
262 R
(6 65)

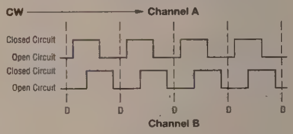
Specifications are subject to change without notice

QUADRATURE OUTPUT TABLE
This table is intended to show available outputs as currently defined.

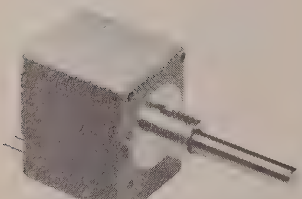
1/4 CYCLE PER DETENT



FULL CYCLE PER DETENT
(Normally Open in Detent Shown)



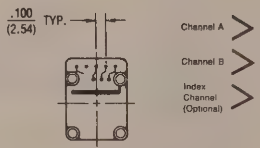
ROTARY OPTICAL ENCODER

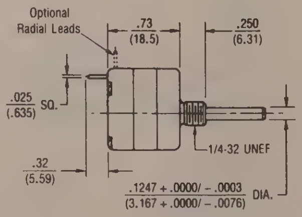


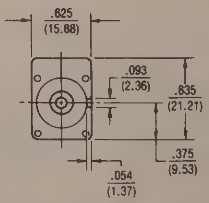
ROTARY OPTICAL ENCODERS

- **Small size**
- **CMOS and TTL compatible**
- **Two channel quadrature output**
- **Square wave signal**
- **High operating speed**
- **Long life**

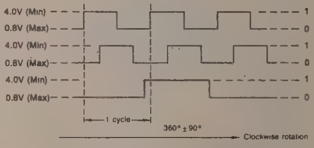
Electrical Characteristics
Output
...........2-bit gray code, Channel A leads Channel B by 90° (electrical) with clockwise rotation
Supply Voltage
...................5.0 VDC ± 0.25 VDC*
Supply Current
.........................26 mA maximum
Output Voltage
Low Output
............................0.8V maximum
High Output
..................................4V minimum
Output Current
Low Output
............................25 mA minimum
Insulation Resistance (500 VDC)
............................1,000 megohms
Rise/Fall Time
.............................200ns (typical)
Shaft RPM (Ball Bearing)
....................5,000 rpm maximum
Power Consumption
.........................136mW maximum
Pulse Width (Electrical Degrees, Each Channel)
...............................180° ±45° TYP.
Pulse Width (Index Channel)
....................................360° ±90°
Phase (Electrical Degrees, Channel A to Channel B)
...............................90° ±45° TYP.
Index Channel Centered on 1-1 State Combination of A and B Channels
....0° ±45°
* Consult factory for other voltages up to 15 VDC.


.100
(2.54)
TYP.
Channel A
Channel B
Index Channel (Optional)


Optional Radial Leads
.73
(18.5)
.250
(6.31)
.025
(.635)
SQ.
1/4-32 UNEF
.32
(5.59)
.1247 + .0000/ – .0003
(3.167 + .0000/ – .0076)
DIA.


.625
(15.88)
.093
(2.36)
.835
(21.21)
.375
(9.53)
.054
(1.37)

OUTPUT TABLE



STANDARD RESOLUTIONS AVAILABLE

(Full quadrature output cycles per shaft revolution.)

25*	128
50*	200
64	256
100	

For Non-Standard Resolutions – Consult Factory

*channel B leads channel A

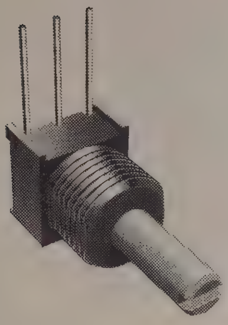
Consult factory for other available options.
Specifications are subject to change without notice.

BOURNS INC

BOURNS, INC., • 1200 COLUMBIA AVENUE, RIVERSIDE, CA 92507-2114
(909) 781-5500 • FAX: (909) 781-5700

MINIATURE ENCODERS

NEW!



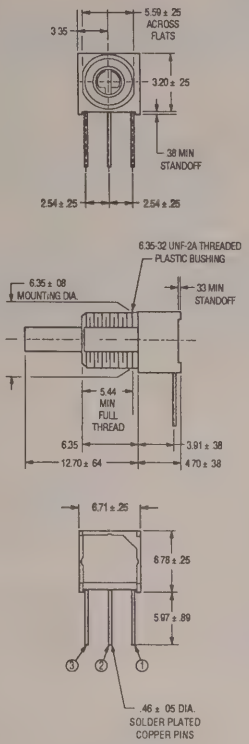
Model 3375

1/4" (6mm) Square Sealed

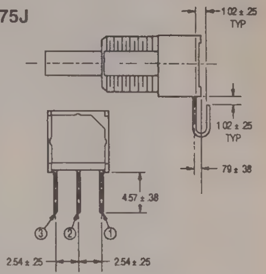
- **Long operating life**
- **High operating temperature capabilities**
- **Bushing or PCB mount**
- **Conductive plastic element**

Electrical Characteristics	
Output	2-bit gray code, Channel A leads Channel B by 90° electrically turning clockwise (CW)
Closed Circuit Resistance	2 ohms maximum
Open Circuit Resistance	100K ohms minimum
Contact Rating	10 milliamp @ 10 VDC or 0.1 watt maximum
Insulation Resistance (500 VDC)	1,000 megohms minimum
Dielectric Withstanding Voltage Sea Level	900 VAC minimum
Electrical Travel	Continuous
Contact Bounce (15 RPM)	5 milliseconds maximum
RPM (Operating)	120 maximum
Environmental Characteristics	
Temperature Range	-55°C to +125°C
Vibration	50G
Contact Bounce	0.1 millisecond maximum
Shock	100G
Contact Bounce	0.1 millisecond maximum
Rotational Life	100,000 cycles
Mechanical Characteristics	
Mechanical Angle	Continuous
Torque	5 oz-in. maximum

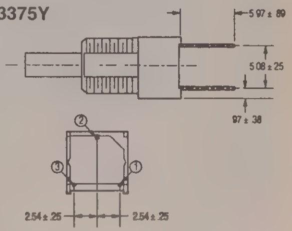
COMMON DIMENSIONS
3375C


3 35
5.59 ± 25 ACROSS FLATS
3.20 ± 25
.38 MIN STANDOFF
2.54 ± 25
2.54 ± 25
6.35-32 UNF-2A THREADED PLASTIC BUSHING
6.35 ± 08 MOUNTING DIA.
.33 MIN STANDOFF
5.44 MIN FULL THREAD
6.35
3.91 ± 38
12.70 ± 64
4 70 ± 38
6.71 ± 25
6.78 ± 25
5.97 ± .89
③
②
①
.46 ± 05 DIA. SOLDER PLATED COPPER PINS

3375J


1 02 ± 25 TYP
1 02 ± 25 TYP
79 ± 38
4.57 ± 38
③
②
①
2.54 ± 25
2.54 ± 25

3375Y


5 97 ± 89
5 08 ± 25
97 ± 38
②
③
①
2.54 ± 25
2.54 ± 25

HOW TO ORDER

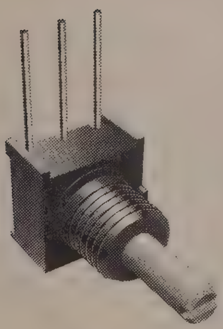
3375 C - 1 - 006

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Pulses Per Revolution

Consult factory for other available options.

Specifications are subject to change without notice.

NEW!



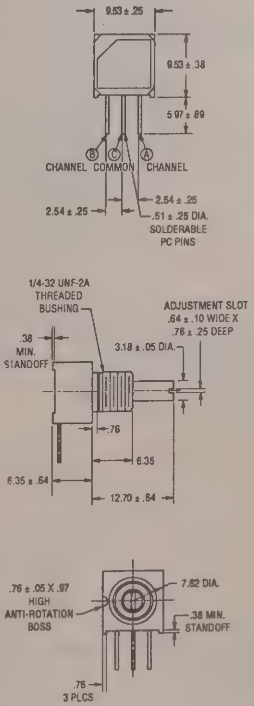
Model 3315

3/8" (9mm) Square Sealed

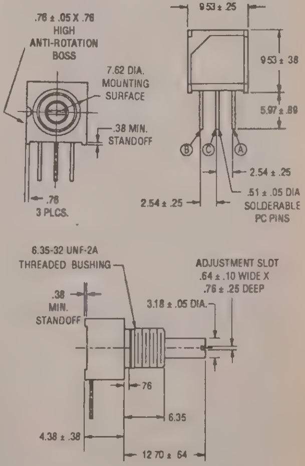
- **Long operating life**
- **High operating temperature capabilities**
- **Bushing or PCB mount**
- **Conductive plastic element**

Electrical Characteristics	
Output	2-bit gray code, Channel A leads Channel B by 90° electrically turning clockwise (CW)
Closed Circuit Resistance	2 ohms maximum
Open Circuit Resistance	100K ohms minimum
Contact Rating	10 milliamp @ 10 VDC or 0.1 watt maximum
Insulation Resistance (500 VDC)	1,000 megohms minimum
Dielectric Withstanding Voltage Sea Level	900 VAC minimum
Electrical Travel	Continuous
Contact Bounce (15 RPM)	5 milliseconds maximum
RPM (Operating)	120 maximum
Environmental Characteristics	
Temperature Range	-55°C to +125°C
Vibration	30G
Contact Bounce	0.1 millisecond maximum
Shock	100G
Contact Bounce	0.1 millisecond maximum
Rotational Life	100,000 cycles
Mechanical Characteristics	
Mechanical Angle	Continuous
Torque	5 oz-in. maximum

COMMON DIMENSIONS
3315


9.53 ± .25
9.53 ± .38
5 97 ± .89
Ⓑ
Ⓒ
Ⓐ
CHANNEL
COMMON
CHANNEL
2.54 ± .25
2.54 ± .25
.51 ± .25 DIA. SOLDERABLE PC PINS
1/4-32 UNF-2A THREADED BUSHING
ADJUSTMENT SLOT .64 ± .10 WIDE X .76 ± .25 DEEP
.38 MIN. STANDOFF
3.18 ± .05 DIA.
.76
6.35
6.35 ± .64
12.70 ± .64
.76 ± .05 X .97 HIGH ANTI-ROTATION BOSS
7.62 DIA.
.38 MIN. STANDOFF
.76 3 PLCS

COMMON DIMENSIONS
3315-1


.76 ± .05 X .76 HIGH ANTI-ROTATION BOSS
7.62 DIA. MOUNTING SURFACE
.38 MIN. STANDOFF
.76 3 PLCS.
9 53 ± 25
9 53 ± 38
5.97 ± .89
Ⓑ
Ⓒ
Ⓐ
2.54 ± .25
2.54 ± .25
.51 ± .05 DIA SOLDERABLE PC PINS
6.35-32 UNF-2A THREADED BUSHING
ADJUSTMENT SLOT .64 ± .10 WIDE X .76 ± .25 DEEP
.38 MIN. STANDOFF
3.18 ± .05 DIA.
76
6.35
4.38 ± .38
12 70 ± 64

HOW TO ORDER

3315 C - 1 - 006

Model
Style
Standard or Modified Product Indicator
1 = Plastic Bushing (Standard)
2 = Metal Bushing
Pulses Per Revolution

Consult factory for other available options.

Specifications are subject to change without notice.

Canon
Laser Linear Encoders

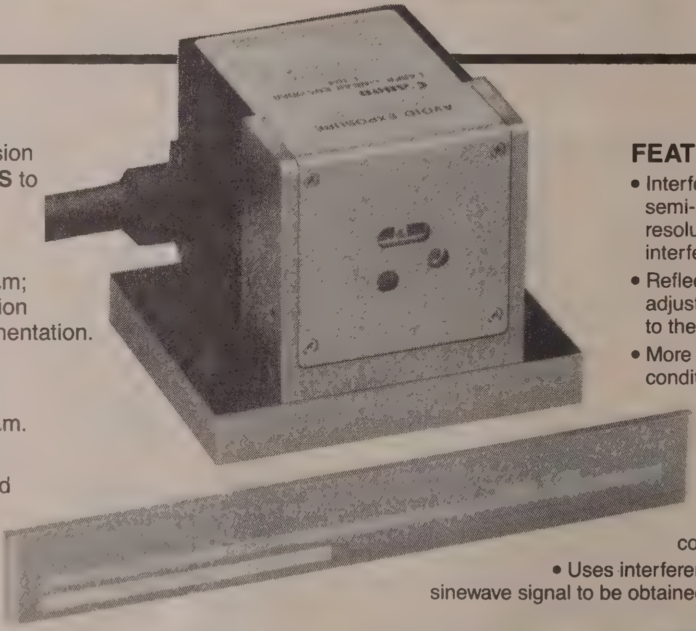
0.01μm RESOLUTION. EVEN IN THE REAL WORLD.

Canon has added high-precision **LASER LINEAR ENCODERS** to its full line of laser rotary encoders. The Canon laser linear encoder provides for maximum resolution of 0.01μm; thereby allowing high resolution closed loop control of instrumentation.

L-104 has a scale slit pitch of 1.6μm and sinewave period output from main unit of 0.4μm.

L-108 has a scale slit pitch of 3.2μm and a sinewave period output from main unit of 0.8μm.

A 16 signal interpolator CI16-2 and 40 signal interpolator, CI40-2 are available, enabling optimum combinations to achieve various resolution and responsiveness.



FEATURES:

- Interference by fine grating with a semi-conductor laser achieves resolution equal to that of laser interferometers.
- Reflection-type, allowing easier adjustment of alignment as compared to the transmission type.
- More stable under variable ambient conditions compared to conventional laser interferometers due to the use of a scale method instead of the laser wavelength standard method.
- Zero-phase index signals are output, allowing simple control of positioning.
- Uses interference, thus providing a full sinewave signal to be obtained from the photodetector.

Please contact CANON directly for special applications in O.E.M. quantities

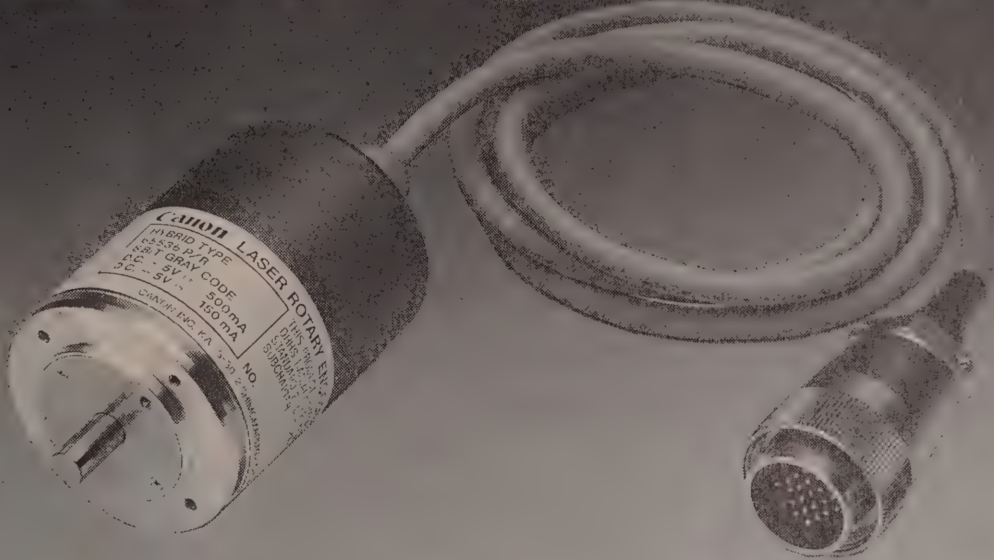
Canon Interface/Display Unit CL-40 or CL-16 (optional)

Canon

CANON U.S.A. INC. Components Division
New York Office/Headquarters, One Canon Plaza, Lake Success, NY 11042 • (516) 488-6700 • FAX: (516) 328-4609
Canon U.S.A., Inc., 2051 Mission College Blvd., Santa Clara, CA 95054-1509 • Tel:(408) 982-5200 • FAX:(408) 986-1325

Canon

very high resolution Laser Rotary Encoders



MODEL	RESOLUTION (ppr)		MAXIMUM FREQUENCY RESPONSE (KHz)	MAXIMUM ANGULAR VELOCITY (rps)	SIGNAL OUTPUT		SIZE (mm × mm)
					Analog or digital	Output Circuit	
X-1	225,000	18,000,000**	675	3 (180 rpm)	Analog	Op Amp Serial Resister (Balanced)	140 × 50
K-1	81,000	1,296,000*	500	6.2 (372 rpm)	Analog	Op Amp Serial Resister (1 Vp-p)	36 × 48
R-10	81,000		500	6.2 (372 rpm)	Digital	Open Collector	36 × 48
R-1L	81,000		500	6.2 (372 rpm)	Digital	Line Driver (Balanced)	36 × 58
M-1	50,000		2,000	40 (2400 rpm)	Digital	Line Driver (Balanced)	56 × 70
TR-36	3,600		300	83 (5000 rpm)	Digital	Line Driver	40 × 17

*With CI16-1, CI16-2, CI16-V (16 × output pulse) Interpolator
**With IU-80/120 (80 × output pulse) Interpolator.

All models are incremental.

FEATURES: • COMPACT SIZE • LOW INERTIA • HIGH RESOLUTION
• Direct Coupling • Pure Sine Wave Output • Either Sine Or Square Wave Output
• Analog May Be Multiplied • Absolute Models Available

APPLICATIONS: • Robotics • Machine Tool • Imaging Systems • Calibration Equipment • Surveying Equipment

Ask about our new 3600 p/rev. Model 36.

Canon

Please contact CANON directly for special applications in O.E.M. quantities.

CANON U.S.A. INC. Components Division
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Canon U.S.A., Inc., 2051 Mission College Blvd., Santa Clara, CA 95054-1509 • Tel:(408) 982-5200 • FAX:(408) 986-1325

CLAROSTAT

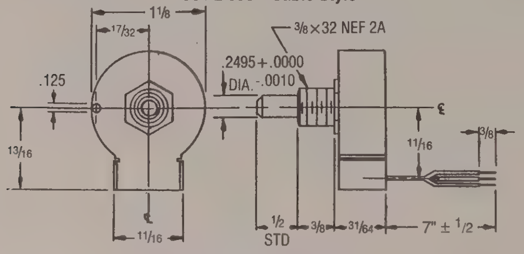
ENCODERS

SERIES 600
OPTICAL ROTARY ENCODER

DESCRIPTION:
The series 600 controls are manually operated, rotary, optical encoders that output two square waves in quadrature at a rate of 128 pulses per channel per revolution as a standard with other resolutions down to 24 pulses available. The outputs are TTL compatible. The variation by construction is the terminal configuration, with the one model having (4) cable leads, and the other model having (4) pin leads and internal resistors.

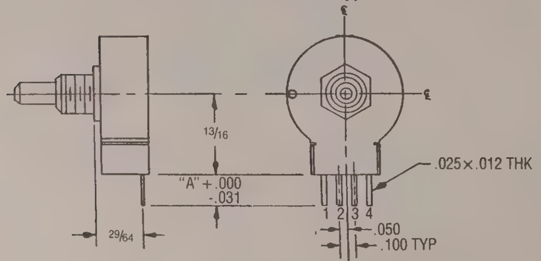
Electrical Specifications
INPUT POWER: 5 volts DC ±5% @ 30 MA max. plus external requirements.
OUTPUT RATE: 128 pulses/revolution per channel—standard
Other pulses/revolution between 10 and 128 are available.
CHANNELS: Two separate output channels in quadrature, 90° ± 45°
OUTPUT VOLTAGE: High level voltage—2.4 volts min. with 10K load to ground. Low level voltage—.4 volt max.

MODEL 600—Cable Style



1 1/8
17/32
3/8×32 NEF 2A
.2495+.0000
DIA. -.0010
.125
13/16
11/16
3/8
1/2
STD
3/8
31/64
7" ± 1/2
11/16

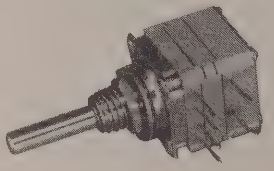
MODEL 600—PC Terminals Type B-66



13/16
"A" +.000
-.031
29/64
.025×.012 THK
1 2 3 4
.050
.100 TYP

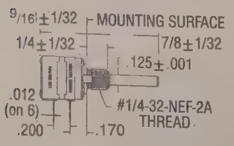
Series
- **600** = Sleeve-bearing construction with two channel quadrature output
- **605** = Sleeve-bearing construction with one channel output
- **610** = Ball-bearing construction with two channel quadrature output
- **615** = Ball-bearing construction with one channel output

SERIES 688
1/2 INCH SQUARE OPTICAL ENCODER

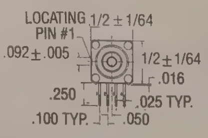


DESCRIPTION:
The Series 688 controls are manually operated, rotary, optical encoders that output two square waves in quadrature at a rate of 64 pulses per channel per revolution as a standard with other resolutions down to 20 pulses available. The outputs are TTL compatible.

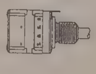
Electrical Specifications
INPUT POWER: 5 Volts DC ±5% @ MA max. plus external requirements.
OUTPUT RATE: 64 pulses/revolutions per channel-standard. Other pulses/revolution between 20 and 64 are available.
CHANNELS: Two separate output channels in quadrature, 90° ± 45°.
OUTPUT VOLTAGE: High level voltage—2. 4 volts min. with 10KΩ load to ground. Low level voltage—.4 volt max.



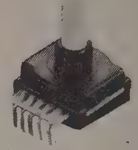
9/16 ±1/32
MOUNTING SURFACE
1/4 ±1/32
7/8 ±1/32
.125 ±.001
.012
(on 6)
#1/4-32-NEF-2A
THREAD
.200
.170



LOCATING PIN #1
1/2 ±1/64
.092 ±.005
1/2 ±1/64
.016
.250
.025 TYP.
.100 TYP.
.050



SERIES 500
MECHANICAL ROTARY ENCODER

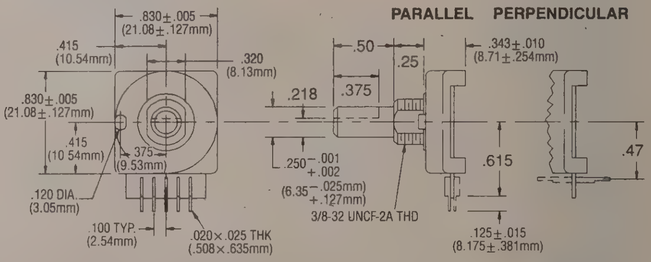


DESCRIPTION:
The Series 500 Controls are manually-operated, rotary, mechanical encoders that provide a 2-bit grey code for relative reference applications and a 4-bit grey code for absolute reference applications. It has a rotational life of more than 100,000 shaft revolutions, a positive detent feel and can be combined with a second modular section in a concentric-shafts construction.

The Series 500 is small-sized (.830 in. sq. × .343 thick) and commonly used in limited-space, panel-mounted applications where the need for costly, front-panel displays can be completely eliminated.

Electrical Specifications
OUTPUT: 2-bit grey code, channel L leads channel R by 90° electrically in the CW direction. 4-bit grey code, absolute electrical position output. (Hexidecimal, B.C.D. and counting codes available upon request see Output Code Table section next page.)
CLOSED CIRCUIT RESISTANCE: 5Ω maximum
OPEN CIRCUIT RESISTANCE: 100kΩ maximum
CONTACT RATING: Resistance load 250 ma @ Vdc maximum
SWITCHING LOADS: 1.5 ma @ 115 Vac; 150 ma @ 14 Vdc
BOUNCE (Jitter): 5 ms/cycle @ 15 RPM
DIELECTRIC WITHSTANDING VOLTAGE: 1000 Vac @ ATM
ELECTRICAL TRAVEL: Continuous (rotational position stops are available upon request)
OPERATING SPEED: 50 RPM maximum

Control Dimensions, Single Control



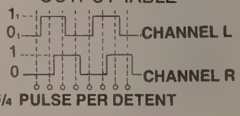
PARALLEL
PERPENDICULAR
.830 ±.005
(21.08 ±.127mm)
.415
(10.54mm)
.320
(8.13mm)
.830 ±.005
(21.08 ±.127mm)
.415
(10.54mm)
.375
(9.53mm)
.120 DIA.
(3.05mm)
.100 TYP.
(2.54mm)
.020×.025 THK
(.508×.635mm)
.218
.50
.25
.375
.250 -.001 +.002
(6.35 -.025mm +.127mm)
3/8-32 UNCF-2A THD
.343 ±.010
(8.71 ±.254mm)
.615
.47
.125 ±.015
(8.175 ±.381mm)

SERIES 388E
TWO BIT GRAY CODE MECHANICAL ENCODER

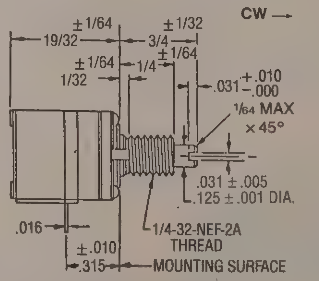
DESCRIPTION:
Only one half inch square, the Series 388E is a direct digital, contacting, mechanical encoder for low resolution limits in such applications as sensing, cursing scanning or robotics. Meets those requirements for a digital output component for limited space applications.

Electrical Specifications
OUTPUT: 2 Bit gray code, channel L leads channel R by 90° electrically in CW direction.
CONTACT RESISTANCE: 2.5K Max.
OPERATIONAL RESISTANCE: 10 Megohm Min.
CONTACT RATING: 5 VDC at 5 ma
INSULATION RESISTANCE: 100 Megohm at 50 VDC
JITTER: 5 Milliseconds/cycle at 15 RPM

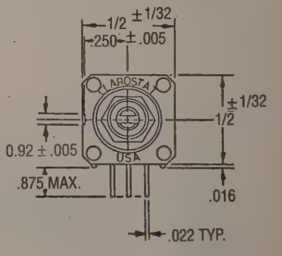
OUTPUT TABLE



1
0
CHANNEL L
1
0
CHANNEL R
1/4 PULSE PER DETENT



CW →
±1/64
19/32
±1/32
3/4
±1/64
±1/64
1/32
1/4
.031 +.010 -.000
1/64 MAX
×45°
.031 ±.005
.125 ±.001 DIA.
.016
1/4-32-NEF-2A
THREAD
±.010
.315
MOUNTING SURFACE



1/2 ±1/32
.250 ±.005
CLAROSTAT
USA
±1/32
1/2
0.92 ±.005
.875 MAX.
.016
.022 TYP.

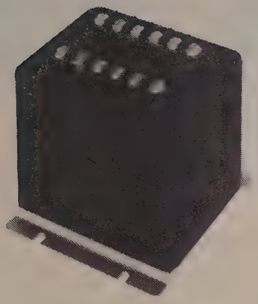
HOW TO ORDER

Cat. No.	Description	Detents	Pluse
388EN-4P	4 Pulse/Rev/Chan.	16	1/4/Det.
388EN-6P	6 Pulse/Rev.Chan.	24	1/4/Det.

CLAROSTAT, 1600 West Plano Parkway, Plano, TX 75075 (Fax 1-800-223-5138) Phone: (800) 874-1874

WATT, WATT-HOUR, VAR & CURRENT TRANSDUCERS

WATT, WATT-HOUR, VAR TRANSDUCERS



UL RECOGNIZED

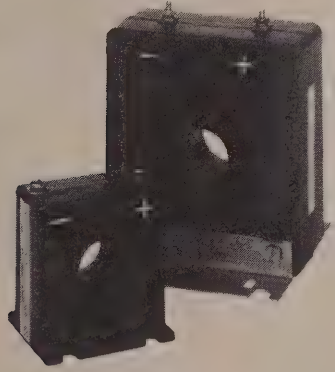
Basic Accuracy: ±0.5
Frequency: 60 HZ
Elements: 1, 2 or 3
Physical Size:
4.19 X 4.38 X 3.75 high

Applications:
1 Phase-2 Wire, 1 Phase-3 Wire,
3 Phase-3 Wire, 3 Phase-4 Wire
Aux. Power: 120/240 VAC

WATT-HOUR
CR-4146-X-OX-X
Pulse Rate: 1 Watt Hour/Pulse (Standard)
Output: T=Triac, N=Transistor
Number of Elements: 1, 2 or 3

WATT & VAR.
CR-4149-X-X
Output: A = 0-1 mA DC, B = 4-20 mA DC
Number of Elements: 1, 2 or 3

2-WIRE, 4-20 ma CURRENT TRANSDUCER



Accuracy: ±0.5% FS
Max. Signal Out: 30 mA
Supply Voltage: 24 VDC
Frequency: 60 HZ
Insulation Class: 600V

UL RECOGNIZED

P/N	RANGE ACA	WINDOW OPENING INCHES
CR-4320-5	0-5	.93
CR-4320-10	0-10	.93
CR-4320-15	0-15	.93
CR-4320-20	0-20	.93
CR-4320-30	0-30	.93
CR-4320-50	0-50	.93
CR-4320-75	0-75	.93
CR-4320-100	0-100	.93
CR-4320-150	0-150	.93
CR-4320-200	0-200	.93
CR-4320-300	0-300	1.25
CR-4320-400	0-400	1.25

4-WIRE, 4-20 mA CURRENT TRANSDUCER

Accuracy: ±0.5% FS
Max. Signal Out: 30 mA
Supply Voltage: 120 VAC
Frequency: 60 HZ
Insulation Class: 600V

UL RECOGNIZED

P/N	RANGE ACA	WINDOW OPENING INCHES
CR-4340-5	0-5	.94
CR-4340-20	0-10/15/20	.94
CR-4340-75	0-25/50/75	.94
CR-4340-100	0-100	2.13
CR-4340-150	0-150	2.13
CR-4340-200	0-200	2.13
CR-4340-300	0-300	2.13
CR-4340-400	0-400	2.13
CR-4340-600	0-600	2.13

CALL OR FAX FOR COMPLETE TECHNICAL INFORMATION

CR MAGNETICS, INC.
308 AXMINISTER DR.
FENTON, MO 63026
314-343-8518
(FAX) 314-343-5119

SEE SECTION 4500
FOR INFORMATION ON OUR CURRENT SENSING RELAYS.

SEE SECTION 5600
FOR INFORMATION ON OUR CURRENT INDICATORS & TRANSFORMERS.

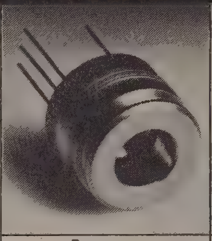
PRESSURE TRANSDUCERS

Features

- **Pressure ranges:** 0-5 to 20,000
- **Types:** general purpose, gage,absolute, sealed, self-amplified, two-wire transmitters, depth sensors, and flush mount
- **Output:** voltage, current or frequency,
- A unique design that puts only stainless steel* in contact with your pressure media, for most models.
- 2x rated pressure without damage, 5x to 20x rated pressure without bursting.
- Proven long-term zero and span stability.
- Full calibration and temperature compensation.
- Unit-to-unit interchangeability assured through factory calibration to ±1%.
- Full pressure cycles greater than 100 million.
- FM approval on BL and Datamate.

Applications

- Medical instruments
- Air conditioning and refrigeration
- Hydraulic controls
- Oil exploration and extraction
- Aircraft hydraulics
- Agricultural sprayers and dusters
- Geophysical
- Oceanography
- Robotics
- Water management
- Transmissions
- Process control equipment
- Exercise machines
- Physiological monitors
- Environmental control systems
- Engine controls, monitors
- Automotive test stands

	MEDIAMATE® **PSIG**	**MODELS AB/HP, AB** **PSIA, PSIG, PSIS**	**MODEL SR®** **PSIG**	**MODELS EA, EAF** **PSIG**
				
	Compact Size, Low Cost	**High Performance**	**Pressure Sensor**	**Low Cost Amplified**
Pressure Range	0-15, 25, 50, 100, 200, 500, 1000, 2000, 5000, 7112 PSIG	0-6, 15, 25, 50 PSIG 0-100, 200, 500, 1,000, 2000, 3000, 5000, 10,000, 15,000, 20,000 PSIG	0-15, 25, 50, 100, 200, 300 PSIG 0-500, 1000, 2000 PSIG	0-6, 15, 25, 50, 100, 200, 300, 500, 1000, 2000, 5000 PSIG
Accuracy	±0.5, 1% span	AB/HP: ±0.25%, 0.5% span AB: ±1% span	±0.5, 1% span	±1% span
Signal Output	0 to 50 mV	0 to 100 mV	25mV/mA, minimum	EA: 1 to 6 Vdc EAF: 1 to 6 Khz
Excitation	5 Vdc recommended (6 Vdc maximum)	5 Vdc recommended (6 Vdc maximum)	4 mA	EA: 8 to 20 Vdc EAF: 10-20 Vdc
Operating Temp Range	–40°F to 212°F (–40°C to 100°C)	–65°F to 200°F (–57°C to 93°C)	–40°F to 212°F (–40°C to 100°C)	EA: –67°F to 212°F (–55°C to 100°C) EAF: –40°F to 185°C) (–40°C to 85°C)
Compensated Temp Range	30°F to 180°F (–1%C to 82°C)	AB/HP: 30°F to 160°F (–1°C to 71°C) AB: 30°F to 130°F (–1°C to 54°C)	32°F to 167°F (0°C to 75°C)	30°F to 185°F (–1°C to 85°C)
Thermal Effect On Zero	<±1% span–any 100°F (55°C) range within the compensated temperature range	AB/HP: <±1% span–any 100°F (55°C) range within the compensated range AB: <±5% span within compensated range	<±1% span–any 90°F (50°C) change within the compensated temperature range	<±1% span–any 100°F (55°C) range within the compensated temperature range
Thermal Effect On Span	<±1%–any 100°F (55°C) range within the compensated range	AB/HP: <±1%–any 100°F (55°C) range within the compensated range AB: <±3% span within compensated range	<±1%–any 90°F (50°C) change within the compensated temperature range	<±1%–any 100°F (55°C) range within the compensated range
Options Available	Port with 1/8" BSPP thread, 12 mm hex nut Protective boot Hirschmann connector	1,3,4,5,7 TEF (see option list)		

ACCESSORIES AND OPTIONS PRESSURE TRANSDUCERS

Adapters For Pressure Transducers

These adapters are simple two-piece fittings which house the AB, BF or BL transducers. They not only interface with the working system, but also shield the transducer from the mechanical environment.

Model	Description	Max. Pres	Burst Pres
AD-1SS	300 Series Stainless Steel, 1/4" NPT male	10,000 PSI	20,000 PSI
AD-1SF	300 Series Stainless Steel, 1/4" NPT, male with a 40 micron snubber	10,000 PSI	20,000 PSI
AD-1N	Nylon 1/4" NPT male	200 PSI	400 PSI
AD-2SS	300 Series Stainless Steel	3,000 PSI	6,000 PSI
AD-3SS	300 Series Stainless Steel, 1" NPT male flushing	10,000 PSI	20,000 PSI
AD-4N	Nylon, barbed fitting for 1/4" ID hose	100 PSI	200 PSI
AD-5SS	416 Series Stainless Steel high	20,000 PSI	40,000 PSI
AD-6SS	300 Series Stainless Steel	10,000 PSI	20,000 PSI
AD-7SS	416 Stainless Steel, 1/4" NPT male	20,000 PSI	40,000 PSI

DATA INSTRUMENTS
Data Instruments Inc., Acton, MA 01720 USA
(508) 264-9550 • Fax: (508) 263-0630 • (800) 333-DATA, or (800) 333-3282

MODEL SA
ECLIPSE

	MODEL SA PSIA, PSIG, PSIS	MODEL LP WC, PSI	DATAMATE®, XPRO® PSIA, PSIG, PSIS	MODELS BL, BF PSIA, PSIG, PSIS	ECLIPSE® PSIS
	Rugged Steel Housing	**Low Pressure**	**Two-Wire Transmitters**	**Flush Diaphragm, Amplified**	**Low Cost Amplified**
Pressure Range	0-15, 25, 50, 100, ,200 PSIA 0-100, 200, 500, 1000, 3000, 5000, 7112 PSIS	1", 2", 3", 5", 10" wc 6/D 1 PSIG/D	0-15, 25, 50 PSIG 0-100, 200, 500, 1000, 3000, 5000 PSIS	0-5, 15, 25, 50 PSIG 0-100, 200, 500, 1000, 2000, 3000, 5000 PSIS 0-10,000, 20,000 PSIS	0-100, 200, 300, 500, 1000, 2000, 3000, 5000, 7100 PSIS; 0-10, 15, 20, 35, 100, 200, 350, 500 bars
Accuracy	±1% span	±1% F.S.D.	±1%	±1% span	±1% span
Signal Output	1 to 6 Vdc	.1-5 Vdc or 4-20 mA	4 to 20 mA	BL: 4 to 20 mA BF: 0 to 5 Vdc	.5 to 4.5 Vdc
Excitation	9 to 20 Vdc	12 to 24 Vdc	12 to 40 Vdc linear derating to 35 Vdc from 77°F to 212°F (25°C to 100°C)	BL: 12 to 36 Vdc BF: 12 to 20 or 20 to 32 Vdc	5 Vdc
Operating Temp Range	–67°F to 221°F (–55°C to 105°C)	–13°F to 185°F (–25°C to 85°C)	–0°F to 212°F (–18°C to 100°C)	BL: –40°F to 185°F (–40°C to 85°C) BF: –50°F to 200°F (–45°C to 93°C)	–40° to 221°F (–40° to 105°C)
Compensated Temp Range	30°F to 185°F (–1°C to 85°C)	50°F to 122°F (10°C to 50°C)	30°F to 130°F (–1°C to 54°C)	30°F to 130°F (–1°C to 54°C)	0° to 180°F (–18° to 82°C)
Thermal Effect On Zero	<±1% span–any 100°F (55°C) range within the compensated temperature range	±1% to ±5% depending on range. Includes zero and span coefficients.	<±1% span within compensated range	<±12% spanwithin compensated range	±1% span typical
Thermal Effect On SPan	<±1%–any 100°F (55°C) range within the compensated range		<±1%within compensated range	<±1%within compensated range	±1% span typical
Options Available	Hirschmann connector	DIN Rail mounting	FM approval standard with Datamate	1, 2 (see option list)	Hirschmann Connector

Options

Options that improve operation or add features for specific applications can be incorporated into Data Instruments transfucers at additional cost.
The options listed below are those referred to by numerical code in the information to the right.
1. Absolute pressure version available in 0-15, 25, and 50 PSIA. (Models AB, AB/HP, BL, BF only)
2. Improved accuracy to less than ±0.5% span; improved thermal effect on zero to less than ±1% span within compensated range. (Models BL, BF only)
3. Barbed fitting for attaching protective hose around cable. (Models AB, AB/HP only)
4. Splice longer cable onto standard 3' (9.1 m) cable. (Model AB only)
5. Install longer continuous cable. (Model AB, AB/HP only)
7. Extended operating range to 300°F (140°C), Not applicable for 6 and 15 PSI. Includes Bendix PTIH-10-6P electrical connector with extended case. Mating connector not included. (Models AB, AB/HP only)
TEF–Teflon® coating on all wetted surfaces. Available on ranges 0-25 thru 0-500 PSI.

Special Features Available With Some Transducers Models

- Bi-directional Model AB, EA or SA for vacuum measurement
- Metric Calibrated Model BL, PL-1, and IMC
- High impedance bridge for low power applications
- Special case materials for high corrosion resistance
- Welded pressure ports
- Special calibration or temperature performance
- Strain links for measuring tensile and compressive forces

Model	Description
Hirschmann	Quick-disconnect connector for SA and MEDIAMATE (factory-installed)
ZB-BF	External Zero Balance Circuit for Model BF
ZB-BL	External Zero Balance Circuit for Model BL
Mating Connector	Matches Bendix PTIH-10-6P (For Models BF, BL and AB with option 7)

How To Order

Always order by name of product, and full description. State in detail any special features required. All orders are subject to final acceptance by Data Instruments Inc.

Terms

Net 30 days upon credit approval; otherwise payment must be received in advance of shipment, or COD shipment.

DATA INSTRUMENTS
Data Instruments Inc., Acton, MA 01720 USA
(508) 264-9550 • Fax: (508) 263-0630 • (800) 333-DATA, or (800) 333-3282

DISPLACEMENT TRANSDUCERS

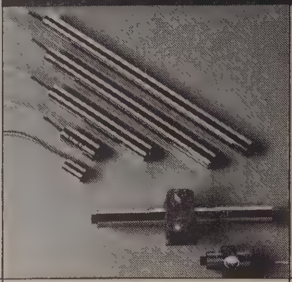
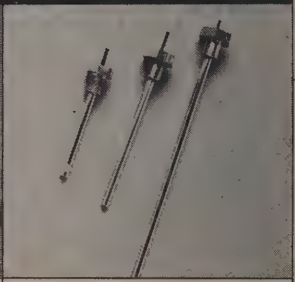
Introduction

Fastar is a precision inductive displacement and position transducer. Available in two mechanical configurations, Fastar and HydraStar, it offers shorter body lengths and faster response compared to LVDT's and magnetostrictive devices.

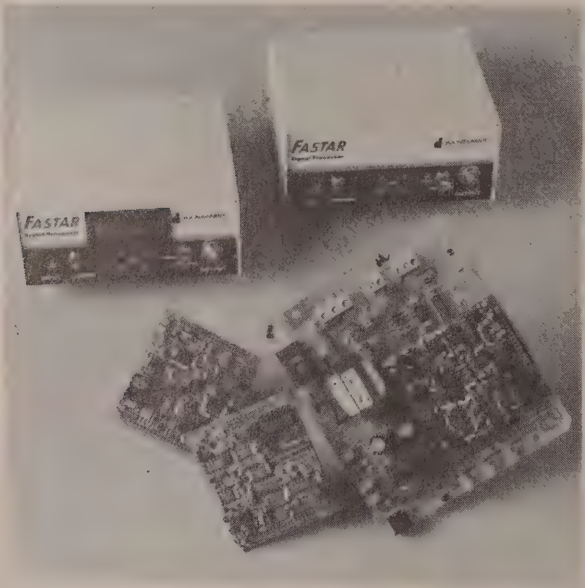
The two mechanical configurations and five models of signal processors allow Fastar to readily be used in applications ranging from laboratory research to volume OEM. When used with the patented signal processors shown in this brochure, the Fastar family provides the following key features.

Features

- Displacements of 0.76 to 24"
- Fastar body length approximately 1.3" longer than linear range; HydraStar body length approximately 1.8" longer
- Excellent stroke to stroke repeatability
- 0.15% or 0.1% linearity
- Unequaled response time of <30µsec between core motion and change in output
- Adjustable output; 0-5, 0-10, ±5, ±10Vdc. Also 4-20mA on SP150
- A unique dynamic compensation technique to reduce temperature errors at the transducer
- HydraStar designed specifically to fit cylinders machined to mount a Temposonics® type transducer
- Wide operating temperature range
- Fastar versions resistant to EMI
- Maximum Operating Pressure: 5000 PSI (350b)

	FASTAR®	HYDRASTAR®
		
Range	**Linear** .76, 2, 4, 6, 8, 10, 12, 18, 24 inches	2, 4, 6, 8, 10, 12, 18, 24 inches
Non-Linearity	0.15% Std 0.10% Optional	0.10%
Resolution	Infinite	Infinite
Repeatability	0.003% of F.S. typical	0.003% of F.S. typical
Comp Temp Range	25°F to 175°F (–5°C to 80°C)	25°F to 175°F (–5°C to 80°C)
Operating Temp Range	–60°F to 257°F (–50°C to 125°C)	–60°F to 257°F (–50°C to 125°C)

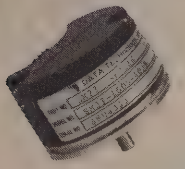
SIGNAL PROCESSORS



	SP50 AND SP100	SP150	SP200A AND SP300A
Operating Temp Range	–30°F to 140°F (–35°C to 60°)	–30°F to 140°F (–35°C to 60°)	–30°F to 140°F (–35°C to 60°)
Temp Coefficients (Scale/Null)	SP50: 0.04%/°F MAX (0.08%/°C) SP100: 0.02%/°F MAX (0.04%/°C)	0.02%/°F MAX (0.04%/°C)	0.02%/°F MAX (0.04%/°C)
Resolution	0.02% F.S.	0.02% F.S.	0.02% F.S.
Adjustments	SP50: Zero, span SP100: Zero, span, Polarity, Temperature Adjustments	Zero, span, polarity, Temperature Adjustments	Zero, span, polarity, 3 T.C. Adjust. Temperature Adjustments
Output Span DC Offset	5-20 Vdc Adjust. SP50: 10V Adjust. SP100: ±10Vdc Adjust.	5-20 Vdc Adjust., 4-20mA ±10 Vdc Adjust.	5-20 Vdc Adjust. ±10 Vdc Adjust.
Phase Shift (Lags) Delay (Motion to Output)	SP50: <2°/ 100 Hz SP100: <1°/ 100Hz SP50: <60µS SP100: <30µS	<1°/100 Hz 30µS	<1°/100 Hz <30µS
Output Noise	<0.01% of span + 1 mV RMS	<0.01% of span + 1 mV RMS	<0.01% of span + 1 mV RMS

DATA INSTRUMENTS
Data Instruments Inc., Acton, MA 01720 USA
(508) 264-9550 • Fax: (508) 263-0630 • (800) 333-DATA, or (800) 333-3282

Data Technology...a leader in the encoder field, offers a wide range of encoder products that are ideally suited for today's demanding applications.



SM23

Low Cost Multipurpose Encoder

☐ Precision surface mount technology ☐ Metal housing & bearings ☐ Single LED and monolithic array assembly ☐ High noise immunity ☐ Full 1 year warranty ☐ Up to 100 kHz standard frequency inclusive of A, B and Z outputs

MECHANICAL SPECIFICATIONS

☐ **Front End:** All metal shaft and bearings housing • Face & servo mount standard ☐ **Cover:** Injection molded flame retardant 94V-O VYDYNE Nylon ☐ **Operating Shaft:** Lower of 3000 RPM or ((6 x 10^6) ÷ (CPR)) RPM ☐ **Shaft Rotation:** Bi-directional & continuous ☐ **Shaft Loading Max:** Axial: 5 lbs. (2.27Kg) Radial: 5 lbs. (2.27Kg) ☐ **Bearings:** Shielded, Instrument Quality ☐ **Starting Torque:** 0.05 oz-in (3.6 gm-cm) ☐ **Moment of Inertia:** 4.0 x 10^{-5} oz-in-sec^2 (3.0 gm cm^2) ☐ **Weight:** 5 ounces ☐ **Case Diameter:** 2.30 inches (58.4 mm) ☐ **Case Length:** 1.40 inches ☐ **Shaft Diameter:** 0.25 inches (6.4 mm) ☐ **Shaft Length:** 0.62 inches (15.7 mm)

ELECTRICAL SPECIFICATIONS

☐ **Encoder Type:** Optical Solid State ☐ **Code:** Incremental ☐ **Resolution:** 1-2000 CPR (cycles per revolution) ☐ **Power Input:** +5VDC ±10%, 130 ma • +12VDC ±10%, 130ma • +15VDC ±10%, 130 ma ☐ **Output Channels:** Dual (A quad B) squarewaves with zero marker pulse (ungated) ☐ **Phase Relationship:** A leads B by 90 degrees electrical (±30 degrees nominal ± 1/8 cycle worst case) for clockwise rotation ☐ **Frequency Response** 100 kHz A, B & Z Channels ☐ **Drive Capability:** Power mosfet buffered outputs TTL and CMOS compatible • Source impedance: 1K ohm to VCC or specify open drain (collector) • Sink current: 48 ma at 0.3V maximum ☐ **Rise and Fall Time:** Less than 1.0 microsec. into 1000 pf load ☐ **Accuracy:** Pulse to Adjacent Pulse: ±6 arc seconds, Pulse to Any Other Pulse: ±3 arc minutes ☐ **Illumination Source:** Single Infrared Emitting Diode • (IR LED) Gallium Aluminum Arsenide • (GaAlAs) hermetically sealed

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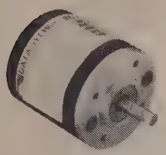


SM15

Advanced Small Industrial Encoder

☐ Available in line counts up to 1024 PPR ☐ Fast operating speeds (200 kHz) ☐ Miniature sealed ball bearing ☐ Wide operating temperature range (-10°C to +70°C)

MECHANICAL SPECIFICATIONS

☐ **Starting Torque:** 10g - cm or less ☐ **Shaft Loading:** Radial 2kg Axial 1kg ☐ **Angular Acceleration:** 1 x 10^5 rad/sec^2 ☐ **Inertia:** 10g - cm^2 ☐ **Slew Speed:** 6000 RPM maximum ☐ **Bearing Life:** 1 x 10^8/RPM hours ☐ **Net Weight:** 150g maximum

ELECTRICAL SPECIFICATIONS

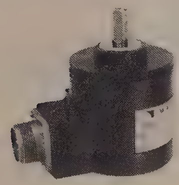
☐ **Power Source:** +5 VDC ☐ **Signal Mode:** Dual channel 90° phased with optional index pulse. 5V unit available with differential outputs ☐ **Output Mode:** Line Driver (5V model only) ☐ **Light Source:** Infrared Diode ☐ **Rise & Fall Time:** 1 micro second or less

ENVIRONMENTAL SPECIFICATIONS

☐ **Vibration:** 50 Hz - 10G - 1 Hr ☐ **Shock:** 30 G 11ms ☐ **Operating Temperature:** -10°C to +70°C ☐ **Storage Temperature:** -30°C to +80°C ☐ **Humidity:** 35-85% RH No condensation

AVAILABLE LINE COUNTS

☐ 100 ☐ 200 ☐ 250 ☐ 256 ☐ 300 ☐ 360 ☐ 400 ☐ 500 ☐ 512 ☐ 600 ☐ 800 ☐ 900 ☐ 1000 ☐ 1024



DT25

Encoder: Industrial Sealed Heavy Duty

☐ Up to 5400 lines on the disc (up to 86,400 PPR with multiplier logic) ☐ Fast operating speeds (100 kHz operating frequency) ☐ Low quadrature deviation (90 degrees ±22.5 degrees) ☐ Wide operating temperature range (-18°C to +71°C) ☐ Two year warranty on entire encoder (5 Years for the IR LED light source)

MECHANICAL SPECIFICATIONS

☐ **Construction:** Anodized aluminum totally sealed ☐ **Shaft Speed:** 3000 RPM maximum recommended. See bearing life chart ☐ **Shaft Acceleration/Deceleration:** 100,000 radians/seconds^2 ☐ **Rotation:** Bi-directional ☐ **End Play:** .001 inches (0.025 mm) ☐ **Radial Play:** .001 inches (0.025 mm) ☐ **Shaft run out (maximum):** .001 TIR (with reference to 1.2500 pilot at 1 inch from mounting face) ☐ **Bearing Thrust (maximum):** 35 lbs. (156 N) ☐ **Radial Force (maximum):** 35 lbs. (156 N) ☐ **Start Torque (maximum):** 1.25 ounce-inch (8.8 x 10^{-3} newton centimeters) ☐ **Moment of Inertia:** 0.4 x 10^{-3} oz -in-sec^2 (0.28 gm-cm-sec^2) ☐ **Weight (including connector):** 10 oz. (270 gr) ☐ **Connector:** Models 00 and 01 MS3102E-16S-1P or equivalent • Models 02 and 03 MS3102E-18S-1P or equivalent ☐ **Bearing:** Instrument quality ☐ **Bearing Lubrication:** Andok "C" Lube

ELECTRICAL SPECIFICATIONS

☐ **Resolution:** 1 to 5400 CPR (86,400 PPR with interpolation and multiplier logic) ☐ **Frequency:** A, B(A,B) includes zero index response at stated A,B frequency Lowest of: 100 kHz or ((3000 RPM) ÷ (60 sec ÷ min)) x resolution ☐ **Light Source:** Single high power (IR LED) Gallium aluminum arsenide (GaAlAs) hermetically sealed 80ma power ☐ **Light Warranty:** 5 years (see warranty statement) ☐ **Phase Relationship:** 90 ±22.5 electrical degrees (1/8 cycle worst case) ☐ **Input Power (Square Wave Output):** 5 Volt Model +5VDC ±10% 150mA • 12 Volt Model +12VDC ±10% 150mA ☐ **Output Characteristics:** 5 Volt Model TTL Output Source - 400µa @ +2.4VDC min Sink 16mA @ +0.4VDC max. • 12 Volt Model Output source impedance 1K ohm to 12VDC. Sink 10mA @ +0.3VDC max. • 15 Volt Model Output source impedance 1K ohm to 15VDC Sink 10mA @ +0.3VDC max. ☐ **Rise and Fall Time:** 5 Volt Model 0.1 µsec max. • 12 Volt Model 1.5 µsec max. • 15 Volt Model 1.5 µsec max. ☐ **Zero Index (optional):** 1/4 cycle gated pulse (standard)

The above encoders are only 3 of the more than 15 series offered. Call or write for a complete catalog.

Data Technology, Inc.
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MINIGLOSSARY
ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

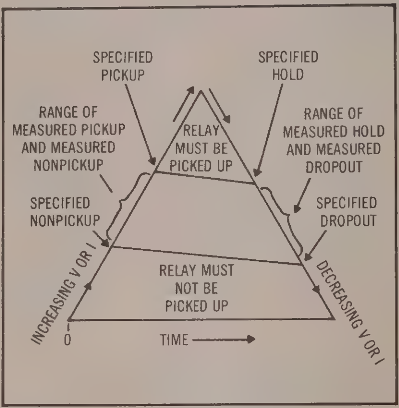
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.


SPECIFIED PICKUP
SPECIFIED HOLD
RANGE OF MEASURED PICKUP AND MEASURED NONPICKUP
RELAY MUST BE PICKED UP
RANGE OF MEASURED HOLD AND MEASURED DROPOUT
SPECIFIED NONPICKUP
SPECIFIED DROPOUT
RELAY MUST NOT BE PICKED UP
INCREASING V OR I
DECREASING V OR I
0
TIME

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

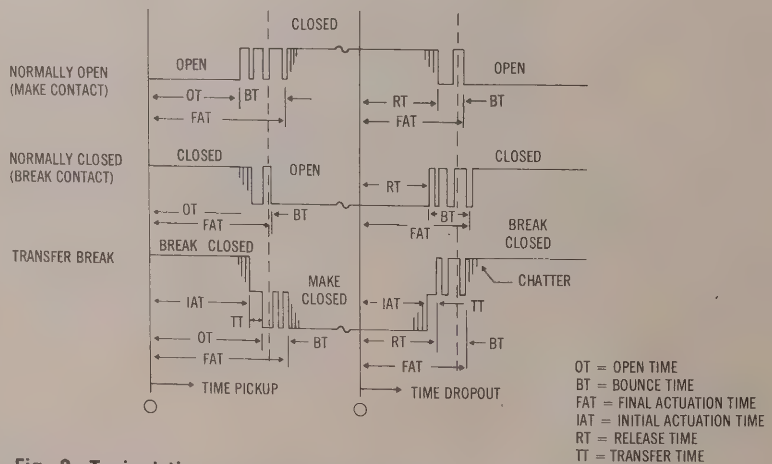

CLOSED
NORMALLY OPEN (MAKE CONTACT)
OPEN
OT
BT
FAT
RT
OPEN
NORMALLY CLOSED (BREAK CONTACT)
CLOSED
OPEN
CLOSED
TRANSFER BREAK
BREAK CLOSED
MAKE CLOSED
BREAK CLOSED
CHATTER
IAT
TT
TIME PICKUP
TIME DROPOUT
0
OT = OPEN TIME
BT = BOUNCE TIME
FAT = FINAL ACTUATION TIME
IAT = INITIAL ACTUATION TIME
RT = RELEASE TIME
TT = TRANSFER TIME

Fig. 2. Typical time vs. current (non-inductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

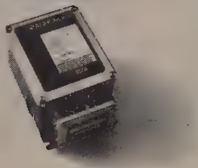
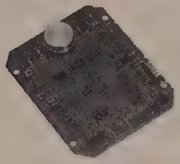
Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

ASHCROFT®

Pressure Transducers

	Models	Applications	Measurement Type	Ranges	Accuracy	Wetted Material	Output Signal
	K1	General/Industrial Intrinsically Safe	Gauge Sealed	15-300 PSIG 500-20,000 PSIS Vacuum & Compound	0.5% F.S. 1.0% F.S.	316 S.S. and 17-4 Ph.	4-20 mA 1-5 VDC 1-6 VDC 0-5 VDC
	KR	Process Plant Refrigeration EMI/RFI Protection	Gauge Absolute	15-500 PSIG 15-300 PSIG	0.5% 1.0%	316 S.S. Hastelloy-C Tantalum	4-20 mA 1-5 VDC 1-6 VDC
	KS	Sanitary Ultra Pure Tank Level	Gauge	5-300 PSIG	1.0% 0.5%	316 S.S.	4-20 mA 1-5 VDC
	IXLdp	Fume Hood Control Emission Flow Monitoring NEMA 4X Intrinsically Safe	Differential	0.05" W.C. to 800" W.C.	0.5% 0.25%	Glass, Silicon RTV Aluminum	4-20 mA 1-5 VDC ±2.5 VDC ±5.0 VDC
	XLdp	Energy Management Systems Medical Breathing Circuit Clean Room Monitoring Leak Detection	Differential	0.1" W.C. to 50" W.C.	1.0% 0.5% 0.25%	Glass,Silicon Aluminum	4-20 mA 1-5 VDC 1-6 VDC
	K2	Industrial OEM	Gauge Sealed	30 to 300 PSIG 500 to 10,000 PSIG	1% 0.5%	316 S.S. and 17-4 Ph.	2 mV/V 3 mV/V 5 mV/V 10 mV/V
	K8	Industrial OEM	Gauge Sealed	45 to 300 PSIG 500 to 10,000 PSIG Vacuum & Compound	1% 0.5%	316 S.S. and 17-4 Ph.	Millivolt
	M1	Medical OEM	Gauge Absolute	5-300 PSIG	1%	Silicon, RTV, BUNA-N, Aluminum	1-4 VDC .5-4.5 VDC 1-5 VDC 4-20 mA

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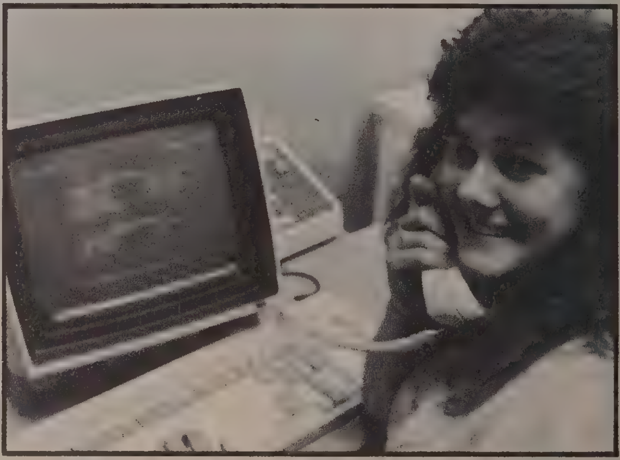

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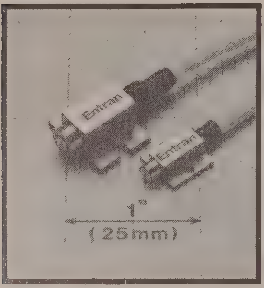
EGA –					
MODEL	125-10D 125F-10D	125-25D 125F-25D	125-100D 125F-100D	125-250D 125F-250D	125-1000D
RANGE	±10 g	±25 g	±100 g	±250 g	±1000 g
OVERRANGE	±50 g	±125 g	±500 g	±1250 g	±3000 g

EGAX –					
MODEL	10 F-10	25 F-25	100 F-100	250 F-250	1000
RANGE	±10 g	±25 g	±100 g	±250 g	±1000 g
OVERRANGE[3]	10,000 g				

EGE-72 Test Instrumentation & Automotive Accelerometers

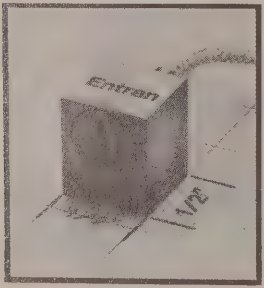


The EGE-72, with its industry standard "footprint" for system testing of shock, vibration and linear accelerations is used for crash, sled, dummy and performance testing of all types. It has a built-in "1/2 - bridge" of fixed resistors suitable for shunt calibration and is compatible with many standard test systems.

EGE –			
MODEL	72BM-200F	72B-2000F	72B3N*-2000F
RANGE	±200 g	±2000 g	±2000 g
OVERRANGE[4] (SHOCK)	±2000 g	±5000 g	±5000 g

* Undamped

EGC-500DS Heavy Duty Accelerometers



The EGC-500DS is a heavy duty accelerometer. Created for on-site testing where rugged construction and overload protection is of paramount importance. Damped and fitted with mechanical stops to impede overload response. The EGC-500DS is ideal for static and dynamic acceleration, vibration and shock measurements, the workhorse of test engineers.

EGC-500DS –						
MODEL	5	20	50	100	200	1000
RANGE	±5 g	±20 g	±50 g	±100 g	±200 g	±1000 g
OVERRANGE	±50 g	±200 g	±500 g	±1000 g	±2000 g	±10,000 g

SPECIFICATIONS

MODEL	EGA/EGC	EGE
NON-LINEARITY	±1%	±2%
TRANSVERSE SENS.	3% max.	
[1]THERMAL ZERO	±1%F.S./100°F (50°C)	±25 mV
THERMAL SENS./ 100°F/50°C	±2½ % (+1 to –4%/F for EGAX	±5%
[2]DAMPING	0.7 cr. 0.4 cr. min 1 cr. max.	EGE-72B3 Not Damped
USEFUL FREQ. RANGE	30% to 50% Res. Freq.	

	EGA/EGC	EGE
INPUT IMPEDANCE nom.	1000 Ω typ., 500 Ω min	750 Ω
OUTPUT IMPEDANCE nom.	450 Ω	750 Ω
EXCITATION	15VDC	10V
COMPENSATED TEMP.	70°F to 170°F (21°C to 77°C)	0° to 150°F (–18° to 66°C)
OPERATING TEMP.	–40°F to 250°F (–40°C to 121°C)	0° to 150°F (–18° to 66°C)
WEIGHT (without leads) grams nom.	EGA, EGAX: ½ EGC-500DS: 20	72B & B3N: 1 72BM: 3

[1] Zero offset of ±15 mV typ at 80°F after warm-up for EGA and EGC. ±25 mV for EGE. [2] Damping factor is a function of temperature and is specified at 80°F.
[3] In sensitive axis only. [4] Half-Sine, 1ms or longer for 2000g, 200μ s or longer for 5000g. Overrange in sinusoidal is 2x range up to 2000g units, 2.5x range above.

This bulletin references Entran's specifications EGAS-187D, EGAXS-187D, EGDAMP-187A and EGC500DS-187D.
Refer to Entran's Accelerometer Instruction and Selection Manual for interpretation of all specifications and proper usage.

Fast Delivery

Pressure Sensors:	1-9	10-24
EGA-125-D	$379.	$360.
EGAX	$495.	$470.
EGC-500DS	$429.	$408.
EGE72B & B3	$516.	$492.
EGE-72BM	$572.	$545.
EGA3-MTG	$299.	

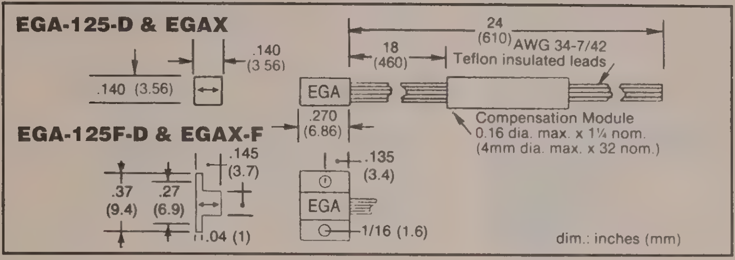
To Order, Call
In USA & Canada: 1-800-635-0650
In UK: (0923) 893 999
In Europe: 33(1)30.55.49.85

EGA –

MODEL	125-10D 125F-10D	125-25D 125F-25D	125-100D 125F-100D	125-250D 125F-250D	125-1000D
SENSITIVITY nom.	12 mV/g	5 mV/g	2.5 mV/g	1 mV/g	0.25 mV/g
RESONANT FREQ. nom.	500 Hz	1000 Hz	1500 Hz	2000 Hz	4000 Hz

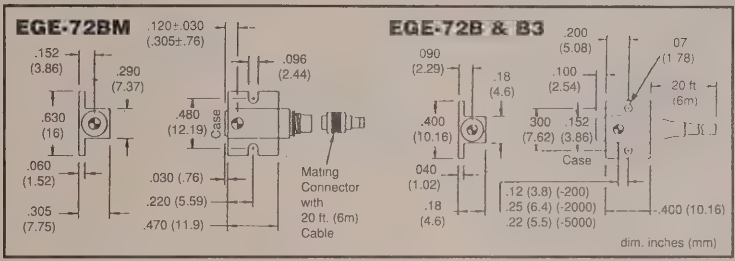
EGAX –

MODEL	10 F-10	25 F-25	100 F-100	250 F-250	1000
SENSITIVITY nom.	8 mV/g	4 mV/g	2 mV/g	1 mV/g	0.25 mV/g
RESONANT FREQ. nom.	600 Hz	1200 Hz	1700 Hz	2000 Hz	4000 Hz


EGA-125-D & EGAX
.140 (3.56)
.140 (3 56)
EGA-125F-D & EGAX-F
.145 (3.7)
.37 (9.4)
.27 (6.9)
.04 (1)
24 (610)
18 (460)
AWG 34-7/42 Teflon insulated leads
EGA
.270 (6.86)
Compensation Module 0.16 dia. max. x 1¼ nom. (4mm dia. max. x 32 nom.)
.135 (3.4)
1/16 (1.6)
dim.: inches (mm)

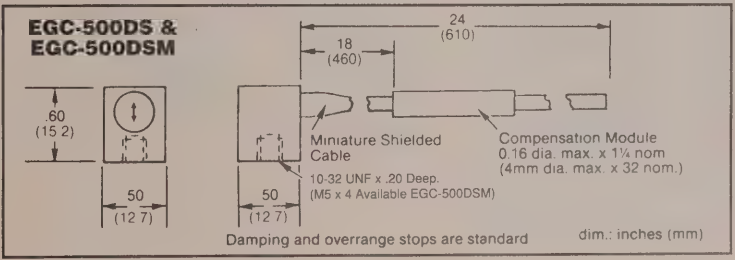
EGE –

MODEL	72BM-200F	72B-2000F	72B3N-2000F
SENSITIVITY nom.	2.5 mV/g	0.25 mV/g	0.20 mV/g
FREQ. RESPONSE nom. ±5%	1000 Hz	2500 Hz	3000 Hz

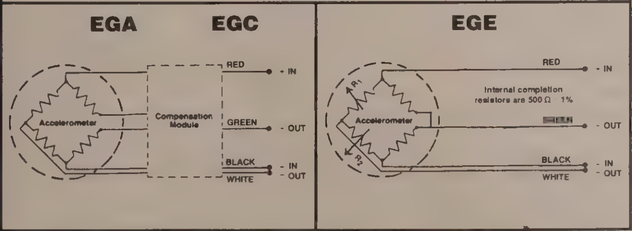

EGE-72BM
.120±.030 (.305±.76)
.152 (3.86)
.290 (7.37)
.096 (2.44)
.630 (16)
.480 (12.19)
Case
.060 (1.52)
.030 (.76)
.220 (5.59)
.470 (11.9)
.305 (7.75)
Mating Connector with 20 ft. (6m) Cable
EGE-72B & B3
090 (2.29)
.18 (4.6)
.100 (2.54)
.200 (5.08)
07 (1 78)
20 ft (6m)
.400 (10.16)
300 (7.62)
.152 (3.86)
Case
040 (1.02)
.18 (4.6)
.12 (3.8) (-200)
.25 (6.4) (-2000)
.22 (5.5) (-5000)
.400 (10.16)
dim. inches (mm)

EGC-500DS –

MODEL	5	20	50	100	200	1000
SENSITIVITY nom.	25 mV/g	10 mV/g	4 mV/g	2 mV/g	1 mV/g	0.2 mV/g
RESONANT FREQ. nom.	370 Hz	800 Hz	1500 Hz	2300 Hz	2800 Hz	4000 Hz

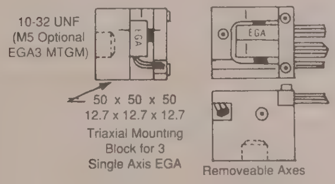

EGC-500DS & EGC-500DSM
.60 (15 2)
50 (12 7)
50 (12 7)
24 (610)
18 (460)
Miniature Shielded Cable
Compensation Module 0.16 dia. max. x 1¼ nom (4mm dia. max. x 32 nom.)
10-32 UNF x .20 Deep. (M5 x 4 Available EGC-500DSM)
Damping and overrange stops are standard
dim.: inches (mm)

WIRING


EGA
EGC
Accelerometer
Compensation Module
RED
+ IN
GREEN
- OUT
BLACK
- IN
WHITE
- OUT
EGE
R1
R2
Internal completion resistors are 500 Ω 1%
RED
+ IN
- OUT
BLACK
- IN
WHITE
- OUT

EGA3-MTG Triaxal Mounting Block for EGA and EGAX

(Purchase accelerometers separately from mounting block)


10-32 UNF (M5 Optional EGA3 MTGM)
EGA
.50 x .50 x .50
12.7 x 12.7 x 12.7
Triaxial Mounting Block for 3 Single Axis EGA
Removeable Axes

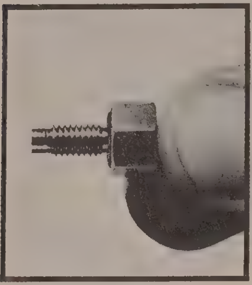
Specifications subject to change without notice.

Entran®Direct "Off-The-Shelf"

— Pressure Sensors —

Other models and ranges available from our full product brochure.

EPX Miniature Threaded Pressure Sensors

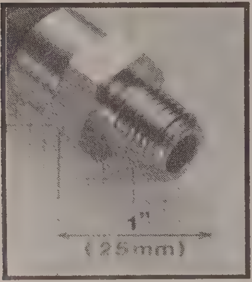


Entran's EPX pressure sensor has a unique design based on mounting ease and flexibility. The EPX offers an optimum combination of characteristics which permit static and dynamic pressure measurements when small size is of prime importance. Its beam welded stainless steel diaphragm, 10-32 UNF or M5 Metric thread and built-in O-ring seal allow simple mounting to test objects and use in corrosive media compatible with 304SS and APX4 with appropriate O-ring material.

EPX-10IW –								
MODEL	-10	-50	-100	-250	-500	-1000	-2500	-5000
RANGE (Gauge/Relative) psi	10	50	100	250	500	1000	2500	5000
OVERRANGE psi	5X Range	2X Range					1.6X Range	1.2X Range

EPX-M5IW –								
METRIC MODEL	-0.7	-3.5	-7	-15	-35	-70	-150	-350
RANGE (Gauge/Relative) bar	0.7	3.5	7	15	35	70	150	350
OVERRANGE bar	5X Range	2X Range					1.6X Range	1.2X Range

EPO Industrial Pressure Sensors

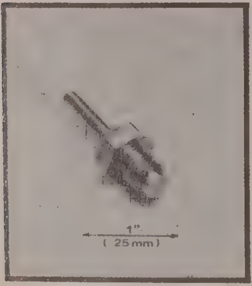


Entran's EPO Industrial pressure sensors, although designed to be economical in cost, have a corrosion resistant stainless steel diaphragm and many of the features of its higher cost relatives. The standard unit is complete with a built-in pipe thread for sealing, internal electrical circuitry and fitted with an electrical connector.

EPO-W01 –						
MODEL	-15P	-50P	-100P	-250P	-500P	-1000P
RANGE (Gauge/Relative) psi	15	50	100	250	500	1000
OVERRANGE psi	3X Range	2X Range				1.5X Range

EPO-W01 –						
METRIC MODEL	-1B	-3.5B	-7B	-15B	-35B	-70B
RANGE (Gauge/Relative) bar	1	3.5	7	15	35	70
OVERRANGE bar	3X Range	2X Range				1.5X Range

EPNM High Stability Pressure Sensors



The EPNM pressure sensors have been designed for applications requiring high stability of the zero offset over a long period of use. Their beam weld diaphragm can be used in fluids compatible with APX-4 stainless steel with an appropriate ring seal. The EPNM is also available with a built-in amplifier providing a 5V Full Scale output.

EPNM-38 –				
MODEL	-150	-300	-1000	-3000
RANGE (Sealed) psi	150	300	1000	3000
OVERRANGE psi	200	450	1500	4500

EPNM-M10 –				
METRIC MODEL	10	20	70	200
RANGE (Sealed) bar	10	20	70	200
OVERRANGE bar	15	30	100	300

SPECIFICATIONS

	EPX	EPO	EPNM		EPX	EPO	EPNM
EXCITATION	10VDC	10VDC	5VDC	COMPENSATED TEMP.	70°F to 170°F (21°C to 77°C)		32°F to 140°F (0°C to 60°C)
ELECTRICAL INPUT	1200 Ω typ. 350 Ω min.	1000 Ω typ. 500 Ω min.	1000 Ω nom.	OPERATING TEMP.	–40°F to 250°F (–40°C to 121°C)		–40°F to 350°F (–40°C to 175°C)
ELECTRICAL OUTPUT	350 Ω nom.	500 Ω nom.	1000 Ω nom.	THERMAL ZERO/100°F	50 (3.5) : ±1 mV >50 (3.5) : ±1.5%FS	±2½%FS	±1%FS
NON LIN & HYST. %FS	50: ±1 100: ± ¾ >100psi: ± ½	±1%FS	± ¾% FS	THERMAL SENS./100°F	±2%FS	±2½%FS	±1%FS
RESOLUTION	Infinite			ZERO OFFSET typ (70°F 20°C)	±10mV	±15mV	±5%FS

This bulletin references Entran's specifications EPXS-187D, FEPNMS-891A.
Refer to Entran's Pressure Transducer Instruction and Selection Manual for interpretation of all specifications and proper usage.

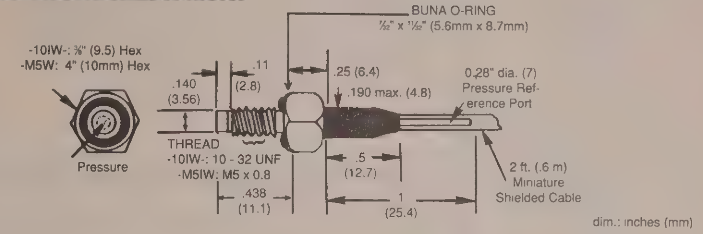
Fast Delivery

To Order, Call
In USA & Canada: 1-800-635-0650
In UK: (0923) 893 999
In Europe: 33(1)30.55.49.85

Pressure Sensors:	1-4	5-24
EPX-10IW & EPX-M5IW	$484.	$439.
EPO	$195.	$185.
EPNM-38 & EPNM-M1O	$469.	$425.

EPX-10IW –								
MODEL	-10	-50	-100	-250	-500	-1000	-2500	-5000
SENSITIVITY nom. mV/psi	2.5	1.5	1.2	.5	.25	.12	.05	.025
¹RESONANT FREQ. nom.	50 KHz	75 KHz	80 KHz	120 KHz	150 KHz	200 KHz	300 KHz	450 KHz
EPX-M5IW –								
METRIC MODEL	-0.7	-3.5	-7	-15	-35	-70	-150	-350
SENSITIVITY (nom.) mV/bar	35	20	17	8	3.5	1.7	.8	.35
¹RESONANT FREQ. nom.	50 KHz	75 KHz	80 KHz	120 KHz	150 KHz	200 KHz	300 KHz	450 KHz

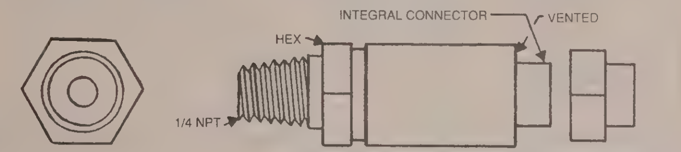
EPX-10IW & EPX-M5IW


BUNA O-RING
⅞₂" x ¹¹⁄₃₂" (5.6mm x 8.7mm)
-10IW-: ⅜" (9.5) Hex
-M5W: 4" (10mm) Hex
.140 (3.56)
.11 (2.8)
.25 (6.4)
.190 max. (4.8)
0.28" dia. (7) Pressure Reference Port
Pressure
THREAD
-10IW-: 10 - 32 UNF
-M5IW: M5 x 0.8
.5 (12.7)
.438 (11.1)
1 (25.4)
2 ft. (.6 m) Miniature Shielded Cable

dim.: inches (mm)

EPO-W01 –						
MODEL	-15P	-50P	-100P	-250P	-500P	-1000P
SENSITIVITY (nom.) mV/psi	5	2.4	1.2	.5	.25	.12
USEFUL FREQUENCY nom.	1 KHz					
EPO-W01 –						
METRIC MODEL	-1B	-3.5B	-7B	-15B	-35B	-70B
SENSITIVITY nom. mV/bar	75	34	14	8	4	2
USEFUL FREQUENCY nom.	1 KHz					

EPO-WO1


INTEGRAL CONNECTOR
VENTED
HEX
1/4 NPT

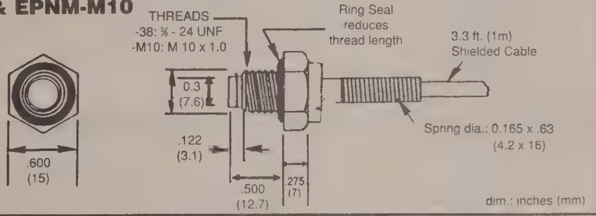
dim.: inches (mm)

TO ORDER MATING CONNECTOR WITH 3 FT SHIELDED CABLE ORDER MODEL NO. CEPO-3

UNWIRED MATE SUPPLIED WITH UNIT

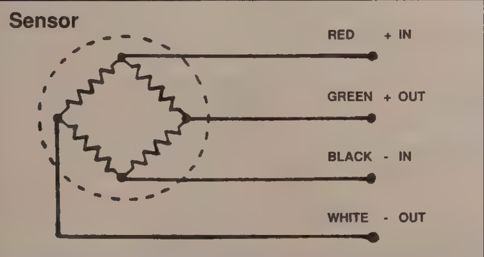
EPNM-38 –				
MODEL	150	300	1000	3000
SENSITIVITY nom.	9 mV F.S. nominal			
¹RESONANT FREQ. nom.	30 KHz	50 KHz	95 KHz	150 KHz
EPNM-M10 –				
METRIC MODEL	10	20	70	200
SENSITIVITY nom.	9 mV F.S. nominal			
¹RESONANT FREQ. nom.	30 KHz	50 KHz	95 KHz	150 KHz

EPNM-38 & EPNM-M10


THREADS
-38: ⅜ - 24 UNF
-M10: M 10 x 1.0
Ring Seal reduces thread length
3.3 ft. (1m) Shielded Cable
0.3 (7.6)
Spring dia.: 0.165 x .63 (4.2 x 16)
.600 (15)
.122 (3.1)
.500 (12.7)
.275 (7)

dim.: inches (mm)

WIRING


Sensor
RED + IN
GREEN + OUT
BLACK - IN
WHITE - OUT

INSTALLATION

INSTALLATION TORQUE EPX		INSTALLATION TORQUE EPNM	
PRESSURE RANGE	IN-LB	PRESSURE RANGE	IN-LB
0 to 50 psi	5	150 to 7500 psi	8
60 to 500 psi	10		
600 to 5000 psi	15		

¹Useful Frequency Range is 20% of Resonant Frequency.

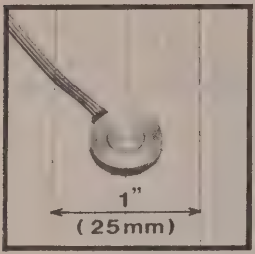
Specifications subject to change without notice.

Entran®Direct "Off-The-Shelf"

— Load Cells —

Other models and ranges available from our full product brochure.

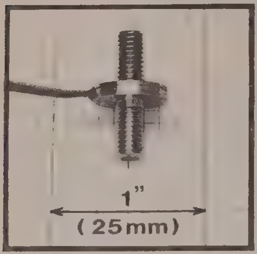
ELF-500 & ELF-13 Miniature Disc Load Cells



Entran's ELF-500 and ELF-13 are the last word in miniaturized load measurement. An incredible 0.11" (2.8mm) in thickness up to 50 lb. (250 N) range with a 0.5" (12.7mm) diameter. The ELF-500 measures both steady state and dynamic compression loads. As they are designed for minimum profile, off-axis loading cannot be isolated due to the absence of flexures.

ELF-500 –						
MODEL	1	5	10	20	50	100
[4]RANGE	1 lbs	5 lbs	10 lbs	20 lbs	50 lbs	100 lbs
[2,4]OVERRANGE	2 lbs	10 lbs	15 lbs	30 lbs	75 lbs	125 lbs
ELF-13 –						
METRIC MODEL	5	25	50	100	250	500
[4]RANGE	5 N	25 N	50 N	100 N	250 N	500 N
[2,4]OVERRANGE	10 N	50 N	75 N	150 N	375 N	625 N

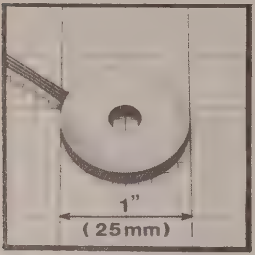
ELF-TC500 & ELF-TC13 Miniature Load Cells with Threaded Studs



Entran's ELF-TC500 and ELF-TC13 are the tension/compression stud mounted versions of the ELF-500 and ELF-13, measuring both static and dynamic loads. The ELF-TC500 has 10-32 UNF threads and is calibrated in lbs., while the ELF-TC13 has M5 x 0.8 metric threads and is calibrated in Newtons. Designed for minimum profile, off-axis loading cannot be isolated due to the absence of flexures.

ELF-TC500 –						
MODEL	1	5	10	20	50	100
[4]RANGE	1 lbs	5 lbs	10 lbs	20 lbs	50 lbs	100 lbs
[2,4]OVERRANGE	2 lbs	10 lbs	15 lbs	30 lbs	75 lbs	125 lbs
ELF-TC13 –						
METRIC MODEL	5	25	50	100	250	500
[4]RANGE	5 N	25 N	50 N	100 N	250 N	500 N
[2,4]OVERRANGE	10 N	50 N	75 N	150 N	375 N	625 N

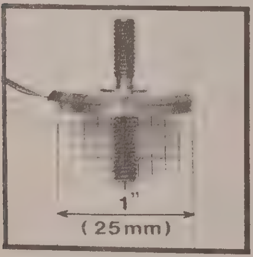
ELF-1000 & ELF-26 Flatline Load Cells



Entran's ELF-1000 and ELF-26 Flatline Load Cells provide the user with applications flexibility as a flat disc or washer shaped load cell. Its high level output of 250mV measures steady state and dynamic compression loads with very low definition, and is available calibrated in either lbs. or Newtons. Off-axis loading cannot be isolated due to the absence of flexures.

ELF-1000 –						
MODEL	10	25	100	250	1000	2500
[4]RANGE	10 lbs	25 lbs	100 lbs	250 lbs	1000 lbs	2500 lb
[2,4]OVERRANGE	20 lbs	50 lbs	200 lbs	500 lbs	1500 lbs	3000 lbs
ELF-26 –						
METRIC MODEL	50	100	500	1000	5000	10,000
[4]RANGE	50 N	100 N	500 N	1000 N	5000 N	10,000 N
[2,4]OVERRANGE	100 N	200 N	1000 N	2000 N	7500 N	12,000 N

ELF-TC1000 & ELF-TC26 Flatline Load Cells with Threaded Studs



Entran's ELF-TC1000 and ELF-TC26 are the tension/compression stud mounted versions of the ELF-1000 and ELF-26. They measure both steady state and dynamic loads and are available with either U.S. (English) or metric threads. Off-axis loading cannot be isolated due to the absence of flexures.

ELF-TC1000 –				
MODEL	10	25	100	250
[4]RANGE	10 lbs	25 lbs	100 lbs	250 lbs
[2,4]OVERRANGE	20 lbs	50 lbs	200 lbs	500 lbs
ELF-TC26 –				
METRIC MODEL	50	100	500	1000
[4]RANGE	50 N	100 N	500 N	1000 N
[2,4]OVERRANGE	100 N	200 N	1000 N	2000 N

SPECIFICATIONS			
NON-LINEARITY	±1%F.S.	INPUT IMPEDANCE nom.	2000 Ω nom. typ. (1000 Ω min.)
HYSTERESIS	±1%F.S.	OUTPUT IMPEDANCE nom.	1000 Ω nom.
THERMAL ZERO	±1%F.S./100°F	EXCITATION	15VDC
THERMAL SENSITIVITY	±2½%F.S./100°F	COMPENSATED TEMP.	70°F to 170°F (21°C to 77°C)
ZERO OFFSET (80°F)	±15mV	OPERATING TEMP.	–40°F to 250°F (–40°C to 121°C)

[1] Useful Frequency range is 20% of Resonant Frequency. [2] Overrange for use within Useful Frequency. [3] Valid for unloaded ELF-500 and ELF-1000 basic units without studs.
[4] Must be loaded perpendicular and on center, distributed over loading surface.

This bulletin references Entran's specifications ELF500/13-591 and ELF1000/26-591.
Refer to Entran's Load Cell Instruction and Selection Manual for interpretation of all specifications and proper usage.

Fast Delivery

Load Cells:	**1-9**	**10-24**
ELF-500 & ELF-13	$385.	$375.
ELF-TC500 & ELF-TC13	$485.	$461.
ELF-1000 & ELF-26	$450.	$428.
ELF-TC1000 & ELF-TC26	$555.	$528.

To Order, Call
In USA & Canada: 1-800-635-0650
In UK: (0923) 893 999
In Europe: 33(1)30.55.49.85

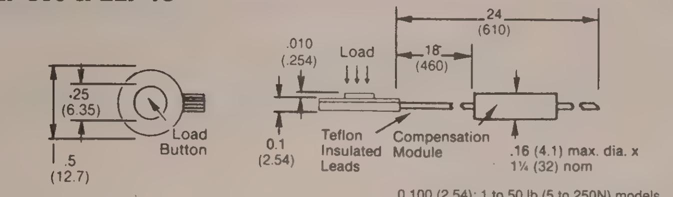
ELF-500 –

MODEL	1	5	10	20	50	100
SENSITIVITY nom.	75 mV/lb	40 mV/lb	25 mV/lb	12.5 mV/lb	5 mV/lb	2.5 mV/lb
COMPLIANCE	> 1000 Hz typ. with deflection. < 500 µin. (13 µm) F.S. nom. for all ranges.					

ELF-13 –

METRIC MODEL	5	25	50	100	250	500
SENSITIVITY nom.	15 mV/N	8 mV/N	5 mV/N	2.5 mV/N	1 mV/N	0.5 mV/N
COMPLIANCE	> 1000 Hz typ. with deflection. < 500 µin. (13 µm) F.S. nom. for all ranges.					

ELF-500 & ELF-13


.010
(.254)
Load
24
(610)
18
(460)
.25
(6.35)
Load Button
.5
(12.7)
0.1
(2.54)
Teflon Insulated Leads
Compensation Module
.16 (4.1) max. dia. x
1¼ (32) nom

dim.: inches (mm)

0.100 (2.54): 1 to 50 lb (5 to 250N) models
0.150 (3.81): above 50 lb (250N) models

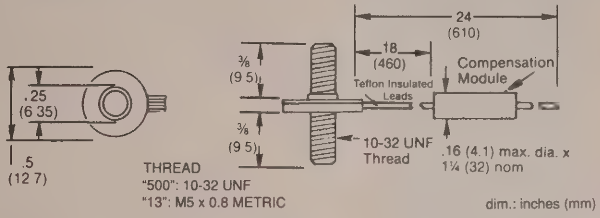
ELF-TC500 –

MODEL	1	5	10	20	50	100
SENSITIVITY nom.	75 mV/lb	40 mV/lb	25 mV/lb	12.5 mV/lb	5 mV/lb	2.5 mV/lb
COMPLIANCE	> 1000 Hz typ. with deflection. < 500 µin. (13 µm) F.S. nom. for all ranges.					

ELF-TC13 –

METRIC MODEL	5	25	50	100	250	500
SENSITIVITY nom.	15 mV/N	8 mV/N	5 mV/N	2.5 mV/N	1 mV/N	0.5 mV/N
COMPLIANCE	> 1000 Hz typ. with deflection. < 500 µin. (13 µm) F.S. nom. for all ranges.					

ELF-TC500 & ELF-TC13


24
(610)
18
(460)
Compensation Module
Teflon Insulated Leads
⅜
(9 5)
⅜
(9 5)
.25
(6 35)
.5
(12 7)
10-32 UNF Thread
.16 (4.1) max. dia. x
1¼ (32) nom
THREAD
"500": 10-32 UNF
"13": M5 x 0.8 METRIC

dim.: inches (mm)

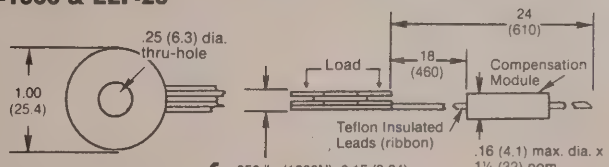
ELF-1000 –

MODEL	10	25	100	250	1000	2500
SENSITIVITY nom.	250 mV nom. Full Scale.					
COMPLIANCE	> 200 Hz typ. with deflection. < 500 µin. (13 µm) F.S. typ. for all ranges.					

ELF-26

METRIC MODEL	50	100	500	1000	5000	10,000
SENSITIVITY nom.	250 mV nom. Full Scale.					
COMPLIANCE	> 200 Hz typ. with deflection. < 500 µin. (13 µm) F.S. typ. for all ranges.					

ELF-1000 & ELF-26


.25 (6.3) dia.
thru-hole
1.00
(25.4)
Load
24
(610)
18
(460)
Compensation Module
Teflon Insulated Leads (ribbon)
.16 (4.1) max. dia. x
1¼ (32) nom

dim.: inches (mm)

MODEL { <250 lb. (1000N): 0.15 (3.84)
1000 lb. (5000N): .340 (8.6)
2500 lb. (10,000N): .500 (12.7)

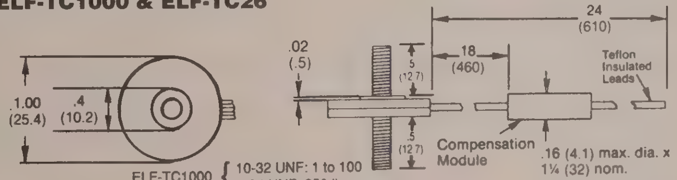
ELF-TC1000 –

MODEL	10	25	100	250
SENSITIVITY nom.	250 mV nom. Full Scale.			
COMPLIANCE	> 200 Hz typ. with deflection. < 500 µin. (13 µm) F.S. typ. for all ranges.			

ELF-TC26 –

METRIC MODEL	50	100	500	1000
SENSITIVITY nom.	250 mV nom. Full Scale.			
COMPLIANCE	> 200 Hz typ. with deflection. < 500 µin. (13 µm) F.S. typ. for all ranges.			

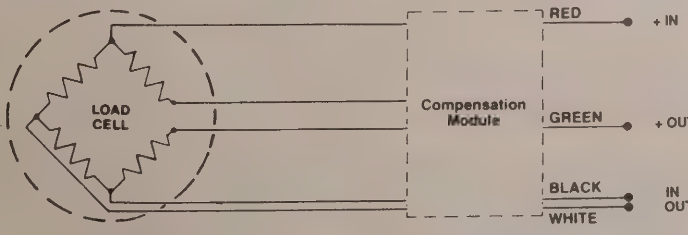
ELF-TC1000 & ELF-TC26


24
(610)
.02
(.5)
5
(12 7)
18
(460)
Teflon Insulated Leads
1.00
(25.4)
.4
(10.2)
.5
(12 7)
Compensation Module
.16 (4.1) max. dia. x
1¼ (32) nom.

ELF-TC1000 { 10-32 UNF: 1 to 100
⅜-24 UNF: 250 lb.

ELF-TC26 { M5 x 0.8: 10 to 500N
M10 x 100: 1000N

dim.: inches (mm)


LOAD CELL
Compensation Module
RED
+ IN
GREEN
+ OUT
BLACK
IN
OUT
WHITE

Specifications subject to change without notice.

Entran® Direct "Off-The-Shelf"

Matched Set of 4

1-2	3-6
$ 60.	$ 52.

—Strain Gages—

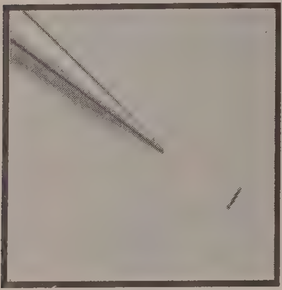
Other sizes and models available from our full product brochure.

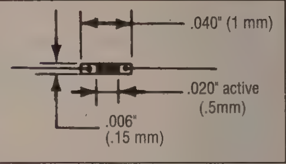
Bulk Box of 10

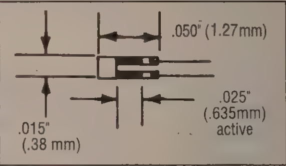
1-9	10-24
$ 75.	$ 50.

ES Series Semiconductor Strain Gages

Entran semiconductor strain gages are the primary sensing element in thousands of transducers around the world and are constantly employed by engineers and scientists for model studies and field test experimentation. Processed from P-type silicon in orientations which provide maximum sensitivity to applied strain, they are available in both "bar" and "U" shaped configurations. All Entran semiconductor strain gages are fabricated with high quality, first-grade materials and pure gold leads for maximum reliability. Areas as small as ⅛" in diameter can be gaged with a fully active four arm bridge. Apply them yourself or take advantage of our Gageing Service in the USA or Europe.



MODEL	SHAPE	R RESISTANCE nom.	[4]TCR nom.	GF-GAGE FACTOR nom.	[4]TCGF nom.	
ESB-020-350	Bar	350 Ω	+22%/100°F	+155	-18%/100°F	
ESB-020-500	Bar	500 Ω	+22%/100°F	+155	-18%/100°F	

MODEL	SHAPE	R RESISTANCE nom.	[4]TCR nom.	GF-GAGE FACTOR nom.	[4]TCGF nom.	
ESU-025-500	U	500 Ω	+14%/100°F	+140	-15%/100°F	
ESU-025-1000	U	1000 Ω	+22%/100°F	+155	-18%/100°F	

	MATCHED SETS OF 4	UNMATCHED BULK SETS OF 10
QUANTITY OF GAGES IN PACK	4	10
MATCHING (R)	R within ±2% of each other	R within ±10% of each other
R nom. (70°F)	Resistance in ohms, ±10%	Resistance in ohms, ±20%
GF nom. (70°F)	Gage Factor, $\frac{\Delta R/R}{\Delta L/L}$ ±5%	
[4]TCR nom.	Thermal Coefficient of Resistance, $\frac{(\Delta R/R)\%\pm3\%}{100°F}$ 70°F to 170°F (21°C to 77°C)	
[4]TCGF nom.	Thermal Coefficient of Gage Factor, $\frac{\Delta GF\%\pm3\%}{100°F}$ 70°F to 170°F (21°C to 77°C)	
GAGE TYPE	P-Type Silicon	
[1]STRAIN LEVEL	0-1000 µε recommended 0-3000 µε maximum	
[2]WATTAGE RATING (per gage)	0-25 mw recommended 50 mw maximum	
TEMP. RANGE	-100°F to +600°F (-73°C to 315°C)	
LEAD WIRES	Gold, 0.0015" diameter x 0.25" length min. (0.038mm dia. x 6.35 mm)	
YOUNG'S MODULUS	E=27 x 10^6 psi (1.9 x 10^6 kg/cm^2)	
WATTAGE	Watts=(Voltage on Gage)^2/(Gage Resistance)	
[3]SENSITIVITY(Vo)	Voltage Out= ¼ (No. Active Arms)(Gage Factor)(Strain Level)(Excitation Voltage) example: Fully active 4 Arm Bridge. GF=130. 500µε. 5V Exc. Vo= ¼ (4) (130) (500 x 10^6) (5V)=325mV	
BONDING	Apply thin Epoxy precoat for electrical isolation. Then apply bonding coat to substrate, place gage (handling by its leads only) on wet epoxy and align. Gage is held in position by surface tension only. DO NOT apply weights or force as this may damage the gage. Micro Measurements M-Bond 610 or equivalents are recommended.	

[1]µε=microstrain=strain in in/in x 10^6. [2]mw=milliwatt. [3]Equations assume bridge with adjacent tension and compression arms for additive outputs. [4]The actual values of TCR and TCGF greatly depend upon excitation voltage, heat sinking, temperature of use, mounting and prestrain and catalog values should not be used as absolute numbers for calculation of data for experimental or design use. TCR and TCGF, where important, must be calibrated after gage mounting.

This bulletin references Entrans's specification ESS-385A.

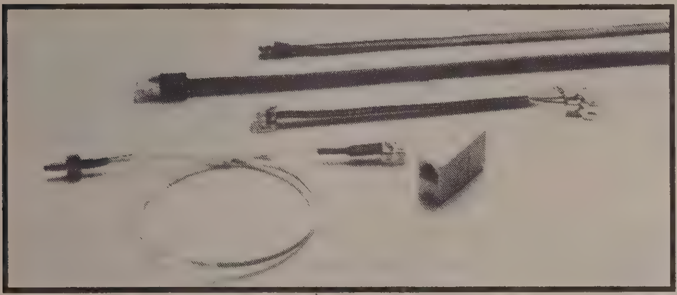
Specifications subject to change without notice.

Fast Delivery

To Order, Call
In USA & Canada: 1-800-635-0650
In UK: (0923) 893 999
In Europe: 33(1)30.55.49.85

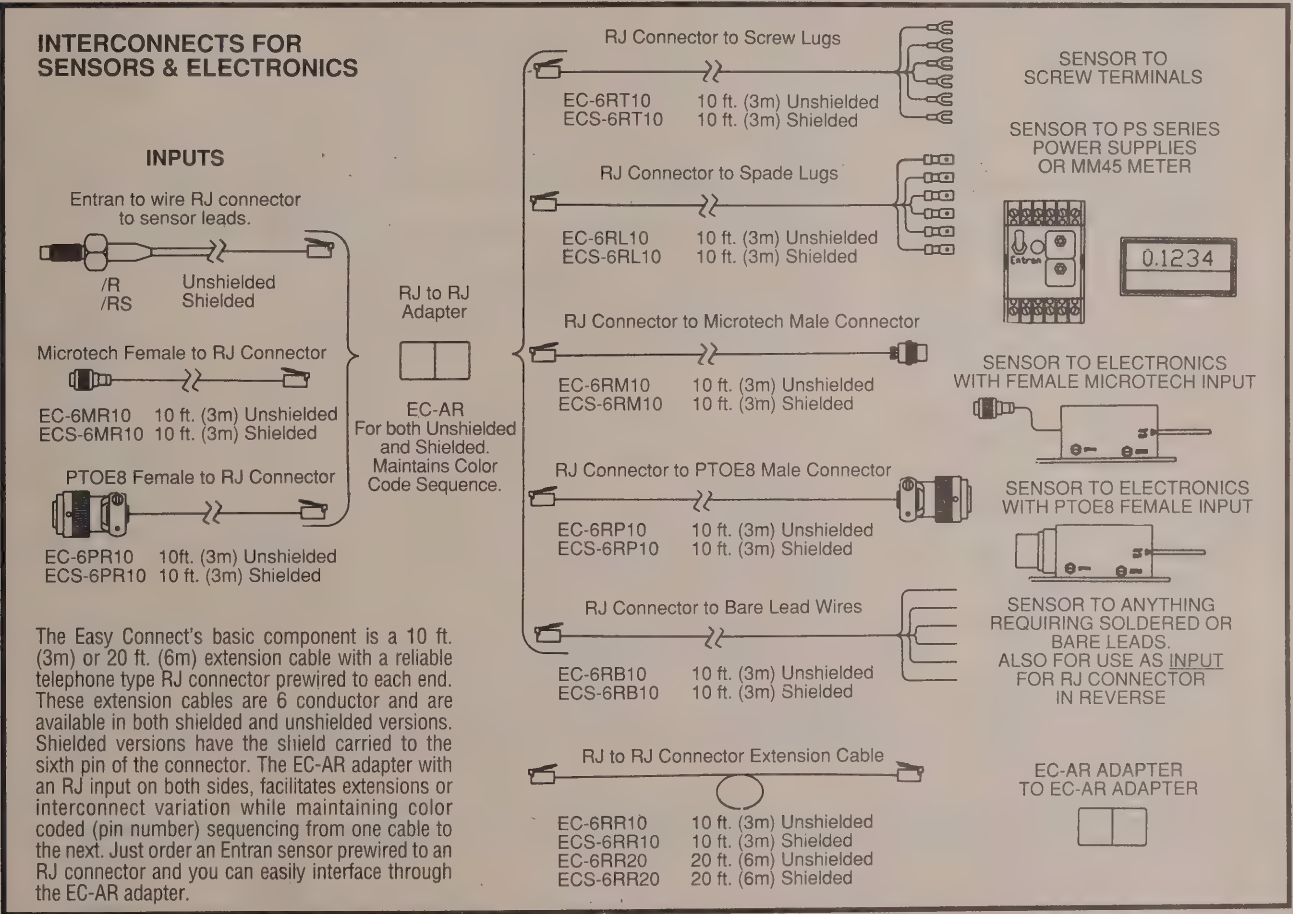
— Cables and Connectors —

"Easy Connect" Cable & Connector System



- PREWIRED CABLES AND CONNECTORS
- FAST AND EASY TO USE
- INEXPENSIVE

Interconnects made easy with Entran's new "Easy Connect" system. A complete line of prewired cables and connectors for use with most of Entran's product lines enable quick and easy installation. This broad range of cables will interconnect most Entran sensors with power supplies, amplifiers, meters and Hi/Lo setpoint modules as well as other types of instrumentation that you may already own.



INTERCONNECTS FOR SENSORS & ELECTRONICS

INPUTS

Entran to wire RJ connector to sensor leads.
/R Unshielded
/RS Shielded

Microtech Female to RJ Connector
EC-6MR10 10 ft. (3m) Unshielded
ECS-6MR10 10 ft. (3m) Shielded

PTOE8 Female to RJ Connector
EC-6PR10 10ft. (3m) Unshielded
ECS-6PR10 10 ft. (3m) Shielded

RJ to RJ Adapter
EC-AR
For both Unshielded and Shielded.
Maintains Color Code Sequence.

RJ Connector to Screw Lugs
EC-6RT10 10 ft. (3m) Unshielded
ECS-6RT10 10 ft. (3m) Shielded
SENSOR TO SCREW TERMINALS

RJ Connector to Spade Lugs
EC-6RL10 10 ft. (3m) Unshielded
ECS-6RL10 10 ft. (3m) Shielded
SENSOR TO PS SERIES POWER SUPPLIES OR MM45 METER

RJ Connector to Microtech Male Connector
EC-6RM10 10 ft. (3m) Unshielded
ECS-6RM10 10 ft. (3m) Shielded
SENSOR TO ELECTRONICS WITH FEMALE MICROTECH INPUT

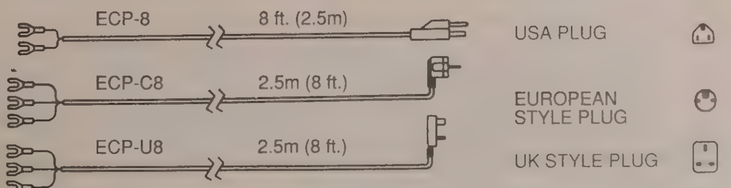
RJ Connector to PTOE8 Male Connector
EC-6RP10 10 ft. (3m) Unshielded
ECS-6RP10 10 ft. (3m) Shielded
SENSOR TO ELECTRONICS WITH PTOE8 FEMALE INPUT

RJ Connector to Bare Lead Wires
EC-6RB10 10 ft. (3m) Unshielded
ECS-6RB10 10 ft. (3m) Shielded
SENSOR TO ANYTHING REQUIRING SOLDERED OR BARE LEADS.
ALSO FOR USE AS INPUT FOR RJ CONNECTOR IN REVERSE

RJ to RJ Connector Extension Cable
EC-6RR10 10 ft. (3m) Unshielded
ECS-6RR10 10 ft. (3m) Shielded
EC-6RR20 20 ft. (6m) Unshielded
ECS-6RR20 20 ft. (6m) Shielded
EC-AR ADAPTER TO EC-AR ADAPTER

The Easy Connect's basic component is a 10 ft. (3m) or 20 ft. (6m) extension cable with a reliable telephone type RJ connector prewired to each end. These extension cables are 6 conductor and are available in both shielded and unshielded versions. Shielded versions have the shield carried to the sixth pin of the connector. The EC-AR adapter with an RJ input on both sides, facilitates extensions or interconnect variation while maintaining color coded (pin number) sequencing from one cable to the next. Just order an Entran sensor prewired to an RJ connector and you can easily interface through the EC-AR adapter.

POWER CORDS FOR MM45 METERS



USA POWER CORD (110V) — ECP-8 — 8 ft. (2.5m) — USA PLUG

CONTINENTAL EUROPE POWER CORD (220V) — ECP-C8 — 2.5m (8 ft.) — EUROPEAN STYLE PLUG

UK POWER CORD (220V) — ECP-U8 — 2.5m (8 ft.) — UK STYLE PLUG

This bulletin references Entran's specification ECS-792.

Specifications subject to change without notice.

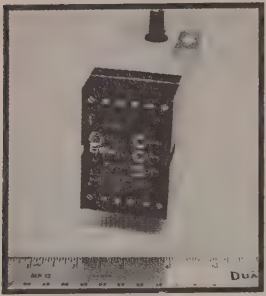
Entran® Direct "Off-The-Shelf"

PS-15 $199.
PS-30 $250.
PS-30A $445.

— Power Supplies —

Fast Delivery

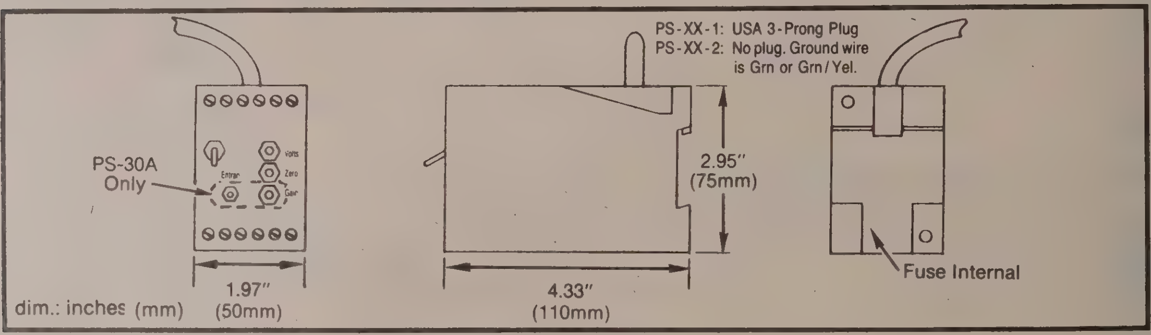
PS Series Power Supplies with Amplifier Option



Entran's new PS Series Power Supplies are a general purpose excitation source for strain gage bridge transducers and companion amplifiers. The PS Series is an ideal accessory for Entran accelerometers, pressure transducers, and load cells, as well as most standard bridge transducers on the market. Available in single and dual adjustable excitations or with a built-in adjustable gain amplifier, accepting 4-wire closed bridge or 5-wire open bridge configurations. The PS-15 is a single polar supply, the PS-30 is bipolar supply for use with external amplifiers requiring plus/minus excitation and the PS-30A features a built-in instrumentation amplifier. Any PS Series supply or amp can be used with the MM45 meter but use with the MM35 requires factory matching.

MOUNTING RAIL OPTION: PSR-3U: 3 UNITS PSR-7U: 7 UNITS PSR-19R: 19" RACK PSR-1M: 1 METER

MODEL	PS-15-1	PS-15-2	PS-30-1	PS-30-2	PS-30A-1	PS-30A-2
INPUT POWER 50 / 60 Hz	120 VAC	220/240 VAC	120 VAC	220/240 VAC	120 VAC	220/240 VAC
SENSOR EXCITATION	to 15 VDC adjustable		±1 to 15 VDC adjustable		±1 to 7.5 VDC adjustable	
CURRENT	100 mA max.		100 mA max.		100 mA max.	
SENSOR OUTPUT	X1 (not amplified)		X1 (not amplified)		X10 to X100 adjustable (0 to 10V)	
SENSOR ZERO	Adjustable for 5-wire open bridge transducer (50 Ω to either leg)				Adjustable for 4-wire closed and 5-wire open bridge sensor	



OPERATING PROCEDURE

1.) If desired, link the "E-Ground" to "C-Common" terminal on PS-30 or to "Output–" on PS-30A and to "Supply–" on PS-15 for non-isolated operation. Power unit through wall plug, turn on front panel switch, red light should activate.

2.) For PS-15: Connect DVM to Transducer "Supply+" and Transducer "Supply–" terminals and adjust "Volts" potentiometer for desired transducer excitation voltage. For PS-30: Connect DVM to Transducer "Supply+" and "C-Common" (use "Output–" on PS-30A instead of "C-Common" terminal) and adjust "Volts" potentiometer for desired transducer excitation voltage (both + and –voltages will be adjusted by this action). Move DVM to "Supply–" from "Supply+" to confirm correct voltage on "–" side.

3.) Connect transducer excitation leads to appropriate "Supply" terminals. Confirm that loaded power supply is providing desired voltage with DVM and fine adjust the "Volts" potentiometer if necessary.

4.) WITH STANDARD 4 WIRE BRIDGE TRANSDUCERS: Connect the transducer signal leads to "Signal+" and "Signal–" terminals.

5.) FOR 5 WIRE OPTION BRIDGE TRANSDUCERS (available from Entran): Connect the "Green+" output lead to the "Signal+" terminal and the "Blue+" output lead to the "5 Wire Zero" terminal. This will activate the "Zero" control potentiometer providing 50 Ω zero offset adjustability. Connect the "White–" lead to the "Signal–" terminal. The PS-30A uses active zero control without the 50 Ω potentiometer.

6.) Connect the "Output" terminals from the front panel to your monitoring or recording equipment.

7.) Adjust the "Zero" potentiometer for "5 Wire" connected transducers to trim the output offset or for "4 Wire" units also on the PS-30A.

8.) FOR USE WITH SEPARATE EXTERNAL AMPLIFIER ON PS-30 ONLY (such as Entran IMV): Connect the amplifier to the "Supply+", "Supply–" and "C-Common" terminals. Power the transducer from IMV or amplifier. Connect "+" output lead from the IMV or amplifier to the "Signal+" terminal and connect the "C-Common" lead to the "Signal–" terminal.

9.) TO SET GAIN OF PS-30A AMPLIFIER: With the transducer supply leads connected to the PS-30A, but before connecting the transducer signal leads, set the gain by utilizing the "SET" button and "GAIN" potentiometer. Determine the Amplifier Output offset by temporarily linking the "Output–", "Signal+" to "Signal–" terminals and recording the "Output+" to "Output–" voltage. Remove "Signal+" from "Signal–" and connect "Signal+" to "Output–", press/hold the "SET" button. Monitor the test signal (approximately+50mV) which has been internally injected to the "Signal+" and "Signal–" terminals. Then monitoring the amplified test signal at the "Output+" and "Output–" terminals, and subtracting the amplifier output offset to provide the net amplified output, adjust the gain to the desired value with the "GAIN" potentiometer, comparing the net Amplified Output signal to the unamplified test signal on the "Signal" terminals. To confirm and fine adjust the desired gain, re-connect the signal input link and repeat the above procedure until the desired accuracy is achieved and confirmed. After gain is adjusted, release the "SET" button, remove signal link and connect the signal leads of the transducer to the PSA-30A.

This bulletin references Entran specification PSS-792.

Specifications subject to change without notice.

MM35	$460.
MM45	$495.

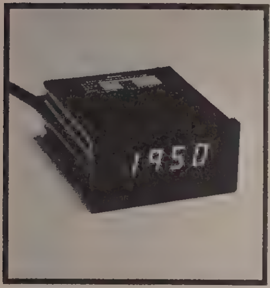
— Meters —

To Order, Call
In USA & Canada: 1-800-635-0650
In UK: (0923) 893 999
In Europe: 33(1)30.55.49.85

Low Cost Digital Sensor Meters

WITH BUILT-IN SENSOR POWER SUPPLY & HI/LO SETPOINT RELAY OPTION

MM35 Series



The MM35 and MM45 Digital Sensor Meters have been manufactured for Entran to complement our line of pressure sensors and load cells, as well as most other sensors on the marketplace. They are both easy and simple to use and in addition to their digital display, provide various levels of excitation so that a sensor can be powered directly from the meter, without use of an external power supply. This is a powerful combination not usually found in digital meters. The MM35 has a 3-1/2 digit display. Its 1999 count can be fully utilized with any input between 1mV/V and 20mV/V and it has two standard transducer excitation voltages. The MM45's 4-1/2 digit display with 19999 counts, can be fully utilized with either a ±200mV or ±2V input signal, and is totally pushbutton programmable from the front panel. It has five standard excitation voltages, selectable by internal connector pins, peak hold, and a pushbutton Tare Zero.

CHECK EXCITATION VOLTAGE REQUIREMENT FOR SENSOR TO BE USED.

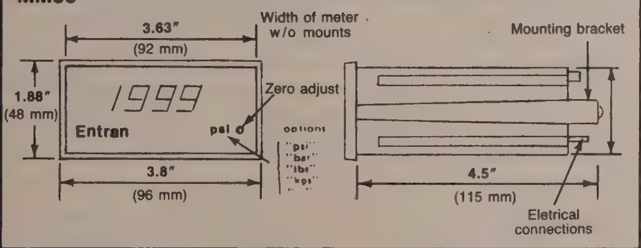
MM45 Series

19998
Entran

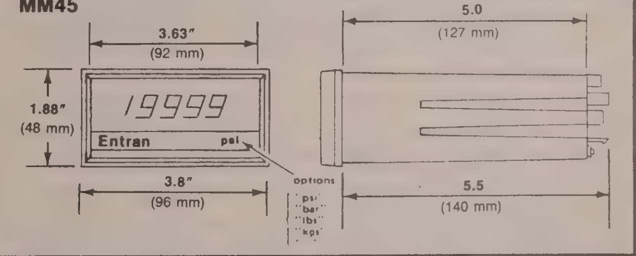
DISPLAY DIGITS	POWER IN	FACEPLATE					
		"psi"	"bar"	"lbs"	"kgs"	"N"	" "
3½, .56″ (14.2mm) H	**110V, 60 Hz**	**MM35P-1**	**MM35B-1**	**MM35L-1**	**MM35K-1**	**MM35N-1**	**MM35-1**
	220V, 50 Hz	**MM35P-2**	**MM35B-2**	**MM35L-2**	**MM35K-2**	**MM35N-2**	**MM35-2**
4½, .50″ (12.7mm) H	**110VAC/220VAC**	**MM45P**	**MM45B**	**MM45L**	**MM45K**	**MM45N**	**MM45**

	MM35	MM45	"-A"	MM35	MM45
FULL RANGE	±1999	±19999	**HI/LO SETPOINT RELAY OPTIONS**	—	-HL1: Hi/Lo set -HL: Hi/Lo Set+Analog
TRANSDUCER INPUTS AVAILABLE	1 to 20mV/V Differential Input	±200mV or ±2V (pin selection)	**SPAN ADJUST & DECIMAL POINT**	Internal Resistors and potentiometer	Front panel pushbutton programmable
ACCURACY OF DISPLAY	±.05%±1 dig. @ 25°C	±.01% of span ±1 dig.	**ZERO ADJUST**	Front panel potentiometer	Front panel pushbutton programmable
SUPPLY VOLTAGES FOR TRANSDUCERS (VDC)	5V and 10V	5V, 6V, 10V, 12V and 15V	**TEMP. SHIFT**	50 ppm / °C	20 ppm / °C
SUPPLY CURRENT FOR TRANSDUCERS (MAX.)	50 mA	24 mA	**OPERATING TEMP.**	32°F to 122°F (0°C to 50°C)	32°F to 140°F (0°C to 60°C)
OUTPUT SIGNAL	Analog 0 to 2 VDC Zero & span adjustable	Option "A" Analog out 0 to 10V front panel prog.	**ELECTRICAL CONNECTION**	Rear panel solder lugs	Rear panel solder lugs or Screw Terminal option "/ST"

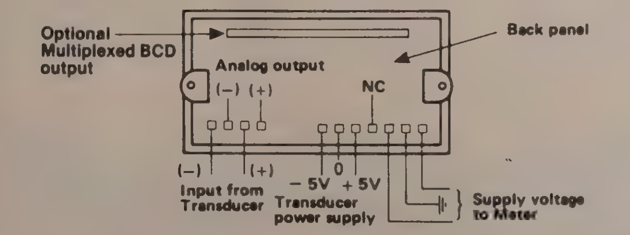
MM35


3.63″
(92 mm)
Width of meter w/o mounts
Mounting bracket
1.88″
(48 mm)
1999
Entran
psi
Zero adjust
options
"psi"
"bar"
"lbs"
"kgs"
3.8″
(96 mm)
4.5″
(115 mm)
Eletrical connections

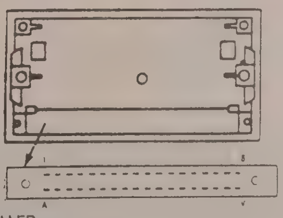
MM45


5.0
(127 mm)
3.63″
(92 mm)
1.88″
(48 mm)
19999
Entran
psi
options
"psi"
"bar"
"lbs"
"kgs"
3.8″
(96 mm)
5.5
(140 mm)

WIRING MM35


Optional Multiplexed BCD output
Back panel
Analog output
(−) (+)
NC
(−)
(+)
Input from Transducer
0
− 5V + 5V
Transducer power supply
Supply voltage to Meter

WIRING MM45



FOR FACTORY INSTALLED
SCREW TERMINALS, ORDER OPTION "/ST"

This bulletin references Entran specification MM35S-187A, MM45S-792

Specifications subject to change without notice.

eem

MINIGLOSSARY
CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (µF) 1 microfarad (µF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

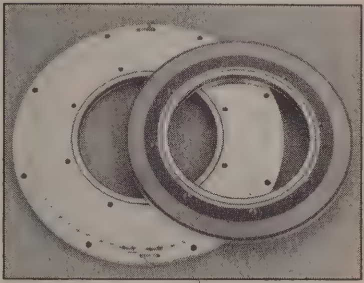
Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

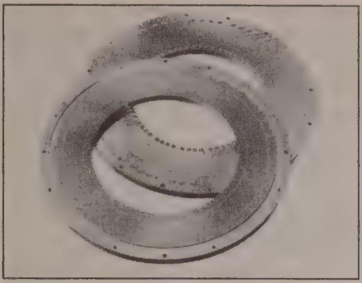
Inductosyn® Position Transducers

Inductosyn transducers provide absolute and incremental positioning information accurate to ±40 microinches, ±0.5 arc second, or better.

Rotary Inductosyn Transducers

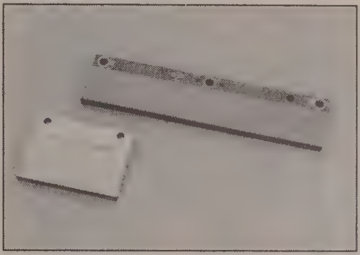


Incremental



Absolute

Linear Inductosyn Transducer



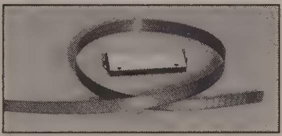
Scale and Slider

Inductosyn transducers consist of two noncontacting, inductively coupled elements which can be directly attached to the fixed and moveable sections of the user's equipment. They provide positioning information to digital readout displays, CNC or other controllers, or provide servo feedback signals.

Rugged and reliable, our position transducers operate anywhere, even under extreme conditions—vibration, temperature from 10°K to 160°C, shock, high pressure, vacuum, and dust or oil films. Choose off-the-shelf or custom designs to solve absolute and incremental positioning requirements.

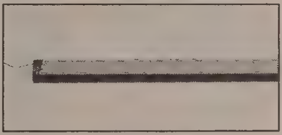
Additional Standard Linear Inductosyns

Tape Scales



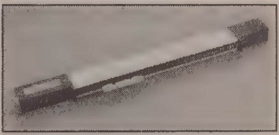
Tape scales provide economical, easily installed one piece scales. Lengths to 120 ft (36M) or more can be supplied. They can be mounted horizontally or vertically. Obtain information on hard to measure travel lengths in long bed metal cutting.

Adjustable Scales



Adjustable scales are one piece bars that can be adjusted after installation to virtually eliminate errors over their full length, limited only by the accuracy of the user's measurement equipment. Lengths to 72 inches (1828 mm) are supplied. Two lengths can be used to provide a total length of 144 inches (3656 mm).

Tape Spars



Tape Spars are completely enclosed scale assemblies installed directly as a component in the user's machine. Spar slider mounts extend through flexible sealing lips for direct attachment to moveable machine parts.

Cassettes

Fully enclosed cassette units are used in extreme environments such as hot rolling mills. Many options are available, including cyclic pitch, travel, and spring return. These units can be pressurized through a purge fitting to help prevent contamination from external sources.

FARRAND CONTROLS
DIVISION OF RUHLE COMPANIES, INC.
99 Wall Street, Valhalla, NY 10595 • Tel: 914/761-2600 Fax: 914/761-0405

For literature or applications assistance call 914/761-2600 or fax 914/761-0405.

DANFYSIK

ULTRASTAB CURRENT TRANSDUCERS

Very high accuracy, non-contacting measurements of electric current

Danfysik ULTRSTAB Current Transducers operate on the zero flux principle and enable precision current measurements to 2000A with flat frequency response from dc to over 300kHz. The compensation current can be measured directly or converted to a voltage in a "burden" resistor. Zero flux current transducers are extremely linear and have excellent temperature and long-term stability. They enable current measurement without ohmic connection to the measured circuit and without the resistive power loss of a shunt. Even at high currents the ULTRASTAB Current Transducers do not require water cooling.

864U and 300A Head

864U and 864I Eurocard ULTRASTAB Current Transducers

These are Eurocard board Transducers designed for use as the current sensing element in high-precision, current regulated power supplies. They offer very high stability combined with excellent frequency response.

EUROCARD BOARD	864I	864U
Polarity	true bipolar	true bipolar
Output (fs)	±1A	±10V
Calibration (ppm of fs)	<50	<50
Linearity (ppm of fs)	<1	<10
Stability (ppm/°C)	<0.1	<2
(ppm/month)	<1	<5
Offset (ppm of fs)	<5	<5
Output noise (ppm of fs)	<5(dc to 50kHz)	<8(dc to 50kHz)
Operating temp (°C)	10 to 40	10 to 40
Dimensions (mm)	160x100x37	160x100x37
(inch)	6.3x4x1.5	6.3x4x1.5

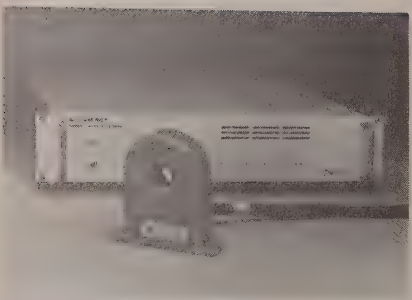
TRANSDUCER HEAD	600A	2000A
Head Current (A)	200,400,600	1000,1500,2000
Upper Frequency (kHz)	500(-3dB)	300(-3dB)
Test Voltage (kV)	2	2
Operating Temp (°C)	0 to 60	0 to 60
Dimensions (mm)	90Dx30L	150Dx45L
Hole diameter (mm)	30	60
Weight (kg/lb)	1.4/3.1	3.1/6.9

860 ULTRASTAB Current Transducer

This is a self-contained, 19 inch rack-mounting instrument with an internal, temperature controlled burden resistor. It is particularly suitable for measuring dc and pulse performance of current regulated power supplies.

860R CONTROL

Polarity	true bipolar
Output (fs)	±10V
Calibration (ppm of fs)	<50
Linearity (ppm of fs)	<5
Stability (ppm°C)	<1
(ppm/month)	<5
Offset (ppm of fs)	<2
Output noise (ppm of fs)	<4(dc to 50kHz)
Operating temp (°C)	10 to 40
Dimensions (inch)	19Wx11.8Dx3.5H
Weight (kg/lb)	5.1/11.3



860R and 600A Head

TRANSDUCER HEAD	600A	2000A
Head current (A)	40 to 600 in 40A steps	125 to 2000 in 125A steps
Upper frequency (kHz)	300(-3dB)	150(-3dB)
Test voltage (kV)	5	5
Operating Temp (°C)	0 to 60	0 to 60
Dimensions (mm)	127Dx48L	160Dx55L
Hole diameter (mm)	26	50
Weight (kg/lb)	1.4/3.1	3.3/7.3

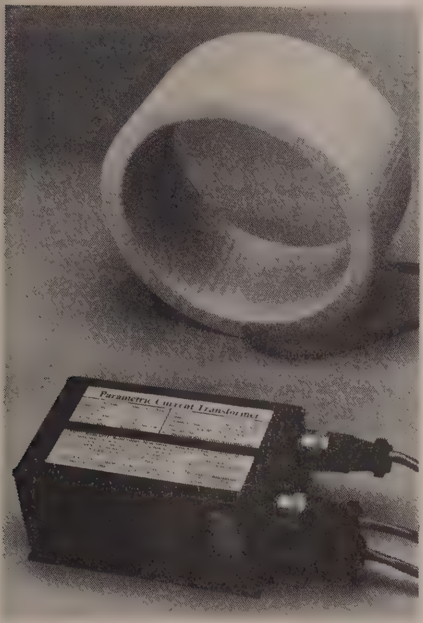
Refer to EEM Section 2900 for Magnetic Field Measurement

GMW *P.O. Box 2578, Redwood City, CA 94064. Tel (415) 368-4884. Fax (415) 368-0816.*

bergoz

CURRENT TRANSFORMERS

High Sensitivity, non-contacting measurement of electric current and charge



PCT with 178mm Head

Bergoz Current Transformers have been developed for the non-destructive measurement of dc and pulse currents in particle accelerators and electron beam devices. They may be applied to the measurement of any electric current where ohmic isolation is desired.

PCT, Parametric Current Transformer

The PCT is a stand-alone instrument using the zero flux principle with very high sensitivity magnetic cores. It can be used to measure dc currents with resolution to better than 10μA.

PCT CONTROL

Polarity		true bipolar
Output	(fs)	±10V
Calibration	(% of fs)	<0.1
Linearity	(% of fs)	<0.01
Stability	(μA/°C)	<±10
	(μA/month)	<±30
Output noise	(μA,rms)	<5(dc to 1Hz)
Operating temp	(°C)	10 to 40

TRANSDUCER HEAD

Head current	(fs)	10mA,100mA,1A or 10A
Frequency response	(kHz)	dc to 20 (-3dB)
Operating temp	(°C)	0 to 60
Axial length	(mm)	102
Hole diameter	(mm)	28,55,82,122 or 178

FCT, Fast Current Transformer

These are passive ac transformers designed for displaying fast current pulses.

Current ratio	(input/output)	20,10 or 5
Input rise time	(nsec)	<1
Droop	(%/μsec)	<2
Peak current	(A max)	100
Output signal into 50 ohm	(V/A)	1.25,2.5,5
Operating temp	(°C)	0 to 60
Axial length	(mm)	22
Hole diameter	(mm)	28,55,88,122 or 178

FCT, ICT

ICT, Integrating Current Transformer

The ICT is a capacitively shorted transformer and a fast current transformer with a common high-sensitivity core. Very fast current pulses are integrated on the secondary capacitance and read out as a current accurately proportional to the integral of the signal current, ie the pulse charge.

Current ratio	(input/output)	100, 20, 10
Input rise time	(psec)	<1
Input pulse length	(nsec)	<5
Linearity error	(%)	<0.1
Output signal into 50 ohm	(mV/nC)	10, 50, 100
Operating temp	(°C)	0 to 60
Axial length	(mm)	32
Hole diameter	(mm)	28, 55, 88, 122 or 178

Refer to EEM Section 2900 for Magnetic Field Measurement

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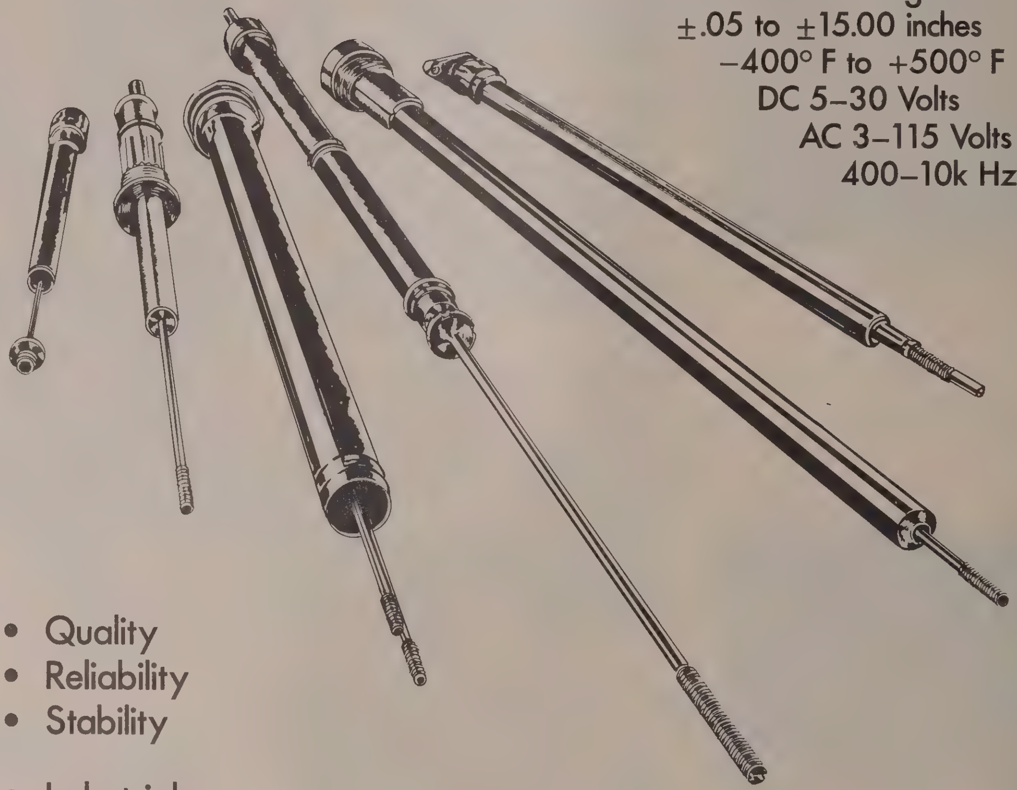
Precision Displacement Transducers

Standard & Custom Designs Available

Linear Position Ranges:
±.05 to ±15.00 inches
−400° F to +500° F
DC 5–30 Volts
AC 3–115 Volts
400–10k Hz



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SINCE 1954

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HAMLIN

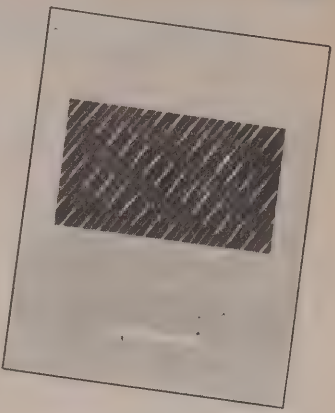
REED RELAYS • REED SWITCHES • POSITION SENSORS

QUALITY ELECTRONIC COMPONENTS SINCE 1949

HAMLIN INC.
612 East Lake Street
Lake Mills, WI 53551 USA
Phone 414/648-3000 FAX 414/648-3001

The heart of all Hamlin magnetic proximity sensors is a hermetically sealed reed switch, for environmental integrity and dependability. When a magnetic actuator is placed within a prescribed proximity of the sensor, the switch contact changes state. Their cost is far below inductive or capacitive proximity sensors. They require no power to operate and provide a switch closure output.

ALL SENSORS FILE #E61760(N)



For detailed product information request the Hamlin Magnetic Proximity Sensor Catalog. The 16 page brochure provides complete data about Hamlin's broad family of standard Magnetic Proximity Sensors plus application and design recommendations. Also included are dimensions, electrical specifications and operation characteristics.

SPECIFICATIONS

Initial Contact Resistance (Maz.) ....0.200 Ohms
Typical Operate Time............................1.0 ms
Shock w/o False Operation....................10 G's 11ms, 1/2 sine wave
Operate & Storage Temp.......................-40°C to +105°C
Operation Life (Typical).........................50,000,000 @ 5Vdc, 10ma
5,000,000 @ 120Vdc, 75ma.

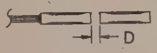
ORDERING INFORMATION

SENSOR NUMBER	OPERATE POSITION	CONTACT RATING	SWITCHING VOLTAGE	MUST OPERATE DISTANCE	MUST RELEASE DISTANCE	TERMINATION OR WIRING	SENSOR LIST PRICE	MATCHING ACTUATOR	ACTUATOR LIST PRICE
59025-010	1	10W	200Vdc	.150	.800	12" PVC Leads	3.65	57025-000	2.74
59045-010	4	10W	200Vdc	.075	.550	PCB PINS	1.92	57045-000	3.31
59050-010	4	10W	200Vdc	.150	.750	PCB PINS	1.82	57050-000	3.31
59065-010	1	10W	200Vdc	.150	.800	12" PVC Leads	3.84	57065-000	3.41
59070-010	1	10W	200Vdc	.150	.800	12" PVC Leads	4.08	57070-000	3.41
59085-040	2	10W	200Vdc	.100	.250	12" PVC Leads	8.88	VANE	N/A
59105-010	3	10W	200Vdc	.150	.800	CONNECTOR	4.22	57105-000	2.88
59125-010	3	10W	200Vdc	.150	.800	PINS	3.60	57125-000	2.88
59135-010	3	10W	200Vdc	.350	1.150	12" TEFLON Leads	6.86	57135-000	3.84
59140-010	3	10W	200Vdc	.175	.800	12" PVC Leads	3.65	57140-000	3.36
59145-010	3	10W	200Vdc	.225	.800	12" PVC Leads	3.60	57145-000	2 88
59160-010	4	10W	200Vdc	.155	.440	SMD Leads	3.60	57045-000	3.31

NOTE: All sensors listed are Form A (SPST NO) except for Model 59085-040 Vane sensor which is Form B (SPST NC)

OPERATE POSITION

1



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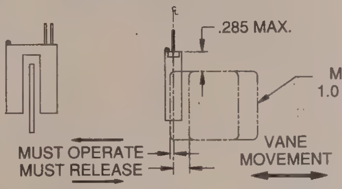

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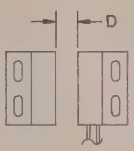

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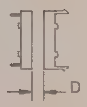
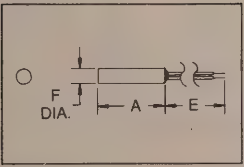
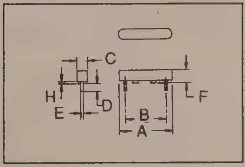


DIMENSIONS

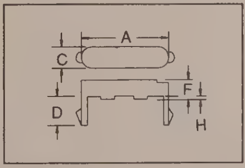
Drawing 1



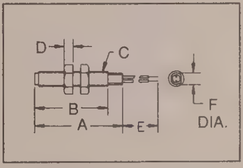
Drawing 2



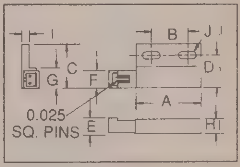
Drawing 3



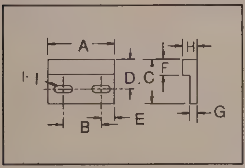
Drawing 4



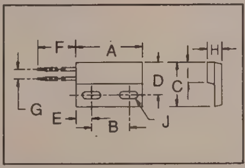
Drawing 5



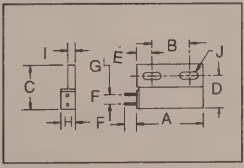
Drawing 6



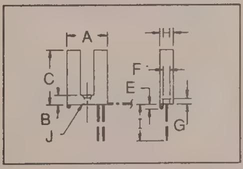
Drawing 7



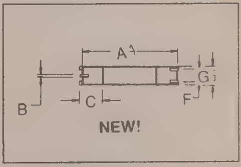
Drawing 8



Drawing 9



Drawing 10



MODEL #	DWG #	DESCRIPTION	A	B	C	D	E	F	G	H	I	J
59025-010	1	SENSOR	1.000	—	—	—	12.0	.245	—	—	—	—
57025-000	1	ACTUATOR	1.000	—	—	—	—	.245	—	—	—	—
59045-010	2	SENSOR	.700	.600	.130	.115	.0185	.170	—	.025	—	—
57045-000	3	ACTUATOR	.700	—	.130	.160	—	.170	—	.025	—	—
59050-010	2	SENSOR	.900	.800	.180	.115	.020	.200	—	.025	—	—
57050-000	3	ACTUATOR	.900	—	.180	.160	—	.200	—	.025	—	—
59065-010	4	SENSOR	1.500	1.250	5/16-24	.187	12.0	7/32	—	—	—	—
57065-000	4	ACTUATOR	1.500	1.250	5/16-24	.187	—	7/32	—	—	—	—
59070-010	4	SENSOR	1.500	1.250	M8X1.25	.250	12.0	5.56mm	—	—	—	—
57070-000	4	ACTUATOR	1.500	1.250	M8X1.25	.250	—	5.56mm	—	—	—	—
59085-040	9	SENSOR	.750	.150	1.000	—	.062	.165	.075	.250	12.0	4-40 & C'SUNK
59105-000	5	SENSOR	1.125	.625	.750	.562	.250	.288	.375	.250	.135	.125x.308
57105-000	6	ACTUATOR	1.125	.625	.750	.562	.250	.375	.135	.250	.125x.308	—
59125-010	8	SENSOR	1.125	.625	.750	.562	.250	.236	.100	.250	.135	.125x.308
57125-000	6	ACTUATOR	1.125	.625	.750	.562	.250	.375	.135	.250	.125x.308	—
59135-010	7	SENSOR	1.125	.625	.750	.562	.250	12.0	.200	.250	.375	.125x.312
57135-000	6	ACTUATOR	1.125	.625	.750	.500	.250	.375	.135	.250	—	.312x.125
59140-010	7	SENSOR	.906	.551	.551	.430	.177	12.0	—	.236	.296	.126x.150
57140-000	6	ACTUATOR	.906	.551	.551	.430	.177	.296	.118	.236	.126x.150	—
59145-010	7	SENSOR	1.125	.625	.750	.562	.250	12.0	—	.385	12.0	.125x.308
57145-000	6	ACTUATOR	1.125	.625	.750	.562	.250	.375	.135	.250	—	.125x.308
59160-010	10	SENSOR	.800	.030	.100	—	—	.105	.150	—	—	—

HERMETIC SWITCH, INC.

Proximity Sensors

Hermetic Switch, Inc. manufactures a variety of two part magnetic proximity sensors (sensor and actuator). All sensors feature hermetically sealed reed switch contacts that can survive harsh environments. Specially selected epoxy potting materials and rugged plastic cases withstand the impacts and forces of the real world.

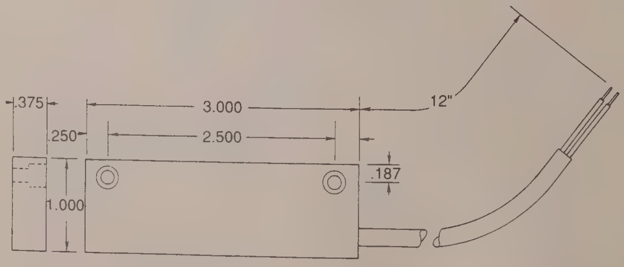
Many models are listed with Underwriters Laboratories, verifying that they have passed rigorous testing. Custom sensors not shown in our catalog may be required for your application. Consult factory for complete operate data, catalogs, and engineering assistance.

Contact Ratings

SENSOR MODEL	RECOMMENDED ACTUATOR	CONTACT FORM	SWITCHING RATINGS		
			MAX VOLTS DC	MAX AMPS DC	MAX WATTS DC
1100	1000	SPST-NO	30	.25	3.0
1200	1000	SPST-NC	30	.25	3.0
1300	1000	SPDT	30	.25	3.0
1500	1005	SPST-NO	30	.01	0.25
1700	1007	SPST-NO	100	.25	7.0
1800	1007	SPST-NC	100	.25	3.0
1900	1007	SPDT	100	.25	3.0
5100	5000	SPST-NO	30	.25	3.0
5200	5000	SPST-NC	30	.25	3.0
5300	5000	SPDT	30	.25	3.0
8200	8100	SPST-NO	200	.50	10.0
8300	8100	SPDT	100	.25	3.0
8400	8100	SPST-NC	100	.25	3.0
8500	8100	SPST-NO	—	—	360 VA*
8600	8100	SPST-NO	200	.50	10
9100	9000	SPST-NO	120	1.0	25
9200	9000	SPST-NC	120	1.0	25
9300	9000	SPDT	120	1.0	25
9125	9000	SPST-NO	120	3.0	100
9225	9000	SPST-NC	120	3.0	100
9325	9000	SPDT	120	3.0	100
9150	9000	SPST-NO	240	3.0	200
9250	9000	SPST-NC	240	3.0	200
9350	9000	SPDT	240	3.0	200

* AC Only.

PART # 9100-9350



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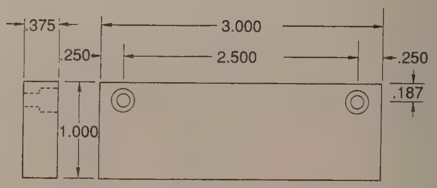

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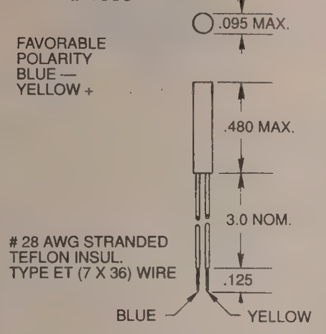
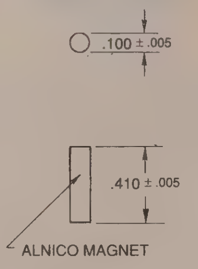
Proximity Sensors

PART # 1500



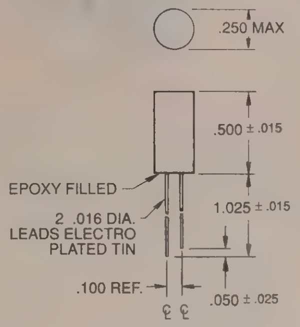
.095 MAX.
FAVORABLE POLARITY BLUE — YELLOW +
.480 MAX.
3.0 NOM.
# 28 AWG STRANDED TEFLON INSUL. TYPE ET (7 X 36) WIRE
.125
BLUE
YELLOW

PART # 1005 ACT



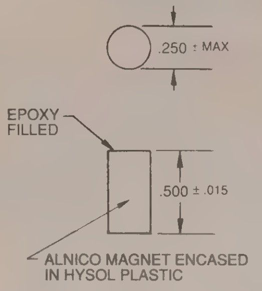
.100 ± .005
.410 ± .005
ALNICO MAGNET

PART # 1600



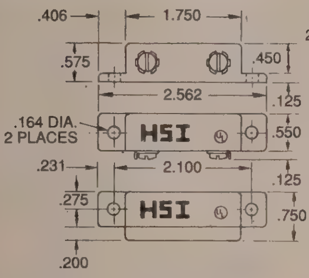
.250 MAX
.500 ± .015
EPOXY FILLED
2 .016 DIA. LEADS ELECTRO PLATED TIN
1.025 ± .015
.100 REF.
.050 ± .025

PART # 1006 ACT



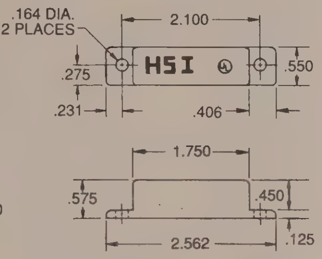
.250 ± MAX
EPOXY FILLED
.500 ± .015
ALNICO MAGNET ENCASED IN HYSOL PLASTIC

PART # 5100, 5200 or 5300



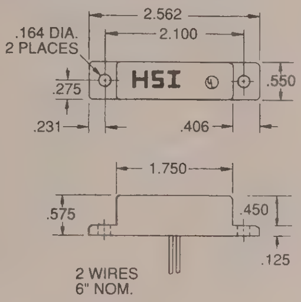
.406
1.750
.575
.450
2.562
.125
.164 DIA. 2 PLACES
HSI
.550
.231
2.100
.125
.275
HSI
.750
.200

PART # 5000 ACT



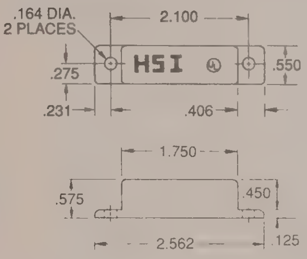
.164 DIA. 2 PLACES
2.100
HSI
.275
.550
.231
.406
1.750
.575
.450
2.562
.125

PART # 6100, 6200 or 6300



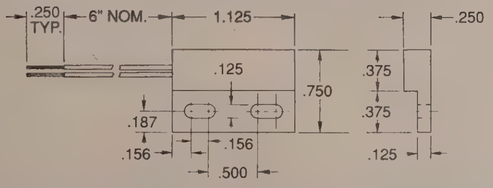
2.562
.164 DIA. 2 PLACES
2.100
HSI
.275
.550
.231
.406
1.750
.575
.450
2 WIRES 6" NOM.
.125

PART # 6000 ACT



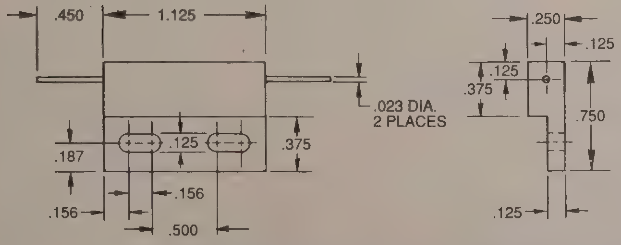
.164 DIA. 2 PLACES
2.100
HSI
.275
.550
.231
.406
1.750
.575
.450
2.562
.125

PART # 8200, 8300 or 8500



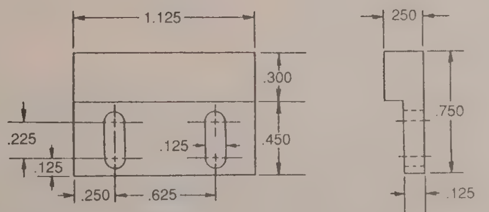
.250 TYP.
6" NOM.
1.125
.250
.125
.750
.375
.375
.187
.156
.156
.500
.125

PART # 8400 or 8600



.450
1.125
.250
.125
.125
.375
.023 DIA. 2 PLACES
.750
.125
.375
.187
.156
.156
.500
.125

PART # 8100 ACT



1.125
250
.300
.750
.225
.125
.450
.125
.250
.625
.125

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Aerospace

Humphrey is recognized by military and government agencies both in the U.S. and abroad as a leading supplier of components for aerospace and weapon system applications including guidance and control for RPV's, target and reconnaissance drones and autopilots. The company is fully qualified in accordance with MIL specifications and NASA requirements.

General Industry

Humphrey is an established supplier of products ranging from miniature precision components to sophisticated, highly accurate measuring and control instruments used on a wide variety of commercial products and robotic systems. Humphrey's dynamic testing systems provide data for evaluating automotive, seagoing and ground vehicles under actual operating conditions.

Oceanographic

Humphrey manufactures an extensive line of special purpose instruments used in hundreds of oceanographic applications between the surface and the seabed. The company has developed a reputation for fast response on special systems and components including such new developments as underwater attitude sensors, shipboard sonar stabilizing equipment, and towed underwater sonar vehicle autopilots.

Mining/Petroleum

Humphrey vertical and horizontal directional surveying systems provide continuous or selected downhole readings to 20,000' and more. Data includes slant angle, slant angle bearing, azimuth, time and cable depth. All information is displayed on the surface readout and a permanent record is provided by computer. Humphrey directional surveying systems reduce field surveying time and improve accuracy.

Model Variations

The standard models described herein are typical only. Numerous variations are available or modifications can be readily made. Custom designs and engineering offered.

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San Diego, CA 92123 U.S.A.
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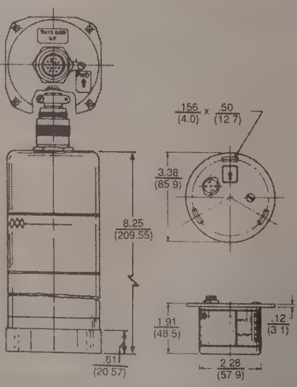
directional gyros

DG11-0105-1

Directional gyro with synchro output on outer gimbal and flux gate north seeking system. AC motor. Power 115V-400 Hz and 26V-400 Hz. Weight approx. 2.5 lbs. Size approx. 8.25" high x 3.77" dia. May be used with standard 3-inch GRO6 repeater or 5-inch GRO3 repeater.

SPECIFICATIONS

MECHANICAL FREEDOM	
Inner gimbal	±85° minimum
Outer gimbal	360° continuous
Accuracy (with flux detector)	±1.5°
Input motor	115V ±400Hz @ 65 MA
Erection system	26V ±400Hz @ 50 MA
AMPLIFIER (supplied from 26V input)	
Voltage	28 VDC
Power	4 watts approximately
OUTPUT SYNCHRO OUTER GIMBAL	
Input voltage	400 Hz, 26 volts
Output voltage	11.8 volts
Accuracy	±0.5°
Slaving rate	0.5°/minimum
Insulation resistance	50 megohms min. with 50 VDC applied
Service life	500 hours minimum
ENVIRONMENTAL CONDITIONS	
Altitude	–1000 feet to 40,000 feet
Temperature	–55°C to +70°C
Vibration	0.036 DA or 5G, whichever is limiting, 5 to 500 Hz
Shock	15G. 11 MS
Humidity	0 to 95% relative humidity
Weight	2.5 pounds



magnetic flux detectors

FD01-0101-1

Flux detector for use with directional gyro or servo compass to provide continuous north reference. Uses standard flux gate windings suspended in pendulus position. Freedom to ±45° pitch and roll. Operates on 14 mA with frequency of 400 Hz. Output is 140 mV P-P, 800 Hz when connected to standard synchro system. Size 2.28" dia. (excluding mounting flange) x 1.91" high, Weight 5.5 oz.

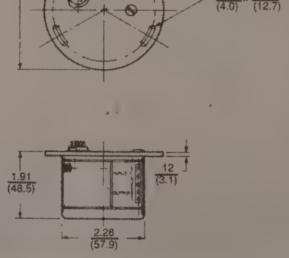
SPECIFICATIONS

INPUT	
Voltage	20V P-P 400-560 Hz
Current	15 MA RMS
OUTPUT	
Voltage	140 MV P-P
Frequency	800 Hz (400 Hz input)
OUTPUT SYSTEM	(Consisting of a synchro connected to flux gate in a standard configuration)
Voltage	Null 60 MV P-P Peak 350 MV P-P
Frequency	800 Hz (400 Hz input)

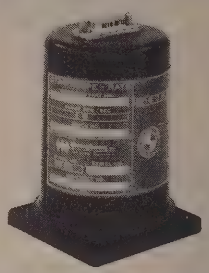
REMARKS

FD01-0101-1 is designed for use in conjunction with the DG11 series slaved directional gyro.

Instrument manufactured in accordance with TSO $C6_{c1}$ dated 1 April 1959.



rate gyros

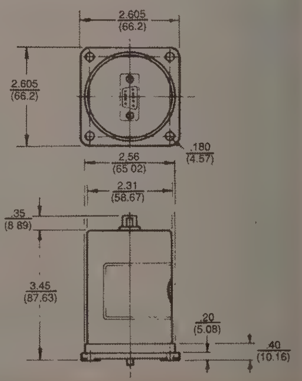


RG51-0106-1 (DC)

Precision DC rate gyroscope designed specifically for supersonic target drones, but also ideal for aircraft autopilot and instrumentation applications. A standard production unit with a proven history of reliability. Available in a wide selection of rate ranges, damping characteristics, and potentiometer configurations; also AC versions.

SPECIFICATIONS

Range	±40°/sec.
Natural frequency	10 Hz approx.
POTENTIOMETER	
Resistance	1,000 ohms ±10%
Power Dissipation	0.5 watts maximum
Accuracy	±1.0% of F.S. at zero rate increasing to ±2.5% at maximum rate
Equivalent contact resistance	200 ohms maximum
Damping factor	0.5 ±0.2
MOTOR	
Voltage	28 VDC, ±10%
Starting time	20 seconds nominal
Service life	500 hours
ENVIRONMENTAL CONDITIONS	
Temperature	–65°F to 165°F
Shock	50 G, 11 ±1 MS duration
Acceleration	20 G steady state
Vibration	0.06 D.A. or 10 G, whichever is limiting, 20 to 500 Hz
Weight	14 ounces approx.



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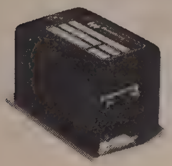
rate gyros

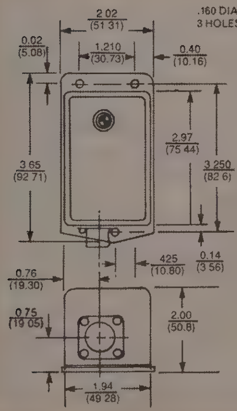


RG78-0300 Series

Precision DC-in DC-out sub-miniature rate gyroscope designed for the most demanding rate control requirements, such as fire control systems, aircraft control, antenna stabilization and missile systems. Fluid filled for precise damping and shock protection. Available in a wide range of rates; and AC-in DC-out versions.

SPECIFICATIONS

Rate range	40 to 1000°/sec
Natural frequency	20 to 140 Hz depending on rate range
Damping ratio	0.3 to 1.2
Output, full scale range	1.0 to 6.0 VDC
LINEARITY	
To half scale	0.5%
To full scale	2.0%
Hysteresis	0.2% of full scale
Threshold	0.03 deg/sec max
Zero offset	0.1% of full scale
Input voltage	24 to 30 VDC
ENVIRONMENTAL	
Temperature	–40°C to 70°C
Shock	100G, 1 MS
Acceleration	60G
Vibration	0.06 G²/Hz, 20-2000 Hz
Weight	12±2 Oz.



vertical gyros

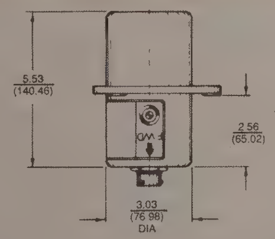
VG24-0636-1

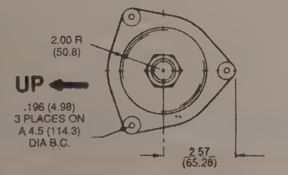
Compact, miniature, AC gyro with potentiometer pickoffs for pitch and roll outputs. Reinforced stainless steel journals for high vibration and shock environments. Low drift. Fully qualified to MIL specifications.

SPECIFICATIONS

Mechanical limits	±80° min. on roll axis. ±60° min. on pitch axis.
OUTPUT	
Pickoff	Center tapped conductive plastic potentiometer
Electrical displacement	±45°
Resistance	10,000 ±5% ohms
Linearity	±1% of full range
115VAC 400 Hz, single phase spin motor (Pin A) and 26VAC fast erection (Pin C)	
Current-starting	360 MA nom at Pin B (AC common)
Current-running	290 MA nom at Pin B (AC common)
115VAC 400 Hz, single phase spin motor (Pin A) and 26VAC normal erection (Pins D/E)	
Current-starting	220 MA max at Pin B common
Current-running	160 MA max at Pin B common
Vertical accuracy	±0.5° of true vertical
Drift	With erection system inoperative, free drift independent of Earth's rotation shall be ±7.5° maximum after 15 minutes of reversing SCORSBY action at 6 cycles per minute.
Temperature	–65°F to +160°F
Shock (non-operating)	40 G, 20 MS; all axes, 35G, 17 MS; vertical negative axis
Weight	2.3 pounds maximum

Note: Other electrical displacements available





vertical stabilized accelerometers

SA09-0601-1

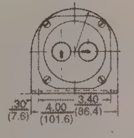
A small precision vertical gyroscope with three sensitive servo-type accelerometers mounted on its inner gimbal. Provides a new combination instrument with five outputs: pitch and roll angles in reference to vertical, and three accelerations vectors. Inner and outer gimbal pickoffs are precision wire-wound potentiometers that provide the pitch and roll outputs. System measures acceleration as small as .001 G. Design simplicity for maximum reliability.

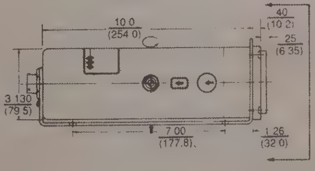
SPECIFICATIONS

See VG24 vertical gyro for typical platform gyro specifications.

Platform Power

ACCELEROMETERS	
LATERAL & FORE & AFT	
Range	±1.0G
Output	±5 VDC
VERTICAL	
Range	±2G
Output	±5 VDC





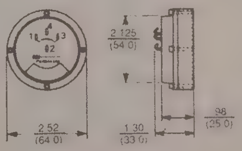
pendulums

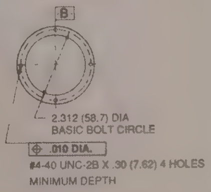
CP17-0601-1

An economical standard pendulum available from stock that provides unequaled precision and performance for its cost. Potentiometric output with resistances available from 500 to 20K ohms. Center or multiple taps. Viscous damping. 0.2° resolution. Ranges from ±5° to ±175°. Service life over 10^6 cycles.

SPECIFICATIONS

Range	±45°
Potentiometer resistance	2,000 ±5% ohms
Power dissipation	0.5 watt at +130°F
Center tap	±0.25% of total electrical travel from theoretical electrical center
Accuracy	±1.0% of full scale
Damping	.1 to .5 damping ratio from +20°F to +130°F
Natural frequency	3.2 Hz
Noise	100 ohms maximum
Insulation resistance 30 megohms at 500 VDC	
Vibration	.060 in D.A., 10 to 30Hz 3 G, 30 to 100 Hz
Shock	100 G, 10 MS
Temperature	
–Storage	–65°F to +160°F
–Operating	+20–°F to +130°F
Sealing	No leakage at 24 in. of HG vacuum
Weight	6 ounces maximum





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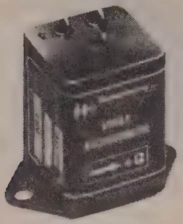
linear accelerometers

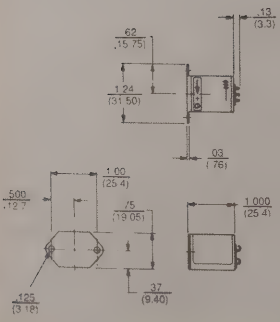


LA45-0101-1

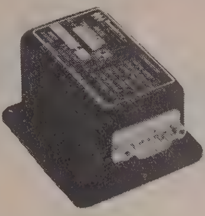
Smallest potentiometer pickoff accelerometer available anywhere, this sub-miniature production instrument is offered in full scale ranges of 2 G to 300 G. Reliability has been proven with production applications in a variety of missile systems. It has a hermetically sealed steel case and a precision 5,000 ohm potentiometer output. Normally oil damped for rugged simplicity. Dry gas damping available for wide temperature ranges.

SPECIFICATIONS

Range	±10 G
Undamped natural frequency	46 Hz
Damping factor	0.4 to 0.7 of critical (oil damped)
Output potentiometer	
Resistance	5,000 ohms ±5%
Resolution	150 turns approximately
Accuracy	±1.5% of full scale
Insulation resistance	50 megohms minimum between any terminal and case when measured with 100 VDC applied potential at standard atmospheric conditions
Threshold	0.8% of full excursion
Sealing	Hermetic
Weight	1 ounce approximately



angular rate sensors

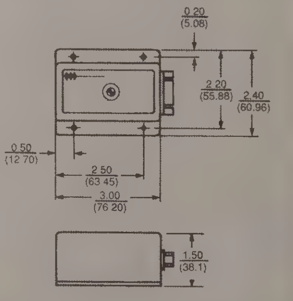


RT15-0102-1

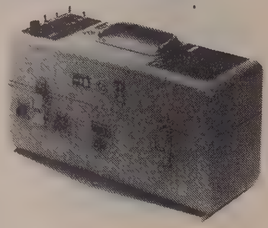
Single-axis transducer. The RT15 series is physically smaller and lighter than the RT03 series transducers. The RT15 series is functionally and operationally equivalent to the larger transducers. Note that a two-axis unit, model RT10-0500 series, is similar to, but slightly larger than, the RT15-series.

SPECIFICATIONS

Rate range	±100°/second
Natural frequency	25 Hz minimum
Damping	0.7 typical
Output	±2.5 VDC ±10% full scale
Linearity	1% of full scale
Resolution	infinite
Hysteresis	none
Null signals	±50 millivolts
Threshold	Virtually zero
Noise	10 millivolts RMS
Input power	±15 VDC at 100 milliamps
Time to full operation	40 milliseconds
Altitude	unlimited
Shock	100 G
Temperature	–55 to +85°C
Life	5 years
Weight	9 ounces



dynamic test systems



CF77-0101-1

Small, lightweight dynamic test system with a self contained power supply used by test facilities and manufacturers of automobiles, aircraft, land and sea vehicles for conducting dynamic measurements of vehicle performance. The system measures 3-axis acceleration, 3-axis position and 3-axis angular rate. A vertical gyro gives pitch and roll outputs and a cageable directional gyro measures yaw. Subminiature accelerometers provide a wide range of sensitivity, and are stabilized in the pitch and roll axes by the vertical gyro. Size is 6.18 (156.97)W x 15.50 (419.1)L x 8.38 (212.9)H plus mounting provisions. Available in 28 VDC or 12 VDC input models. Weight 29 pounds.

SPECIFICATIONS

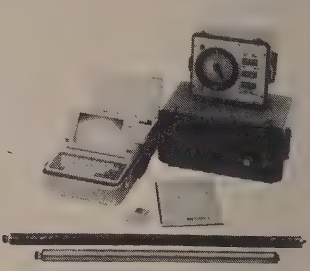
VERTICAL GYRO	
OUTPUT ANGLE	
Pitch	±45° ±2°
Roll	±178° ±2
OUTPUT VOLTAGE	
Pitch	±5 VDC
Roll	±5 VDC
ERECTION SYSTEM	
Time to erect (switch to erect position)	5 minutes to within 0.5° of true vertical from a 25° offset.
Erection accuracy	±0.5 of true vertical
DIRECTIONAL GYRO	
OUTPUT ANGLE Yaw	±178° ±2°
MECHANICAL ANGLE	
Yaw	360° continuous
Pitch	±47° maximum
OUTPUT VOLTAGE	
Yaw	±5 VDC
ACCELEROMETERS RANGE	
Fore-aft	±1.0G
Lateral	±1.0G
Vertical	±3.0G (+2G, –4G as mounted in the system)
OUTPUT	
Fore-aft	±4.90 to ±5.10 VDC/G
Lateral	±4.90 to ±5.10 VDC/G
Vertical	±1.57 to ±1.77 VDC/G
Resolution and threshold	0.005% of full range
Linearity hysteresis and repeat	0.020G
Output Impedance	1000 ohms
RATE GYROS	
Range all axes	±50°/sec
Resolution	Infinite
Threshold	0.010°/sec
Accuracy	±0.5% of full scale to half scale, ±1.0% half to full scale
OUTPUT	
All axes	±2.5 VDC ±0.10 VDC
Output impedance	1000 ohms
Sealing	Pressure sealed, water tight
Service life	1000 hrs minimum

special purpose instruments

Drilled Hole Surveying Equipment
For Oil Well, Mining and Civil Engineering Applications

UltimaxSURVEYOR™ (SRG)

UltimaxSURVEYOR™ (SRG) single wireline multiplexing system consisting of a gyro probe, control unit, and unified computer for use either as a gyro survey system or downhole orientation system. Real time computer capability provides immediate survey data for X-Y coordinates and profile of borehole.



DrillDIRECTOR™

This magnetic sensing instrument provides relative bearing and inclination angle information from a typical drill string in either a vertical or horizontal drilling mode. Probe measurements are sent to the surface on a continuous basis. The data along with cable length, is routed through a surface control unit and displayed on a separate computer console. The IBM compatible laptop computer is used to record the measurements and calculate the borehole trajectory. Slant angle, slant angle bearing, and tool face are displayed on a remote indicator console for use by the driller. A single conductor wireline provides power to the probe and is used for data transmission to the surface. The system includes a downhole probe, surface control unit, cable length measuring device, driller's remote display, computer/printer console, and optional photo verification package.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C

CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E

EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J

JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K

kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L

LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P

PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

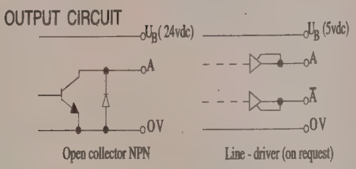
Z

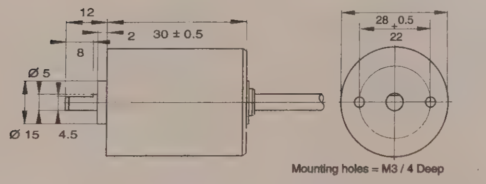
ZIF zero insertion force

Incremental Encoders

Rotary, Optoelectronic, Shafted or Hollow Shaft

GI 325


OUTPUT CIRCUIT
U_B (24vdc)
A
0V
Open collector NPN
U_B (5vdc)
A
Ā
0V
Line - driver (on request)


12
2
30 ± 0.5
8
Ø 5
Ø 15
4.5
28 + 0.5
22
Mounting holes = M3 / 4 Deep

Signal outputs:
2 pulse outputs
1 zero pulse 0
Scanning frequency:
> 150 kHz
Max rotational speed:
6000 rpm
Shaft loading:
axial < 10 N
radial < 15 N
Protection to IP 52

Versions and Order Designations

Digit 1 Not used

Digit 2 Pulse count

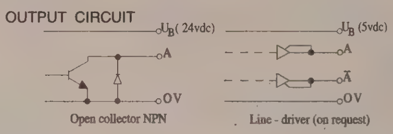
Digit 2	Pulse count
B	60
1	100
C	150
2	200
3	300
4	360
5	500
8	800
7	1000
9	1024
A	1500

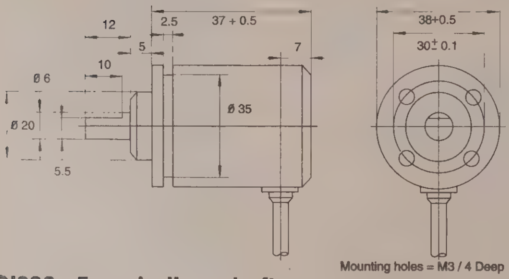
Digit 3	Power supply
0	24vdc
1	5 vdc (Line driver)

GI325. 0 ☐ ☐

Other versions on request.
Pulse counts 2000,2500 to 3600 on request.

GI 326*


OUTPUT CIRCUIT
U_B (24vdc)
A
0V
Open collector NPN
U_B (5vdc)
A
Ā
0V
Line - driver (on request)


12
2.5
37 + 0.5
5
7
10
Ø 6
Ø 35
Ø 20
5.5
38+0.5
30± 0.1
Mounting holes = M3 / 4 Deep

***GI336 - 5mm hollow shaft**

Signal outputs:
2 pulse outputs
1 zero pulse 0
Scanning frequency
> 200 kHz
Max rotational speed
6000 rpm
Shaft loading:
axial < 10 N
radial < 20 N
Protection to IP 52

Versions and Order Designations

Digit 1 Not used

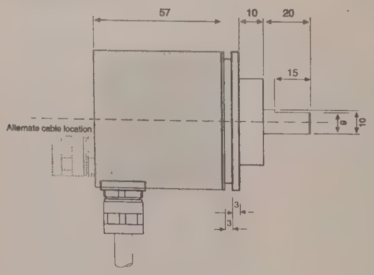
Digit 2	Pulse count
1	100
2	200
3	250
4	360
5	500
6	600
8	900
7	1000
9	1024
A	2000
B	2048
C	2500

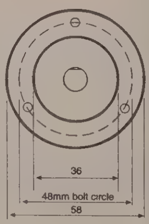
Digit 3	Power supply
0	12 ... 26 vdc
1	5 vdc (Line driver)

GI326. 0 ☐ ☐

Other versions on request

GI 350


57
10
20
15
8
10
Alternate cable location
3
3


36
48mm bolt circle
58

Signal outputs:
2 pulse outputs
1 zero pulse 0
Scanning frequency
> 300 kHz
Max rotational speed
10000 rpm
Shaft loading:
axial < 10 N
radial < 20 N
Protection to IP 52

Digit 1 Shaft

Without seal	With seal	
0	A	Mounting M3

Digit 2and 3 Outputs/voltage

Push-Pull	Line driver	
10	20	10...30 VDC
—	22	5VDC

Digit 3 and 4 Connection

Axial	Radial	Contact
A0	A1	7 pin Amphenol std.
B0	B1	12 pin Amphenal (w/inverted outputs)
11	21	5 wire cable std.
31	41	10 wire cable (w/inverted outputs)
61	—	10 wire cable for line driver output

Digit 5 and 6 pulses per rev.

120/01	200/06	300/11	512/16	900/21	1500/26	3600/31
125/02	216/07	314/12	600/17	1000/22	1800/27	3750/32
127/03	240/08	360/13	625/18	1024/23	2000/28	4000/33
150/04	250/09	400/14	720/19	1250/24	2048/29	4096/34
180/05	256/10	500/15	750/20	1270/25	2500/30	5000/35

Pulses per rev./ordering code

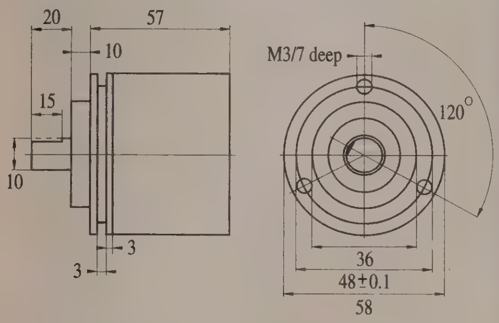
GI350. ☐ ☐☐ ☐☐ ☐☐

IVO INDUSTRIES INC.
201 Industrial Way West
Eatontown NJ 07724
Phone: **908-542-5151**
Fax: **908-542-2938**

Absolute Encoders

Rotary, Optoelectronic, Single turn, Multi-turn

GA 210 10 Bit
GA 240 13 Bit*



Gray or Binary code
Low power consumption
40mA at 24VDC
Scanning frequency
> 200kHz
Max rotational speed:
10000 rpm
Shaft loading:
axial < 10 N
radial < 20 N
Protection to IP 65

***SSI interface also available**

Digit 1 Shaft

Without seal	With seal	
0	A	
		Mounting M3

Digit 2 Signals

Coding: Gray code (push pull on request)

TTL	OC PNP	OC NPN	
—	30	40	10...30 vdc
21	—	—	5 vdc

Coding: Binary code (mating contact on request)

TTL	OC PNP	OC NPN	
—	32	42	10...30 vdc
23	—	—	5 vdc

Digit 3 Connection

Plug

Axial	Radial	Contact
A0	A1	12 pin
B0	B1	16 pin
C0	—	21 pin

Cable 1m

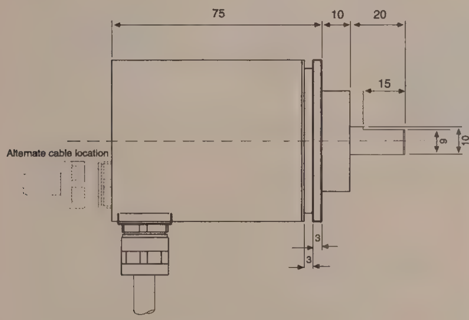
Axial	Radial	
11	21	PG9, 16 core
31	41	PG9, 21 core

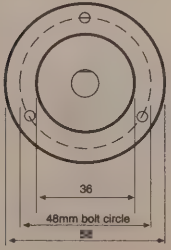
GA210.☐ ☐☐ ☐☐ 01

GM 400 face
GM 401 synchro

25 Bit Multi-turn (8192 increments x 4096 turns)

New patented technology!





Gray or Binary code
Supply: 5VDC,10-30VDC
Low power consumption
50mA at 24VDC
120mA at 5VDC
Temp. -10°C-+60°C
Frequency > 200kHz
Max rotational speed:
6000 rpm
1500 electronic
Protection meets IP 67
with 1 m cable

Also available GK400 serial to parrallel InterBus-S coupler.

No mechanical gearing!
Synchronous Serial Interface reduces wiring and allows for longer transmissions.
3 LED technology provides reliable data output.
Unique electronic zero point setting simplifies set-up.
Compact housing design.

Price is only $700.00

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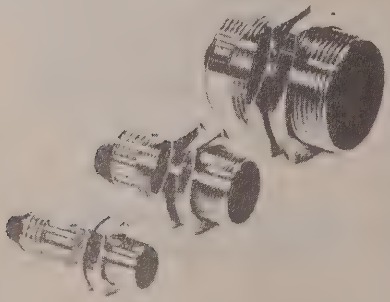
201 Industrial Way West
Eatonton NJ 07724
Phone: **908-542-5151**
Fax: **908-542-2938**

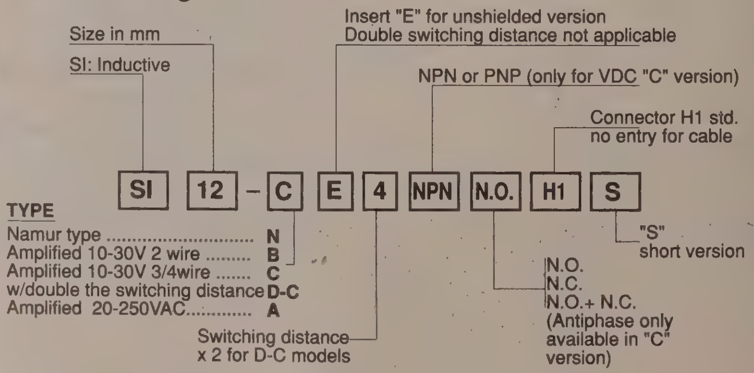
Proximity Sensors

SIZE	Version Type	Switching Distance mm	Operation NO	Operation NC	Operation NO+NC	Voltage 10-30	Voltage 5-24	Output Current mA max	Repeat-ability mm	Switch Freq. Hz	LED	PRICE 1	PRICE 50
4 mm	C	0.8	•	•		*6-35		150	0.01	2000	•	$84	67.20
5 mm	C	0.8	•	•		*6-35		150	0.01	2000	•	$87	69.60
6.5 mm	C	1 or 2	•	•		•		200	0.01	1000	•	$39	31.20
	N	1.0					•		0.01	2000		$27	21.60
	CE	2.0	•	•		•		200	0.01	1000	•	$39	31.20
	NE	2.0					•		0.01	2000		$27	21.60
8 mm	C	1 or 2	•	•		•		200	0.01	1000	*	$39	31.20
	N	1.0					•		0.01	2000		$27	21.60
	CE	2.0	•	•		•		200	0.01	1000	•	$39	31.20
	NE	2.0					•		0.01	2000		$27	21.60
12 mm	B	2.0	•	•		•		100	0.01	1000	•	$34	27.20
	C	2 or 4	•	•	•	•		200	0.01	1000	•	$36	28.80
	N	2.0					•		0.01	2000		$27	21.60
	BE	4.0	•	•		•		100	0.01	1000	•	$34	27.20
	CE	4.0	•	•	•	•		200	0.01	1000	•	$36	28.80
	NE	4.0					•		0.01	2000		$27	21.60
18 mm	B	5.0	•	•		•		100	0.02	600	•	$37	29.60
	C	5.0	•	•	•	•		200	0.02	600	•	$42	33.60
	N	5.0					•		0.02	1000		$34	27.20
	BE	8.0	•	•		•		100	0.02	600	•	$37	29.60
	CE	8.0	•	•	•	•		200	0.02	600	•	$42	33.60
	NE	8.0					•		0.02	1000		$34	27.20
30 mm	B	10.0	•	•		•		100	0.05	300	•	$46	36.80
	C	10 or 15	•	•	•	•		200	0.05	300	•	$46	36.80
	N	10.0					•		0.05	500		$34	27.20
	BE	15.0	•	•		•		100	0.05	300	•	$46	36.80
	CE	15.0	•	•	•	•		200	0.05	300	•	$46	36.80
	NE	15.0					•		0.05	500		$34	27.20

Other Specs
Protection: IP64 Operating Temp: -20° - 70°C Housing: Nickled Brass (4 & 5mm Stainless Steel)
Short Circuit Protection: Version C,B & A Hysteresis: <10%
Connections: 2 meter Cable, connectors available on most models at small additional cost



Part numbering


Size in mm
SI: Inductive
Insert "E" for unshielded version
Double switching distance not applicable
NPN or PNP (only for VDC "C" version)
Connector H1 std.
no entry for cable
SI
12
–
C
E
4
NPN
N.O.
H1
S
TYPE
Namur type .... N
Amplified 10-30V 2 wire .... B
Amplified 10-30V 3/4wire C
w/double the switching distance D-C
Amplified 20-250VAC............ A
Switching distance
x 2 for D-C models
N.O.
N.C.
N.O.+ N.C.
(Antiphase only
available in "C"
version)
"S"
short version

IVO INDUSTRIES INC.
201 Industrial Way West
Eatontown NJ 07724
Phone: **908-542-5151**
Fax: **908-542-2938**

LEM DynAmp, Inc.

(formerly a division of Halmar Electronics, Inc.)

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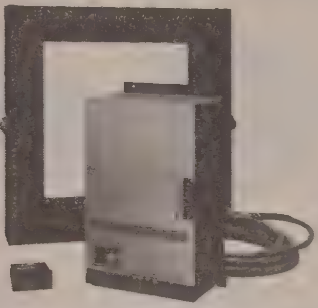
Grove City, OH 43123-0489

Current Metering Systems

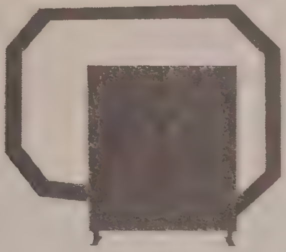
Highest Accuracy Available -0.1%, Proven Reliability, Many Standard Models to Select From...

You can specify current metering from any of 56 standard models from LEM DynAmp, Inc.:

- **Ranges from 4000 to 500,000 Amperes Full Scale**
- **Precision measurement of DC, AC and Bi-Directional currents**
- **Single models or large totalized systems (many individual sensors available)**



Model CM7017 accurately measures dc currents to 40,000 Amps Full Scale



Model CM7150 with 150" Measuring Head and Metering Unit measures up to 350,000 Amperes with 0.1% accuracy.

NEW Family of SIGNAL ISOLATORS features VERSATILITY

Model MVI

Model MVI-RD & MVI-RA

- Highest Isolation Voltage: ±2500 V dc or ac peak
- Highest Accuracy: ±0.1% max.
- Fast Response Time: DC to 4kHz
- Widest Input Scaling Ranges: Input Voltage 100 mV to 1500 V F.S. or Input Current 1 mA to 5 A F.S.
- Versatile Outputs: Voltage Output and Current Output (Customer Specified)
- Powered by AC or DC
- Panel Mount or DIN Rail Mount

Voltage and Current Isolation on a single point basis or full blown data acquisition systems.

Portable Clamp-On Ammeters

Digital, solid-state design works in corrosive atmospheres, wide temperature ranges, high magnetic fields. DC current measurements from 0-100kA @ ±2.5% accuracy. Battery-powered. Optional unit measures ac rms current. Many size sensors available.

Also, Free information about:

- **Integrators & Shunts**

Power Rectifier Analyzer

Safe:

- Install sensors on de-energized rectifier
- Measurements made remotely under load
- Non-contact measurement

Convenient...

- Fast, easy installation with split-apart sensors
- Portable or permanent installations
- Readout on PC or Laptop computers
- Buy or rent

Customer Benefits...

- Locate poor or open conduction paths
- 3% measure of parallel path current sharing
- Troubleshoot and failure prevention
- Certify new rectifier startup
- Improve Power Rectifier Efficiencies

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The Successful Solution for Power Current Measurement

A perfect feed-back system between power current and electronic control

Split Core Transducer
LEM U.S.A. INC
Series LTA

- Measures DC, AC and pulse currents, bandwidth from DC to 150kHz.
- High degree of accuracy: 0.2% to 1% typical
- Currents to 500,000 amperes
- Voltages to 6,400 volts
- Instantaneous or True RMS outputs
- Open and closed loop systems
- Excellent Linearity: less than 0.1% typical
- Accuracy, stability and linearity guaranteed for life
- Reliable in hostile environments
- Rapid Response time: better than 1µsecond
- Wide range of current measurement models

FEEDBACK (Closed Loop) CURRENT TRANSDUCERS- Standard Models

INSTANTANEOUS ANALOG CURRENT OUTPUTS

Nominal Current I_n RMS	Model	Measuring Range (+ and -)	Turns Ratio	Control Output @ I_n	Accuracy @ I_n (+ and -)	Dielectric Strength RMS 50 Hz,1 Min.	Aperture (mm)	Internal Resistance (Ohms)	Supply Voltage (+ and -)	Draw'g Key No.	Dimensions-Approx.		
											Height H(mm)	Width W(mm)	Depth D(mm)
25A	LA25-NP①	0 TO 36A	1:1000	25mA	0.5%	2.5kV	NONE	110	10 to 15	1	16	29.2	26
50A	LA50-S	0 TO 70A	1:1000	50mA	0.5%	3kV	6.4 X 12.7	90	15	2	36	53	26
50A	LTA50-P	0 TO 160A	1:1000	50mA	0.5%	3kV	10	25	15	1	28.3	40	17
50A	LA55-P	0 TO 70A	1:1000	50mA	0.7%	2kV	7 X 12.7	80	12 to 15	1	27	36.5	14.5
100A	LA100-S	0 TO 150A	1:1000	100mA	0.5%	3kV	10 X15	30	15	2	63	53	26
100A	LC100-S	0 TO 200A	1:1000	100mA	0.5%	3kV	15	25	15	4	90	55	31
100A	LT100-P	0 TO 150A	1:1000	100mA	0.5%	3kV	10	30	15	1	33	45	35
100A	LTA100-P	0 TO 160A	1:1000	100mA	0.5%	3kV	10	25	15	1	28.3	40	17
100A	LT100-S	0 TO 200A	1:1000	100mA	0.5%	5kV	15	25	12 TO 18	2	50	76	48
100A	LT100-T	0 TO 200A	1:1000	100mA	0.5%	5kV	BUSBAR	25	12 TO 18	3	50	76	100
200A	LT200-S	0 TO 300A	1:2000	100mA	0.5%	6kV	20	35	12 TO 18	2	52	93	50
200A	LT200-T	0 TO 300A	1:2000	100mA	0.5%	6kV	BUSBAR	35	12 TO 18	3	52	93	112
300A	LC300-S	0 TO 500A	1:2000	150mA	0.5%	3kV	20	35	15	4	95	56	34
300A	LT300-S	0 TO 500A	1:2000	150mA	0.5%	6kV	20	35	12 TO 18	2	52	93	50
300A	LT300-T	0 TO 500A	1:2000	150mA	0.5%	6kV	BUSBAR	35	12 TO 18	4	52	93	112
500A	LC500-S	0 TO 800A	1:5000	100mA	0.3%	3kV	25	80	15	4	110	74	38
500A	LT500-S	0 TO 1000A	1:5000	100mA	0.3%	6kV	25	80	15 TO 24	2	92	116	84
500A	LT500-T	0 TO 1000A	1:5000	100mA	0.3%	6kV	BUSBAR	80	15 TO 24	3	92	116	180
1000A	LC1000-S	0 TO 1500A	1:5000	200mA	0.2%	3kV	40	40	15	4	130	100	38
1000A	LT1000-SI	0 TO 1500A	1:5000	200mA	0.3%	6kV	40	40	15	2	102	169	74
1000A	LT1000-TI	0 TO 1500A	1:5000	200mA	0.3%	6kV	BUSBAR	40	15	3	102	169	180
2000A	LT2000-S	0 TO 3000A	1:5000	400mA	0.2%	6kV	63	25	15 TO 24	2	155	180	118
2000A	LT2000-T	0 TO 3000A	1:5000	400mA	0.2%	6kV	BUSBAR	25	15 TO 24	3	155	180	370

Other models available up to 500,000 amperes ① Designed to provide five current ranges, 5A to 25A.

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Dimensional Drawings

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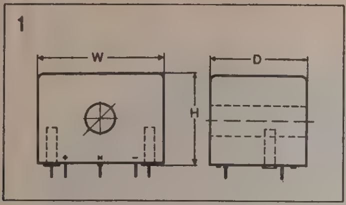
1



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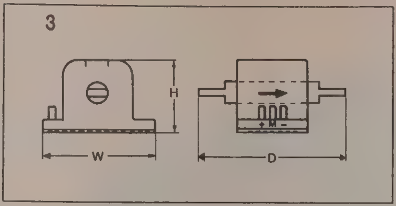

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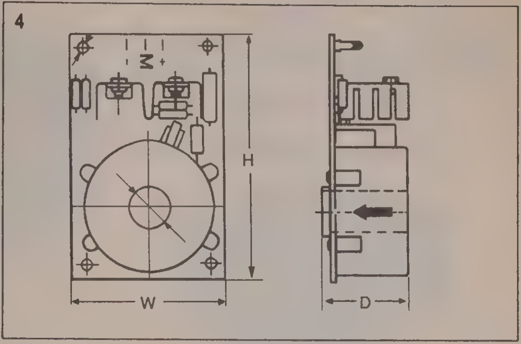

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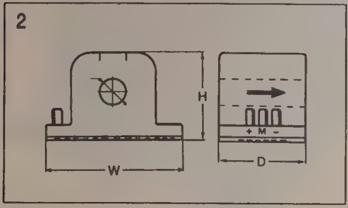

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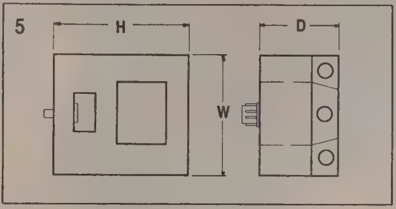

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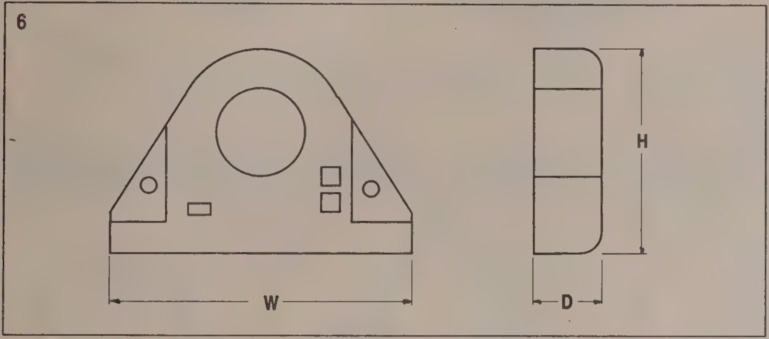

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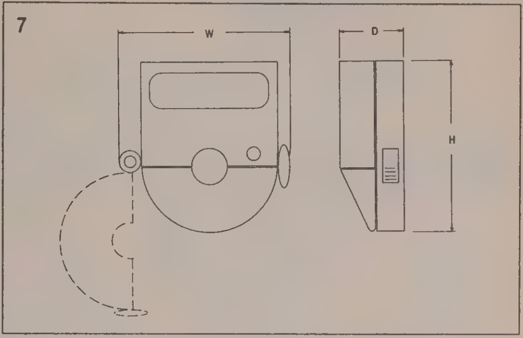

OPEN LOOP CURRENT TRANSDUCERS-Standard Models

INSTANTANEOUS ANALOG OUTPUTS

Nominal Current in RMS (+ and -)	Model	Control Output @ I_n	Measuring Range Peak (+ and -)	Accuracy @ I_n 23 °C	Response Time (max)	Frequency (Small Signal)	Dielectric Strength RMS/50Hz 1 Min.	Supply Voltage (+ and -)	Aperture (mm)	Draw'g Key No.	Dimensions Approx. (mm) Height H	Wide W	Depth D
100A	HAL 100-S	±4V	300A	±1%	3μs	DC to 25kHz	3kV	15VDC	20 X 15	5	41	41	28
200A	HAL 200-S		600A										
300A	HAL 300-S		900A										
400A	HAL 400-S		1000A										
500A	HAL 500-S		1000A										
600A	HAL 600-S		1000A										
100A	HTA 100-S	±4V	300A	±1%	3μs	DC to 25kHz	3kV	15VDC	32	6	70	90	25
200A	HTA 200-S		600A										
300A	HTA 300-S		900A										
400A	HTA 400-S		1000A										
500A	HTA 500-S		1000A										
1000A	HTA 1000-S		1000A										

SPLIT CORE DESIGN

True RMS Outputs also available

Current in Peak (+ and -)	Model	Control Output @ I_n	Accuracy @ I_n 23 °C	Response Time	Frequency (Small Signal)	Dielectric Strength RMS/50Hz 1 Min.	Supply Voltage (+ and -)	Aperture (mm)	Draw'g Key No.	Dimensions Approx. (mm) Height H	Wide W	Depth D
200A	HT 200-SBD	±5V	±1%	1 to 7μs	DC to 25kHz	5kV	15VDC	23	7	72	79	31
300A	HT 300-SBD											
400A	HT 400-SBD											
500A	HT 500-SBD											
1000A	HT 1000-SBD											
200A	HT 200-SID	4 to 20 mA	±1%	1 to 7μs	DC to 25kHz	5kV	15VDC	23	7	72	79	31
300A	HT 300-SID											
400A	HT 400-SID											
500A	HT 500-SID											
1000A	HT 1000-SID											

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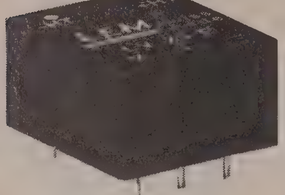
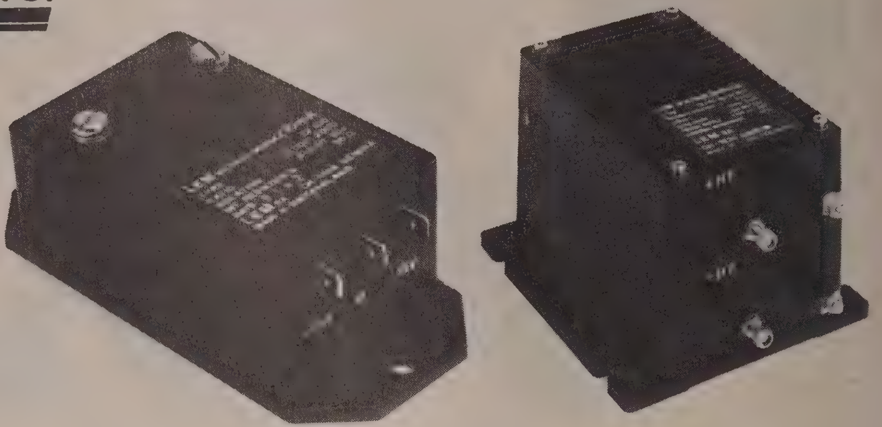
The Successfull Solution for Voltage Measurement





FEEDBACK (Closed Loop) VOLTAGE TRANSDUCERS-Standard Models

INSTANTANEOUS ANALOG CURRENT OUTPUTS

The following Transducers require an external resistor on the primary side to provide appropriate current (I_p) for system voltage to be measured. ①

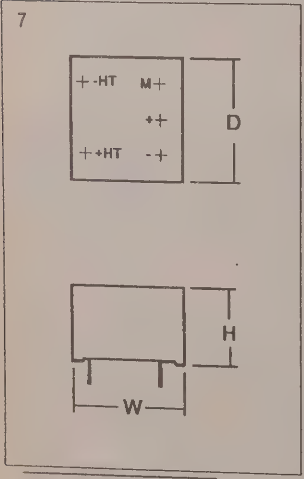
Primary System Voltage V_p	Model	Measuring Current Ip at V_p ①	Turns Ratio	Control Output Current ①	Accuracy @ I_p (+/-)	Dielectric Strength RMS 50 Hz,1 Min.	Supply Voltage (+ and -)	Approximate Dimensions (mm)			
								Key No.	Height H	Width W	Depth D
10V-500V	LV25-P	10mA	2500:1000	25mA	0.6%	2.5kV	15	7	15.9	29.2	26
100-2500V	LV100	10mA	10000:2000	50mA	0.7%	6kV	15	8	138	62	45
100-2500V	LV200-AW	20mA	10000:2000	100mA	0.5%	6kV	15 to 24	10	126	84	100

The following Transducers have the primary side resistor built in for the system voltage to be measured. Other models are available. ①

Primary System Voltage V_p	Model	Measuring Current Ip at V_p ①	Turns Ratio	Control Output Current ①	Accuracy @ I_p (+/-)	Dielectric Strength RMS 50 Hz,1 Min.	Supply Voltage (+ and -)	Key No.	Height H	Width W	Depth D
100V	LV100-100	100mA	1000:2000	50mA	0.7%	6kV	15	9	138	62	99
200V	LV200-AW/2/200	40mA	5000:2500	80mA	1.0%	6kV	15 to 24	10	196	134	105
250V	LV100-250	40mA	2500:2000	50mA	0.7%	6kV	15	9	138	62	99
400V	LV100-400	25mA	4000:2000	50mA	0.7%	6kV	15	9	138	62	99
400V	LV200-AW/2/400	20mA	10000:2500	80mA	1.0%	6kV	15 to 24	10	196	134	105
500V	LV100-500	20mA	5000:2000	50mA	0.7%	6kV	15	9	138	62	99
600V	LV100-600	20mA	5000:2000	50mA	0.7%	6kV	15	9	138	62	99
800V	LV200-AW/2/800	10mA	20000:2500	80mA	1.0%	6kV	15 to 24	10	196	134	105
1600V	LV200-AW/2/1600	10mA	20000:2500	80mA	1.0%	6kV	15 to 24	10	196	134	105
3200V	LV200-AW/2/3200	10mA	20000:2500	80mA	1.0%	6kV	15 to 24	10	196	134	105
6400V	LV200-AW/2/6400	10mA	20000:2500	80mA	1.0%	6kV	15 to 24	10	196	134	105

① Voltage Transducers are wired in parallel with the load. For a given primary system voltage (V_p), a resistor is wired in series on the primary side of the transducer, either externally or internally, to provide a proportional measuring current (I_p)

Dimensional Drawings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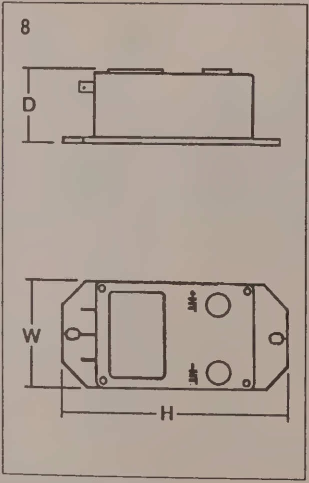
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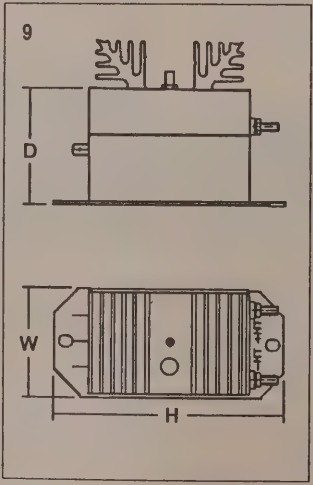
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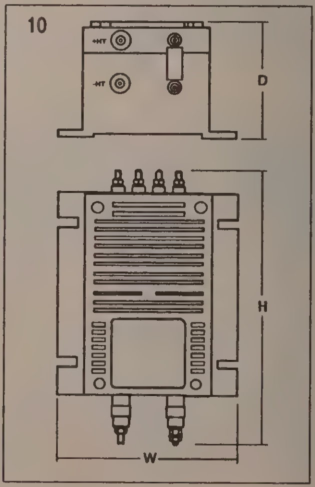
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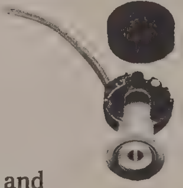
Ledex Encoders

Simplify Encoder Selection with Ledex In-stock Models

Incremental Encoders

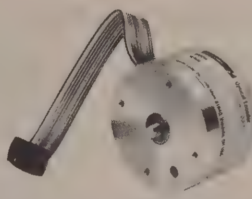
Modular



• Low cost • Install directly on DC servo and stepper motors • Resolution to 2,500 pulses per revolution

Ideal for closed-loop servo and stepper motor systems where low cost, small size, long-term dependability and performance are significant factors in encoder selection.

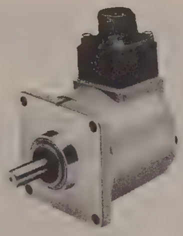
Instrument Grade



- Face or servo mount
- Compact, self-contained shaft encoder
- Resolutions up to 10,000 pulses per revolution

Four series of instrument grade encoders are available with an extensive selection of resolutions, voltage levels and output formats.

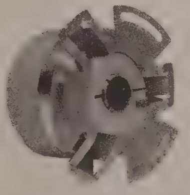
Heavy Duty



- Industrial grade
- Available with a NEMA 4 rating • Flange or servo mount • Integrally coupled model
- Resolutions up to 10,000 pulses/revolution

Rugged encoders designed for the harshest environments where high temperatures, electrical noise, vibration and fluid contaminants are commonly found.

Hollow Shaft

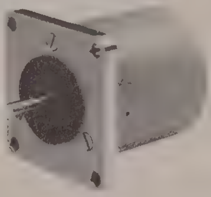


• Resolutions up to 2,500 pulses/revolution • Self-contained, ready-to-mount • 3/8" or 1/2" bore • 1.6" length including flex-mount, 2.0" O.D.

Hollow shaft encoders with unique flex-mount eliminates the special mounting flanges and flexible couplings required with shaft type encoders.

Absolute Encoders

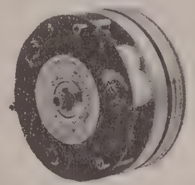
Single Turn

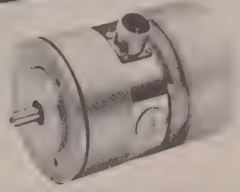


- Output codes: gray, binary, BCD
- Inch or metric mounts: face, servo, or square flange
- 360, 512, 1024, 2048, 4096, and 8192 increments per turn.

State-of-the-art technology with binary, BCD and Gray code formats. Glass code disc for reliability and precision. Three series of encoders.

Multi-Turn

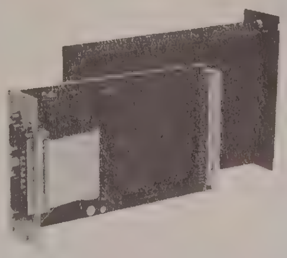




- Modular absolute encoder system
- Synchronous serial interface • Resolution 24 bit Gray code: 4,096 increments per turn, 4,096 turns • Complete self-contained unit or basic encoder

A modular encoder system designed to meet 98% of the multi-turn absolute encoder applications. Designed to stand alone or for direct motor mounting. High quality, clock-like precision.

Serial-to-Parallel Converter Module



- Provides parallel data in the programmable output code groups of Gray, binary or BCD
- Easily programmed
- Non-volatile storage

These modules convert serial information from the multi-turn absolute encoder to parallel data.

- **Use your Visa or Mastercard to save time**
- **Same day shipment on stock models available**
- **Two-week prototyping service for custom designs**

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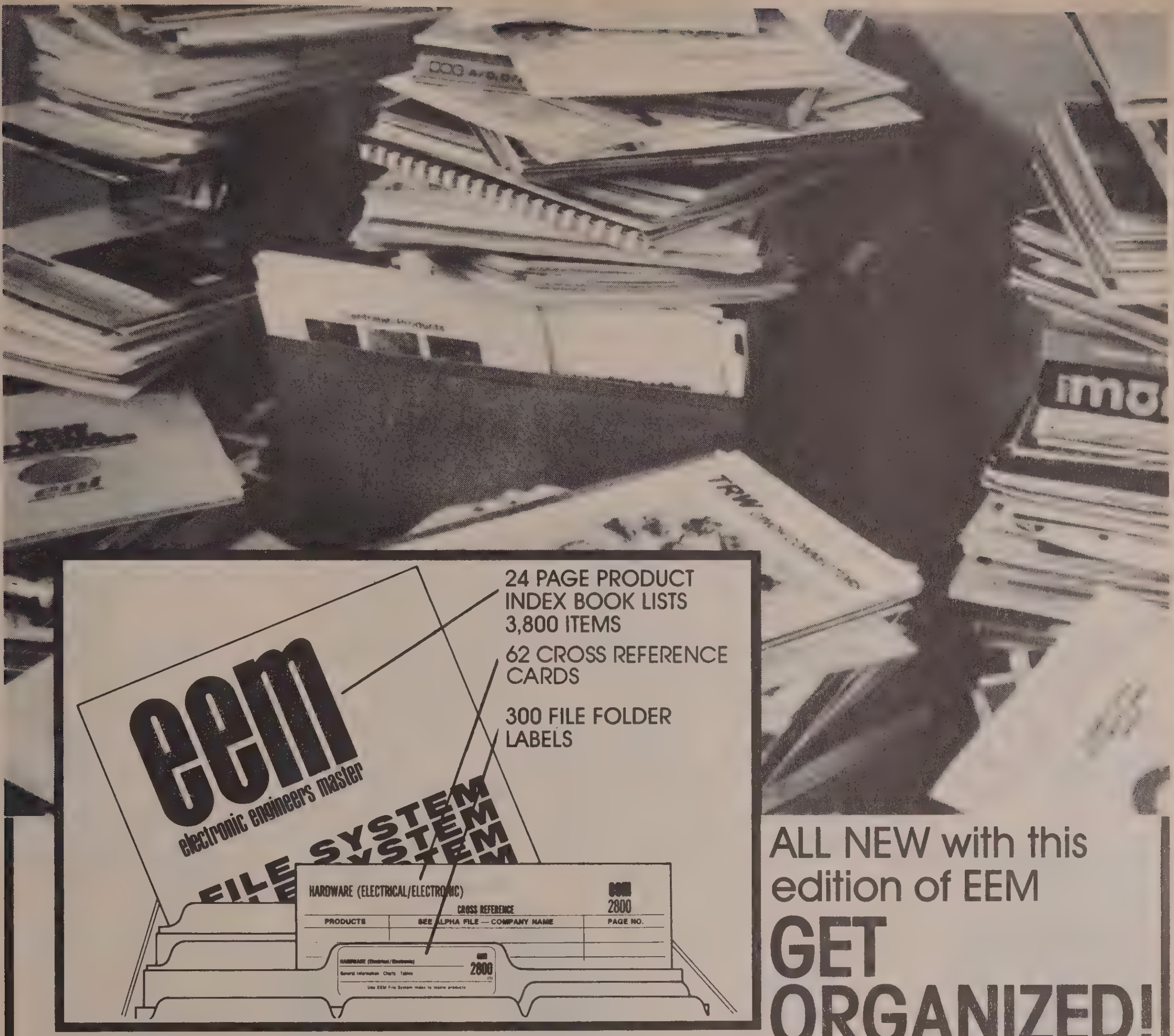
Micro Mo®

MINIATURE ELECTRIC DRIVE SYSTEMS AND ROTARY POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

- ■ Special resolutions & integrated motor-encoder packages available.
- ■ Built-in circuitry available on most models.

INCREMENTAL ENCODER STYLE SELECTOR

SERIES	CASE (mm)	DIAMETER (in.)	OPERATION	STD. RESOLUTION (PPR)	OUTPUT
03A	22	.866	OPTICAL	15	2 CHANNEL QUASISINUSOIDAL
03B	22	.866	OPTICAL	15	2 CHANNEL; SQUARE
09A	22	.866	OPTICAL	180	2 CHANNEL QUASISINUSOIDAL
10A	22	.866	OPTICAL	100	2 CHANNEL QUASISINUSOIDAL
10B	22	.866	OPTICAL	100	2 CHANNEL; SQUARE
HE	10,12,15 OR 16	.393-630	MAGNETIC	10,12,15,16	2 CHANNEL;SINE OR SQUARE
PREX	40	1.575	OPTICAL	100,200,250,300 360,400,500,600	2 CHANNEL + INDEX; SQUARE
HEDS-5000	28	1.102	OPTICAL	100,192,200,256, 360,400,500,512	2 CHANNEL + INDEX;SQUARE
HEDS-5500	30 x 41.1	1.18 x 1.62	OPTICAL	96,100,192 400,500,512	2 CHANNEL + INDEX; SQUARE
HEDS-6000	56	2.205	OPTICAL	192,200,400,500, 512,1000,1024	2 CHANNEL + INDEX; SQUARE


24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
62 CROSS REFERENCE CARDS
300 FILE FOLDER LABELS
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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

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The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will be mailed to you under separate cover.

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a Honeywell Division

Solid State Hall Sensors

Hall effect sensors respond to a magnetic field, or—in the case of Hall vane sensors—to the interruption of a magnetic field. Hall sensors are not rate sensitive. They operate at extremely high speed and include signal conditioning. They offer high reliability, long life, and compatibility with microprocessors and other electronic circuitry.

Sensors are used in:

- Ignition systems
- Brushless DC motors
- Utility meters
- Water softeners
- Gasoline pumps
- Welding equipment
- Balance scales
- Interlocks
- Flowmeters
- Magnetic card readers
- Vending machines
- Home appliances
- Computer equipment
- Medical instruments
- Copy machines
- Laboratory equipment

MAGNETIC POSITION SENSORS

Actual Size

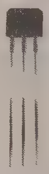
Actual Size

Actual Size

Actual Size

Listing	SS 11	SS22PE	2SSP	SS411A
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	4.5 to 24 VDC	6 to 24 VDC	6 to 24 VDC	3.8 to 24 VDC
Construction	Molded plastic SOT 89 style	Ceramic hybrid circuit	Molded plastic package	Molded plastic package
Termination	Printed circuit board	Printed circuit board	Printed circuit board	Printed circuit board
Operating Speed	0 to over 100 kHz	0-100 kHz	0 to over 100 kHz	0 to over 100 kHz
Operating Gauss (25° C typical) Rel.	40 –40	15 11	15 11	60 –60
Output Type	Digital, current sink 10mA	Digital, current sink 20mA	Digital, current sink 20mA	Digital, current sink 20mA
Other options—Request Catalog 20	Unipolar, Latching magnetics.	4.5 to 5.5 VDC supply.	≈ 1 inch sensing distance.	Unipolar, Latching magnetics.

MAGNETIC POSITION SENSORS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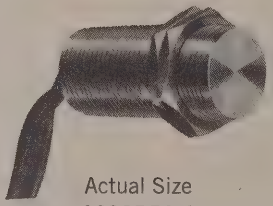
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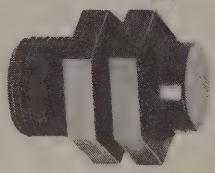

Actual Size

Actual Size

Listing	SS41	103SR5A-1	SR3B-A1	413SR10
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	4.5 to 24 VDC	4.5 to 24 VDC	4.5 to 24 VDC	6 to 16 VDC
Construction	Molded plastic	Threaded aluminum housing	Thermoplastic	Molded plastic housing (Can be gang mounted)
Termination	Printed circuit board	Leadwires	Leadwires	Solder/quick-connect
Operating Speed	0 to over 100 kHz	0 to over 100 kHz	0 to over 100 kHz	0 to over 100 kHz
Operating Gauss (25° C typical) Rel.	40 –40	350 215	90 –90	400 300
Output Type	Digital, current sink 10mA	Digital, current sink 20mA	Digital, current sink 10mA	Digital, current sink 20mA
Other options—Request Catalog 20	Operating gauss.	Threaded stainless steel housing Bipolar magnetics.	Unipolar magnetics.	Bipolar magnetics.

MICRO SWITCH
a Honeywell Division

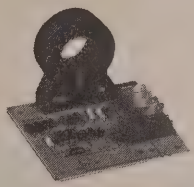
Solid State Hall Sensors

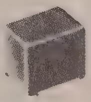
MAGNETIC POSITION SENSORS-Analog Output

Listing	SS19 SS49	Actual Size 91SS12-2	Actual Size SS94A1
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	4 to 10 VDC	8 to 16 VDC	6.6 to 12.6 VDC
Construction	Molded plastic	Ceramic hybrid circuit	Ceramic hybrid circuit
Termination	Surface mount P.C. board	Printed circuit board	Printed circuit board
Operating Speed	1.5 μ seconds Response time	5 μ seconds (Res. Time)	3 μ seconds (Res. Time)
(25° C typical)		Span (–400 to +400) 6V.	Span (–500 to +500) .63Vs.
Output Type	Analog, current source	Analog, current source	Analog, current source
Request Catalog 20			

CURRENT SENSORS

S.S. BASIC SWITCH





Listing	CS Holder Assemblies CSLA2CD	CS Adjustable Linear Sensors CSLF4AD	CS Digital Sensors CSDDIED	1.09 x .40 x .97H. 47XL31-01
Operation	Current sensor	Current sensor	Current sensor	Mechanical plunger
Supply Voltage	6 to 12 VDC	10.5 to 24 VDC	4.5 to 24 VDC	6 to 24 VDC
Construction	Plastic housing	Plastic housing	Plastic housing	Plastic housing
Termination	PC board	PC board Quick conn.	PC board	Solder/quick-connect
Operating Speed	3μ sec.	8μ sec.	150μ sec.	Depends on actuator
Sensed Current max.	72a AC/DC	57a DC	3.5a operate 2.6a release	—
Output Type	Linear, voltage ratio metric	Linear 4-20mA	Digital sinking 40mA	Digital, current sink Normally high 20mA
Other options— Request Catalog 20	Up to 950a sensing. Side mount.	1-5 V output. AC or DC sensing Enclosed versions.	5V or 6-16V supply. Thru hole design. 1.3 to 22a sensing.	Normally low output. Many actuator types.

SALES AND SERVICE

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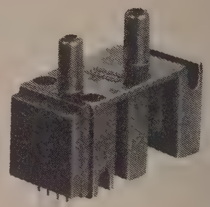
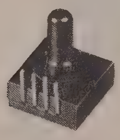
PIEZORESISTIVE PRESSURE SENSORS

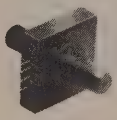
Piezoresistive pressure sensors convert air or liquid pressure to an analog signal. Overall, MICRO SWITCH pressure sensors are small, low cost and reliable. They feature excellent repeatability, high accuracy, and reliability under varying environmental conditions. In addition, they feature highly consistent operating characteristics from one sensor to the next and interchangeability without recalibration. Low cost to keep your systems costs down. Request Catalog 15.

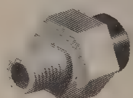
LOW LEVEL SENSORS



	.314 x .5 x 854H **24PC Series**	.314 x .5 x .854H **26PC Series**	.73 x 1.38 x 1.11 H **120PC Series**
Operation	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm
Supply Voltage	10 VDC	10 VDC	10 VDC or 2mA
Pressure Range (psi)	0-.5, 0-15, 0-30	0-5, 0-30	0-28" $H_2$0, 0-5, 0-30
Pressure Measurement Type	Differential & Gage	Gage, Differential	Differential
Construction	Thermoplastic Housing	Thermoplastic Housing	Thermoplastic Housing
Termination	.020" x .040" PCB	.020" x .040" PCB	.020" x .014" PCB
Output	mV	mV	mV
Calibrated Null & Full Scale Output	No	Yes	No (124PC) Yes (126PC)
Temperature Compensated	No	Yes	No (124PC) Yes (126PC)







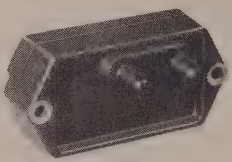
	0.64 sq. x .82H. **130PC Series**	0.85 sq. x 1.35L. **170PC Series**	¼ -18 NPTF port 1 inch hex. **230PC Series**
Operation	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm
Supply Voltage	10 VDC or 2mA typ.	10 VDC or 2mA typ.	10 VDC or 2mA typ.
Pressure Range (psi)	0-1, 0-5, 0-15, 0-30,0-65, 0-100	0-14" $H_2$0, 0-28" $H_2$0	0-15, 0-30, 0-60, 0-100 0-150
Pressure Measurement Type	Absolute & Gage	Differential & Gage	Gage
Construction	Thermoplastic Housing	Thermoplastic Housing	Stainless Steel Housing
Termination	.020" x .014" PCB	.020" x .014" PCB	18" long 22 gauge four conductor cable
Output	mV	mV	mV
Calibrated Null & Full Scale Output	No (134PC) Yes (136PC)	No (174PC) Yes (176PC)	No (234PC) Yes (236PC)
Temperature Compensated	No (134PC) Yes (136PC)	No (174PC) Yes (176PC)	No (234PC) Yes (236PC)

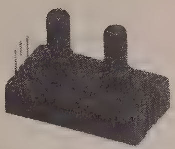
MICRO SWITCH
a Honeywell Division

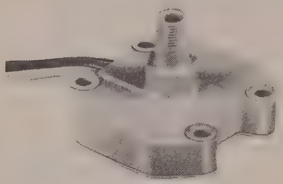
CONDITION SENSORS

HIGH LEVEL PRESSURE SENSORS

Request Catalog 15.


2.35 x .1.18 x 1.12H
140/160PC Series


1.15 x .64 x .84H.
180PC Series

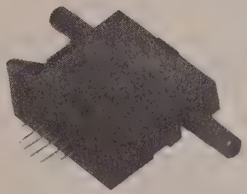

¼ -27 NPT Port
2.2 X 2.3 X 1.57H.
149/249PC Series 240PC Series

Operation	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm
Supply Voltage	8 VDC typ.	8 VDC typ.	8 VDC typ.
Pressure Range (psi)	0-1, 0-2, 0-5, 0-5.8, 0-10, 0-30, (141/142PC) ±1, ±2.5, ±5, ±15 (143PC) 0-27.68" H_2O (161/162PC) ±5" H_2O (163PC) 0-10" H_2O (164PC)	0-5, 0-15, 0-30 (184/185PC) ±2.5, ±5, ±15, (186PC)	3-15 (149PC) 3-15, 0-100, 0-250, (249PC) 0 to -15, (241PC) ±15 (243PC) 0-15, 0-30, 0-60, 0-100, 0-150, 0-250 (242PC)
Pressure Measurement Type	Absolute, Differential, Gage & Vacuum Gage	Absolute, Gage, Differential	Differential/Gage & Vacuum Gage
Construction	Thermoplastic Housing	Thermoplastic Housing	Thermoplastic/Die-cast Aluminum Housing
Termination	.010" x .020" PCB	.010" x .020" PCB	PCB/300mm(12in.) long #18AWG leadwire
Output	Volts	Volts	mA, Volts (240PC)
Calibrated Null & Full Scale Output	Yes	Yes	Yes
Temperature Compensated	Yes	Yes	Yes

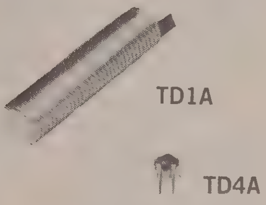
HARSH DUTY PRESSURE SENSOR

SSP Series

AIRFLOW SENSORS


2.14 x 1.24 x .61.
AWM 3100 V

TEMPERATURE SENSORS



TD Temperature Sensors

Operation	Deflection of diaphragm	Silicon bridge heat loss	Proximity to temperature
Supply Voltage	115 VAC, 12 to 36 VDC	10 VDC	1mA (Supply Current)
Construction	Plug-in Die-cast zinc housing NEMA 1, 3, 3R, 4.13	Plastic Housing	Ceramic, plastic or aluminum
Termination	Screw/Receptacle	PCB	Printed circuit board, leadwire or connector compatible
Temperature Range	–25 to 85°C	–25 to 85°C	–40 to 150°C
Output	Digital, adj. set point Linear 4 to 20mA proportional to pressure	Analog 1-5V	Analog

SALES AND SERVICE

MICRO SWITCH serves its customer through a worldwide network of sales offices and distributors. For ordering, application assistance, pricing or name of nearest Authorized Distributor, contact a nearby MICRO SWITCH sales office. See the EEM Yellow Pages or contact:

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Freeport, Illinois 61032
Tel. 1-800-537-6945

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Design Engineers can rely on us to produce a complete line of standard and custom piezo ceramic shapes for a variety of commercial, industrial and military applications.

We've been making innovations in electronic components and piezo ceramics since 1938. And we're still doing it. Take a look at some of our accomplishments in modern ceramic shapes. We've developed discs, blocks, rings, plates, cylinders, tubes and many custom shapes for sonar use, as ultrasonic, hydrophonic, and as torpedo transducers, and in accelerometers and high voltage generators.

Our PZT®-4 is recommended for use in high voltage generators and high power acoustic radiating transducers because of its ability to withstand high levels of electrical excitation and mechanical stress.

PZT-8 was developed to provide a material with the ultimate in power handling capability. This composition has reduced piezoelectric activity at low to moderate excitation levels.

PZT-5A is recommended for use in receiver or generator type transducers such as hydrophones, fuses, accelerometers, and vibration pickups in general, etc., because of its high sensitivity, permittivity and time stability

PZT-5H is better suited to low frequency applications because of increased permittivity, accompanied by a reduced Curie point.

The family of PZT-5 materials may also serve in very low power motor-type transducers because of high motion sensitivity.

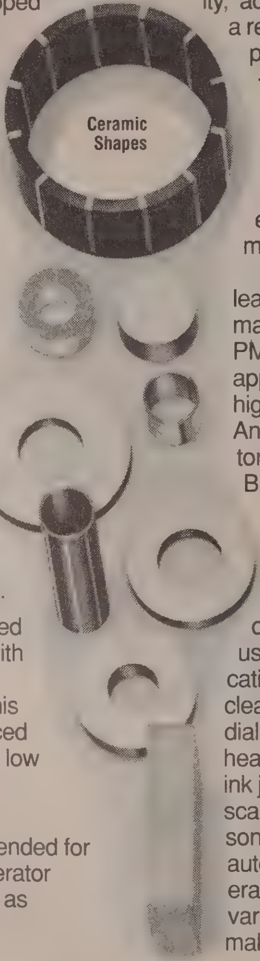
We've also developed lead metaniobate materials, PMN-1 and PMN-2, for diverse applications that feature higher Curie points. And, we are the originators of Unimorphs and Bimorphs to serve as compact transducers for audio tones.

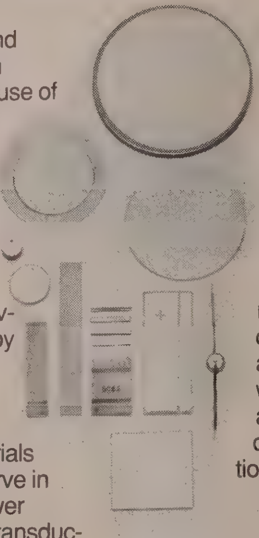
The above compositions are used in such applications as ultrasonic cleaners, kidney dialysis equipment, heart pacemakers, ink jets, ultrasound scanners, gyros, sonobuoys, automatic erasers and a variety of noisemakers. Also in laser positioning and as motion sensors.

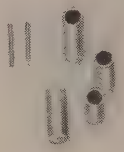
Innovation is also our "hallmark" in bandpass filters, ladder filters, and ceramic resonators. We offer light weight, stable, fixed tuned, miniature ceramic filters and resonators with varieties for almost any kind of communications equipment: consumer—commercial—military.

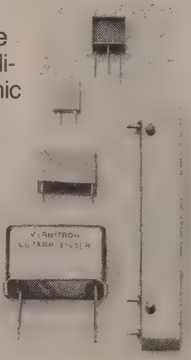
And don't overlook what we've done in piezo igniters for gas fired equipment of all types. Our igniters are original equipment in many makes of barbeque grills, as well as in furnaces, water heaters and camping lanterns. Our igniters are the industry standard worldwide.

So if you're working with piezo ceramics, in alarms, speakers, lasers, sonar, ink jet printing data processing, communications, telephone development, gyros, or hydrophones, pacemakers or gas-fired equipment, give us a call and put our 50 plus years of innovation and experience to work.









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Piezo Igniters

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Bedford, Ohio 44146 USA
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Morgan

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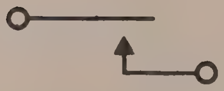
MINIGLOSSARY
RELAY CONTACT FORMS

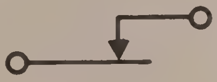
A

Make
SPST-NO



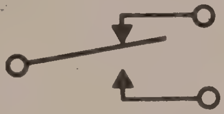
B

Break
SPST-NC



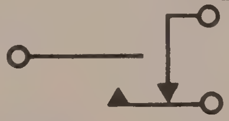
C

Break, Make
(Transfer)
SPDT



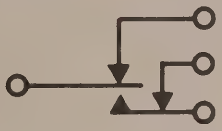
D

Make, Break
(Continuity
Transfer)



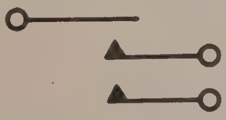
E

Break,
Make,
Break



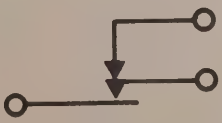
F

Make,
Make



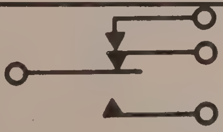
G

Break,
Make



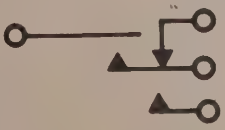
H

Break,
Break,
Make



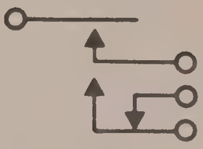
I

Make,
Break,
Make



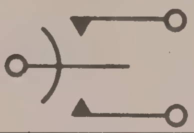
J

Make,
Make,
Break



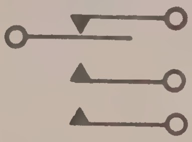
K

Center off
SPDT



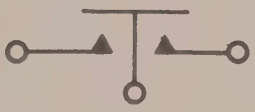
L

Break,
Make,
Make



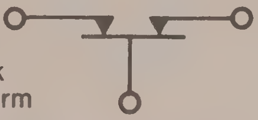
U

Double
make
Contact
on arm



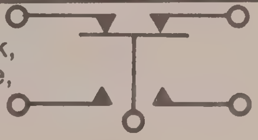
V

Double break
Contact on arm



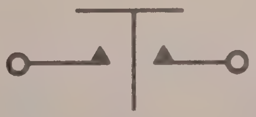
W

Double break,
Double make,
Contact
on arm



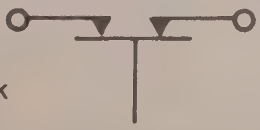
X

Double
make



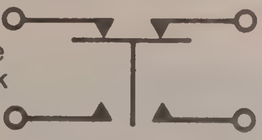
Y

Double break



Z

Double make
Double break
SPDT-DB



ultrasonic ceramic microphones

MURATA ERIE NORTH AMERICA

MA40A5

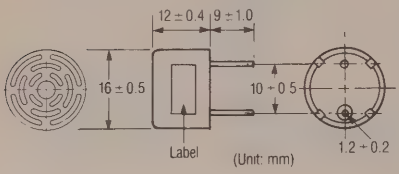
FEATURES

- High sensitivity, small sized and light weight
- Excellent in humidity resistance and fine temperature characteristics
- Excellent vibration and shock resistance
- Large operation range

APPLICATIONS

- Remote control of television, air conditioner or other electronic equipment
- Sensor of burglar alarm system, range finder, etc.
- Sensor for counter

DIMENSIONS



SPECIFICATIONS

		MA40A5R/S
Nominal Frequency	(KHz)	40
Sensitivity	(dB)	– 67 min.
Sound Pressure	(dB)	112 min.
Directivity	(deg)	50°
Capacitance	(pF)	2000
Allowable Input Voltage	(Vrms)	20
Operating Temp. Range	(°C)	– 20 to + 85
Detectable Range	(m)	0.2 to 6
Resolution	(mm)	9

*Sensitivity: 0 dB = 1 V/µ Bar, Sound Pressured at 30 cm, 0 dB = 2×10^{-4} µ Bar

MA40S2R/S

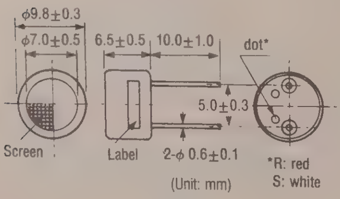
FEATURES

- Subminiature type
- High sensitivity and excellent temperature characteristics
- Excellent humidity resistance, vibration resistance and shock resistance

APPLICATIONS

- Range finder, adjacent switch or burglar alarm system
- Remote control of air conditioner or other electronic equipment
- Sensor for counter or human body

DIMENSIONS



SPECIFICATIONS

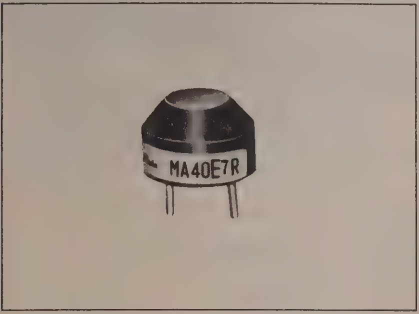
		MA40S2R/S
Nominal Frequency	(KHz)	40
Sensitivity	(dB)	– 74 min.
Sound Pressure	(dB)	100 min.
Directivity	(deg)	100°
Capacitance	(pF)	1600
Allowable Input Voltage	(Vrms)	10
Operating Temp. Range	(°C)	– 30 to + 85
Detectable Range	(m)	0.2 to 4
Resolution	(mm)	9

*Sensitivity: 0 dB = 1 V/µ Bar, Sound Pressured at 30 cm, 0 dB = 2×10^{-4} µ Bar

MURATA ERIE NORTH AMERICA

220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

ultrasonic ceramic microphones



MA40E7R/S

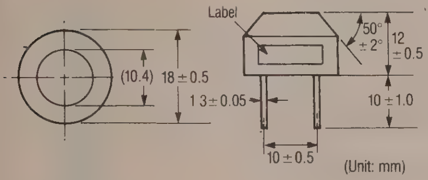
FEATURES

- Can be used outdoors because of its waterproof structure
- Excellent ambient temperature
- High sensitivity and excellent temperature characteristics

APPLICATIONS

- Automobile back up sensors
- Rear obstructives detection for cars
- Distance measurement or object detection outdoors
- Water level or liquid level memter

DIMENSIONS



SPECIFICATIONS

		MA40E7R/S
Nominal Frequency	(KHz)	40
Sensitivity	(dB)	—74 min.
Sound Pressure	(dB)	106 min.
Directivity	(deg)	100
Capacitance	(pF)	2200
Allowable Input Voltage	(Vms)	10
Operating Temp. Range	(°C)	—30 to +85
Detectable Range	(m)	0.2 to 3
Resolution	(mm)	9

MA40B6

FEATURES

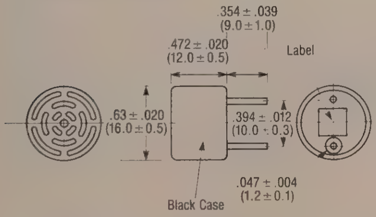
- A special structure provides broad band use
- High sensitivity and large operating range
- Excellent humidity resistance and fine temperature characteristics
- Excellent vibration and shock resistance

APPLICATIONS

- Remote control of television, etc.
- Burglar alarm system

DIMENSIONS

MA40B5/MA40B6



SPECIFICATIONS

		MA40B6
Nominal Frequency	(KHz)	40
Sensitivity	(dB)	– 54 min. (at 30 cm)
Sound Pressure	(dB)	
Directivity	(deg)	40°
Capacitance	(pF)	1100
Allowable Input Voltage	(Vrms)	20
Operating Temp. Range	(°C)	– 20 to + 85
Detectable Range	(m)	0.2 to 4
Resolution	(mm)	9

*Sensitivity: 0 dB = 20 Vpp

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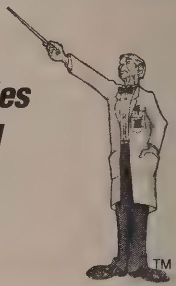

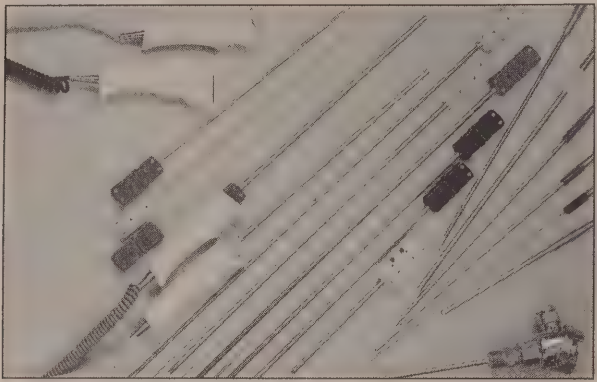

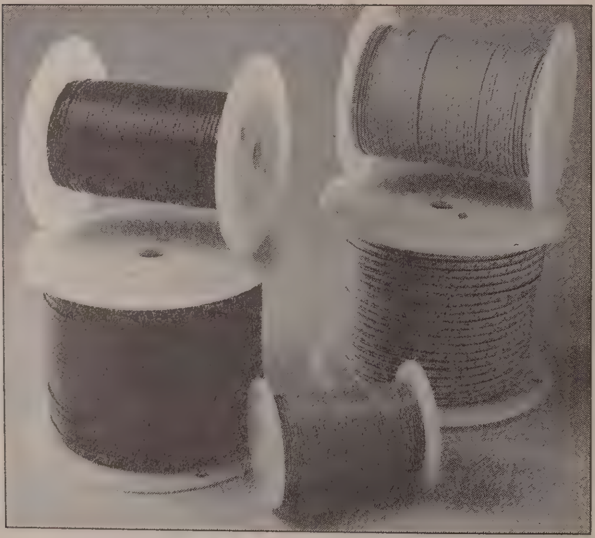

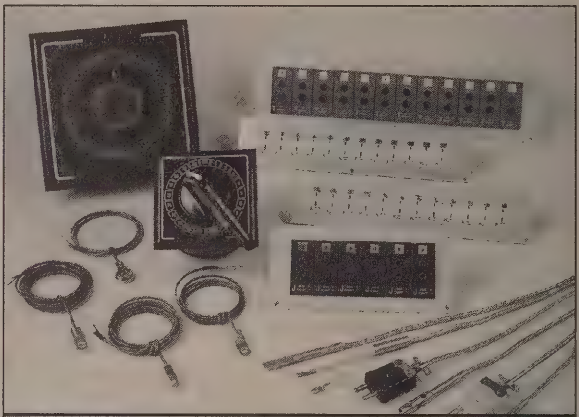

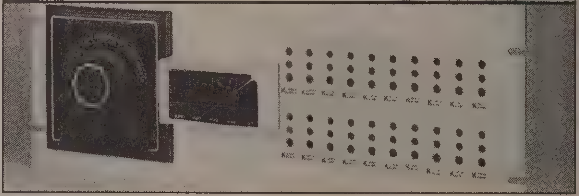

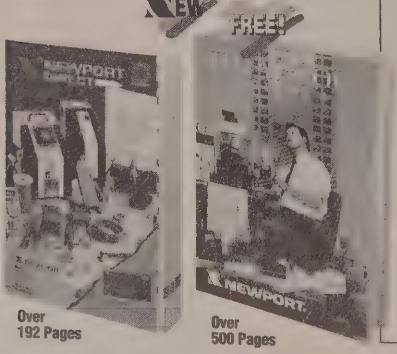

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Optical Encoders

Incremental/Absolute

OAKGRIGSBY

Engineered, manufactured, and tested for superior performance OakGrigsby's Series OE1, 800, and 1000 optical encoders offer unmatched reliability and long life. Advanced optical switching technology eliminates metal contacts and related metal fatigue...the result is superior accuracy and extended life.

OE1 Series

Electrical Specifications

Operating Voltage	5 Vdc ±0.25 Vdc
Switching Current	30 mA max.
Power Consumption	@ 5 Vdc; 150 mW max.
Logic Low Minimum	0.5V
Logic High Minimum	3.8V
Life Rating	5 million cycles
Operating Temperature	-40°C to 125°C
Storage Temperature	-55°C to 150°C
Humidity	85% RH @ 40°C, 240 hrs.

Mechanical Specifications

Shaft Rotation	Continuous
Operating Speed	100 RPM max.
Axial Force	15 lb. min. push/pull force

Materials and Finishes

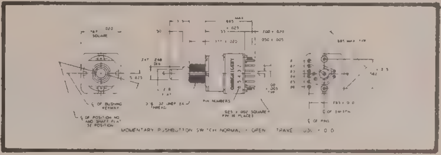
Housing	Thermoplastic
Bushing	Zinc casting, cadmium plate
Shaft	Stainless steel
PC Boards	NEMA Grade FR-4
Board Terminals	Brass tinned
Mounting Hardware	One cadmium plated nut and lockwasher supplied with each

Options

- 16, 24, 32, 64, 128 Electrical Positions
- Bushing Length/Shaft Diameter
- Panel Seal
- Binary/Gray Code
- Cable/PC Terminals

Pushbutton Switch Specifications

Rating @ 25 Vdc	10 mA resistive
Contact Resistance	End of Life-100 milliohms
Voltage Breakdown	250 Vac
Life Rating	3 million cycles
Contact Bounce	Less than: 4 milliseconds at make, 10 milliseconds at break
Operating Force	300 grams standard



800 Series

Electrical Specifications

Operating Voltage	5 Vdc ±0.5 Vdc
Switch Current	30 mA max.
Output	TTL and CMOS compatible
Life Rating	5 million-thermoplastic shaft 10 million-stainless steel shaft 100 million-ball bearing construction
Operating Temp.	-40°C to 105°C
Storage Temp.	-55°C to 150°C
Humidity	85% RH @ 40°C, 240 hrs.

Mechanical Specifications

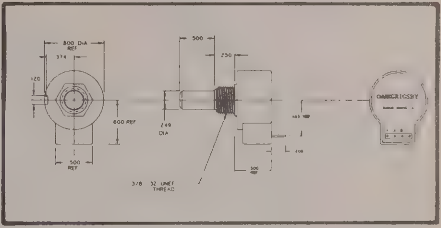
Shaft Rotation	Continuous
Oper. Speed	200 RPM max.- Thermoplastic and stainless steel shaft 2000 RPM max.- Ball bearing construction
Axial Force	15 lb. min. push/pull force

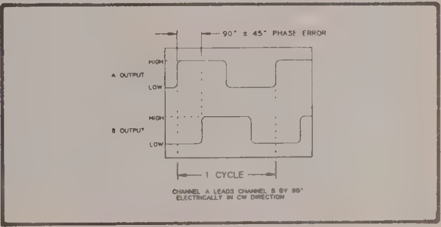
Materials and Finishes

Housing	Thermoplastic
Bushing	Aluminum/brass, nickel plated options
Shaft	Thermoplastic/stainless steel options
PC Boards	NEMA Grade FR-4
Board Terminals	Brass tinned
Mounting Hardware	One cadmium plated nut and lockwasher supplied with each

Options

- 16, 24, 32, 64, 100, 120, and 128 Electrical Positions
- Bushing Lengths/Shaft Diameter and Lengths
- Panel Seal
- Dual Construction - Two sectioned, with concentric shafts
- Cable/PC Terminals




90° ± 45° PHASE ERROR
A OUTPUT
HIGH
LOW
B OUTPUT
HIGH
LOW
1 CYCLE
CHANNEL A LEADS CHANNEL B BY 90° ELECTRICALLY IN CW DIRECTION

1000 Series

Electrical Specifications

Operating Voltage	5 Vdc ±0.5 Vdc
Switching Current	30 mA max.
Output	Open Collector TTL and CMOS compatible
Life Rating	1 million cycles (detented)
Operating Temp.	-40°C to 125°C
Storage Temp.	-55°C to 150°C
Humidity	85% RH @ 40°C, 240 hrs.

Mechanical Specifications

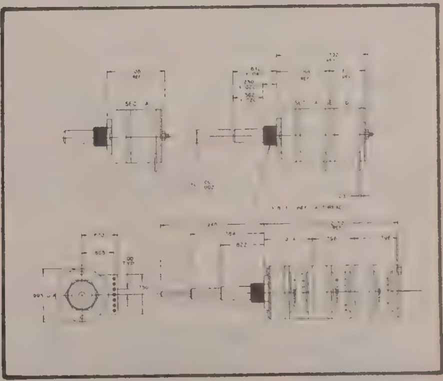
Shaft Rotation	Continuous (stops available)
Oper. Speed	100 RPM max. - standard 2000 RPM max. - ball bearing
Axial Force	15 lb. min. push/pull force

Materials and Finishes

Housing	Thermoplastic
Bushing	Brass/Nickel plate
Shaft	Stainless steel
PC Boards	NEMA Grade FR-4
Board Terminals	Brass tinned
Mounting Hardware	One cadmium plated nut and lockwasher supplied with each

Options

- Binary/Gray Code up to 5 Bit
- Multidecks (3 maximum)
- Bushing/Shaft Diameter and Lengths
- Concentric Shafts
- Custom Codes Available



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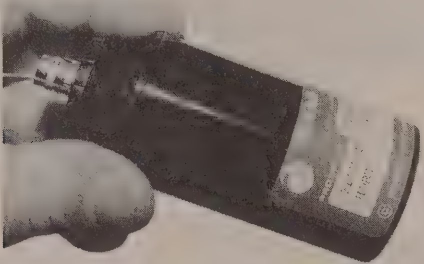

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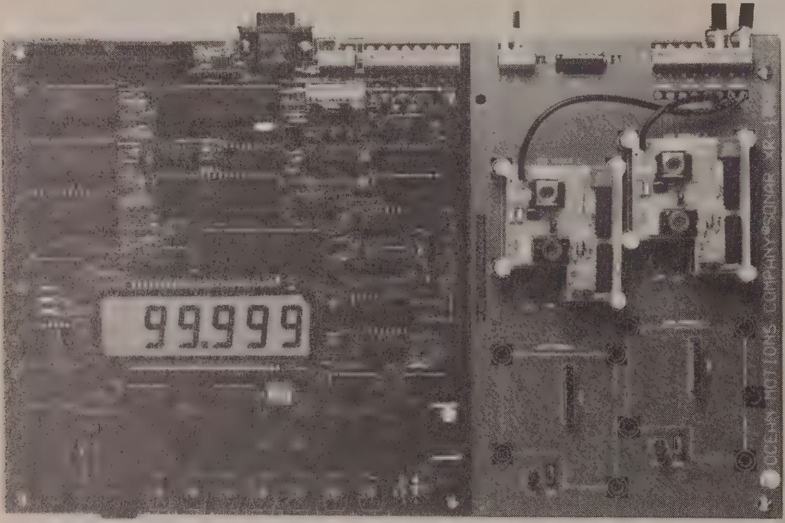

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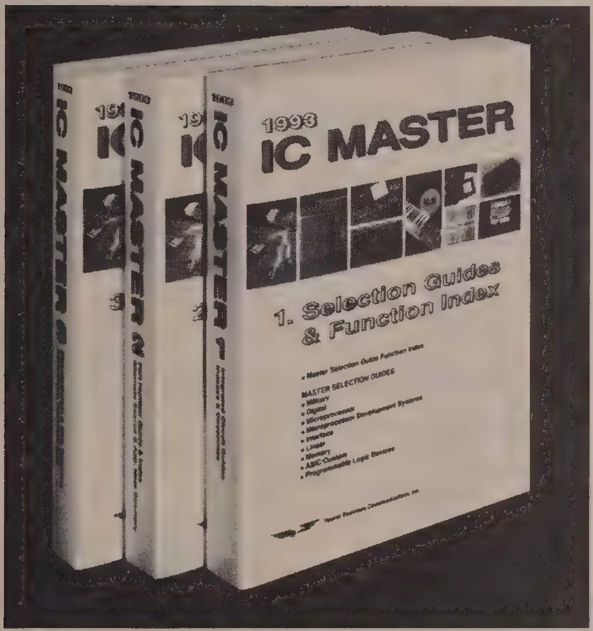

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IC MASTER

Published annually in February,

WATT/WATTHOUR TRANSDUCERS

AC WATT TRANSDUCER

MODEL **PC5**

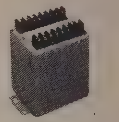
SINGLE PHASE 50/60 HERTZ

FEATURES

- Accurate regardless of phase, voltage unbalance, current unbalance, or power factor.
- Output is proportional to true power delivered to a load; P=EI(COS θ). Provides bi-directional operation.
- **Calibrated with standards traceable to NIST.**

APPLICATIONS

- Equipment power consumption
- For use with SCR controls, chopped waveforms, or where harmonic components exist.
- Standard outputs provide signal for interface with meters, recorders, or data acquisition equipment.



MODELS WITH INTEGRAL CURRENT SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 1.0	100	NOT APPLICABLE	103A	103B	103C	103D	103E	103E2	103CX5	103X5
	0 to 2.5	250		106A	106B	106C	106D	106E	106E2	106CX5	106X5
	0 to 5.0	500		001A	001B	001C	001D	001E	001E2	001CX5	001X5
	0 to 10.0	1000		010A	010B	010C	010D	010E	010E2	010CX5	010X5
	0 to 15.0	1500		019A	019B	019C	019D	019E	019E2	019CX5	019X5
	0 to 20.0	2000		117A	117B	117C	117D	117E	117E2	117CX5	117X5
0 to 300	0 to 1.0	200		104A	104B	104C	104D	104E	104E2	104CX5	104X5
	0 to 2.5	500		107A	107B	107C	107D	107E	107E2	107CX5	107X5
	0 to 5.0	1000		002A	002B	002C	002D	002E	002E2	002CX5	002X5
	0 to 10.0	2000		011A	011B	011C	011D	011E	011E2	011CX5	011X5
	0 to 15.0	3000		020A	020B	020C	020D	020E	020E2	020CX5	020X5
	0 to 20.0	4000		110A	110B	110C	110D	110E	110E2	110CX5	110X5
0 to 600	0 to 1.0	500		105A	105B	105C	105D	105E	105E2	105CX5	105X5
	0 to 2.5	1000		108A	108B	108C	108D	108E	108E2	108CX5	108X5
	0 to 5.0	2000		003A	003B	003C	003D	003E	003E2	003CX5	003X5
	0 to 10.0	4000		012A	012B	012C	012D	012E	012E2	012CX5	012X5
	0 to 15.0	6000		021A	021B	021C	021D	021E	021E2	021CX5	021X5
	0 to 20.0	8000		111A	111B	111C	111D	111E	111E2	111CX5	111X5

Highlighted models, (5A), can be used with customer's existing current transformers.

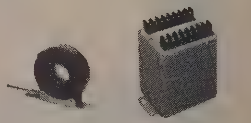
*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit, (15-40Vdc).
All others require 85-135VAC instrument power, (50-400Hz.)

MILLIVOLT OUTPUTS AVAILABLE- CONSULT FACTORY

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
PC5-001CX5



MODELS SUPPLIED WITH EXTERNAL SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	10K	W	058A	058B	058C	058D	058E	058E2	058CX5	058X5
	0 to 200	20K	W	067A	067B	067C	067D	067E	067E2	067CX5	067X5
	0 to 400	40K	X	076A	076B	076C	076D	076E	076E2	076CX5	076X5
	0 to 600	60K	X	085A	085B	085C	085D	085E	085E2	085CX5	085X5
	0 to 1000	100K	Y	094A	094B	094C	094D	094E	094E2	094CX5	094X5
0 to 300	0 to 100	20K	W	059A	059B	059C	059D	059E	059E2	059CX5	059X5
	0 to 200	40K	W	068A	068B	068C	068D	068E	068E2	068CX5	068X5
	0 to 400	80K	X	077A	077B	077C	077D	077E	077E2	077CX5	077X5
	0 to 600	120K	X	086A	086B	086C	086D	086E	086E2	086CX5	086X5
	0 to 1000	200K	Y	095A	095B	095C	095D	095E	095E2	095CX5	095X5
0 to 600	0 to 100	40K	W	060A	060B	060C	060D	060E	060E2	060CX5	060X5
	0 to 200	80K	W	069A	069B	069C	069D	069E	069E2	069CX5	069X5
	0 to 400	160K	X	078A	078B	078C	078D	078E	078E2	078CX5	078X5
	0 to 600	240K	X	087A	087B	087C	087D	087E	087E2	087CX5	087X5
	0 to 1000	400K	Y	096A	096B	096C	096D	096E	096E2	096CX5	096X5

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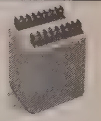
WATT/WATTHOUR TRANSDUCERS

AC WATT TRANSDUCER MODEL PC5

THREE PHASE-THREE WIRE 50/60 HERTZ



MODELS WITH INTEGRAL CURRENT SENSOR (DOUBLE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODELNUMBER PC5-STANDARDOUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1K	NOT APPLICABLE	004A	004B	004C	004D	004E	004E2	004CX5	004X5
	0 to 10	2K		013A	013B	013C	013D	013E	013E2	013CX5	013X5
	0 to 15	3K		022A	022B	022C	022D	022E	022E2	022CX5	022X5
	0 to 20	4K		112A	112B	112C	112D	112E	112E2	112CX5	112X5
0 to 300	0 to 5	2K		005A	005B	005C	005D	005E	005E2	005CX5	005X5
	0 to 10	4K		014A	014B	014C	014D	014E	014E2	014CX5	014X5
	0 to 15	6K		023A	023B	023C	023D	023E	023E2	023CX5	023X5
	0 to 20	8K		113A	113B	113C	113D	113E	113E2	113CX5	113X5
0 to 600	0 to 5	4K		006A	006B	006C	006D	006E	006E2	006CX5	006X5
	0 to 10	8K		015A	015B	015C	015D	015E	015E2	015CX5	015X5
	0 to 15	12K		024A	024B	024C	024D	024E	024E2	024CX5	024X5
	0 to 20	16K		114A	114B	114C	114D	114E	114E2	114CX5	114X5

Highlighted models, (5A), can be used with customer's existing current transformers.

150V models may be used with single-phase, three wire, 120V Edison systems.

**4-20mA loop-powered unit (15-40Vdc).

* Denotes self-powered unit, limiting input voltage ranges to:

85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

MODELS SUPPLIED WITH EXTERNAL SENSORS (DOUBLE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	20K	W	061A	061B	061C	061D	061E	061E2	061CX5	061X5
	0 to 200	40K	W	070A	070B	070C	070D	070E	070E2	070CX5	070X5
	0 to 400	80K	X	079A	079B	079C	079D	079E	079E2	079CX5	079X5
	0 to 600	120K	X	088A	088B	088C	088D	088E	088E2	088CX5	088X5
	0 to 1000	200K	Y	097A	097B	097C	097D	097E	097E2	097CX5	097X5
0 to 300	0 to 100	40K	W	062A	062B	062C	062D	062E	062E2	062CX5	062X5
	0 to 200	80K	W	071A	071B	071C	071D	071E	071E2	071CX5	071X5
	0 to 400	160K	X	080A	080B	080C	080D	080E	080E2	080CX5	080X5
	0 to 600	240K	X	089A	089B	089C	089D	089E	089E2	089CX5	089X5
	0 to 1000	400K	Y	098A	098B	098C	098D	098E	098E2	098CX5	098X5
0 to 600	0 to 100	80K	W	063A	063B	063C	063D	063E	063E2	063CX5	063X5
	0 to 200	160K	W	072A	072B	072C	072D	072E	072E2	072CX5	072X5
	0 to 400	320K	X	081A	081B	081C	081D	081E	081E2	081CX5	081X5
	0 to 600	480K	X	090A	090B	090C	090D	090E	090E2	090CX5	090X5
	0 to 1000	800K	Y	099A	099B	099C	099D	099E	099E2	099CX5	099X5

MODEL PC5 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 48 to 70 Hz.
RESPONSE (Transient 90%):
  With integral sensors: Less than 100 microSeconds
  With current transformers W,X, and Y: 1mS
BURDEN:
  Voltage: 1.25VA
  Current: 1.25VA
  Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
  2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
  Option: A-B: 0-10K
  C-D: Greater than 2K
  E-E2: 0-1.5K
  CX5-X5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.

TEMPERATURE EFFECT (-10° to 60°C):
  +/- 1.0% of reading
  +/- 0.1% F.S. output

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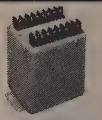
WATT/WATTHOUR TRANSDUCERS

AC WATT TRANSDUCER MODEL PC5

THREE PHASE-FOUR WIRE 50/60 HERTZ



MODELS WITH INTEGRAL CURRENT SENSOR (THREE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1.5K	NOT APPLICABLE	007A	007B	007C	007D	007E	007E2	007CX5	007X5
	0 to 5	1.5K		7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5X5
	0 to 10	3.0K		016A	016B	016C	016D	016E	016E2	016CX5	016X5
	0 to 15	4.5K		025A	025B	025C	025D	025E	025E2	025CX5	025X5
	0 to 20	6.0K		115A	115B	115C	115D	115E	115E2	115CX5	115X5
0 to 300	0 to 5	3.0K		008A	008B	008C	008D	008E	008E2	008CX5	008X5
	0 to 5	3.0K		8.5A	8.5B	8.5C	8.5D	8.5E	8.5E2	8.5CX5	8.5X5
	0 to 10	6.0K		017A	017B	017C	017D	017E	017E2	017CX5	017X5
	0 to 15	9.0K		026A	026B	026C	026D	026E	026E2	026CX5	026X5
	0 to 20	12K		116A	116B	116C	116D	116E	116E2	116CX5	116X5
NOTE: PART NUMBERS 7.5 AND 8.5 DENOTE 21/2 ELEMENT UNITS											

ADDITONAL OUTPUTS AVAILABLE- CONSULT FACTORY

Highlighted models, (5A), can be used with customer's existing current transformers.

Al l voltage specifications are **line-to-neutral voltage**.

*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit (15-40Vdc).
All others require 85-135VAC instrument power, (50-400Hz.).

ORDERING INFORMATION

Example: Self-powered, three phase-four wire, 120V, 5A input with 0-5Vdc output.

PC5-007CX5

MODELS SUPPLIED WITH EXTERNAL SENSORS (THREE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	30K	W	064A	064B	064C	064D	064E	064E2	064CX5	064X5
	0 to 200	60K	W	073A	073B	073C	073D	073E	073E2	073CX5	073X5
	0 to 400	120K	X	082A	082B	082C	082D	082E	082E2	082CX5	082X5
	0 to 600	180K	X	091A	091B	091C	091D	091E	091E2	091CX5	091X5
	0 to 1000	300K	Y	100A	100B	100C	100D	100E	100E2	100CX5	100X5
0 to 300	0 to 100	60K	W	065A	065B	065C	065D	065E	065E2	065CX5	065X5
	0 to 200	120K	W	074A	074B	074C	074D	074E	074E2	074CX5	074X5
	0 to 400	240K	X	083A	083B	083C	083D	083E	083E2	083CX5	083X5
	0 to 600	360K	X	092A	092B	092C	092D	092E	092E2	092CX5	092X5
	0 to 1000	600K	Y	101A	101B	101C	101D	101E	101E2	101CX5	101X5

MODEL PC5 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 48 to 70 Hz.
RESPONSE (Transient 90%):
  With integral sensors: Less than 100 microSeconds
  With current transformers W,X, and Y: 1mS
BURDEN:
  Voltage: 1.25VA
  Current: 1.25VA
  Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
  2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
  Option: A-B: 0-10K
  C-D: Greater than 2K
  E-E2: 0-1.5K
  CX5-X5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5%
  Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
  +/- 1.0% of reading
  +/- 0.1% F.S. output

FOR WATTHOUR TRANSDUCERS CONTACT FACTORY
CONTACT FACTORY FOR FREE COPY OF COMPLETE PRODUCT CATALOG

OHIO SEMITRONICS, INC.

1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-2287
PHONE: (614) 486-9561 FAX: (614) 486-0743
TO PLACE AN ORDER: 1-800-537-6732

WATTHOUR TRANSDUCER

OSI WATTHOUR TRANSDUCER *MODEL* WL45R

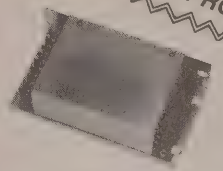
FEATURES

- Low cost.
- Small package.
- Three phase three wire or three phase four wire measurement.

APPLICATIONS

- Substation metering.
- Industrial power monitoring.
- Load profiling.
- Revenue metering.

NEW PRODUCT



DESCRIPTION

The WL series transducer is a low cost watthour transducer utilizing electronic multiplication of line current and phase voltage to produce true power. Time integration results in a contact closure for each 5 watthours of energy transferred to the load.

Low cost and small size are accomplished by eliminating expensive potential transformers. The input/output isolation normally provided by the potential transformers is achieved by the dry contact output relay. This technique requires the use of isolating current transformers for current sensing.

SPECIFICATIONS

INPUTS

VOLTAGE: 120/208 & 277/480VAC

PHASE: 3 Phase 3 Wire Or 3 Phase 4 Wire

RANGE: ±15%

*CURRENT: (Non-Isolated) 5 Amp

BURDEN: 2.5 VA

POWER FACTOR: 0.5 Lead To 0.5 Lag

OUTPUT

RELAY: Dry Contact, 120 V, 0.3 A, 10 VA MAX.

CLOSURE DURATION: 250 Milliseconds

ISOLATION: INPUT/OUTPUT/CASE 1500 VAC

ACCURACY ±0.5% F.S.

POWER REQUIREMENTS

INSTRUMENT POWER: 208/240/480V, 50/60Hz, 2.5 Watts

TEMPERATURE EFFECTS

(–20°C To +60°C) ±0.03%/°C

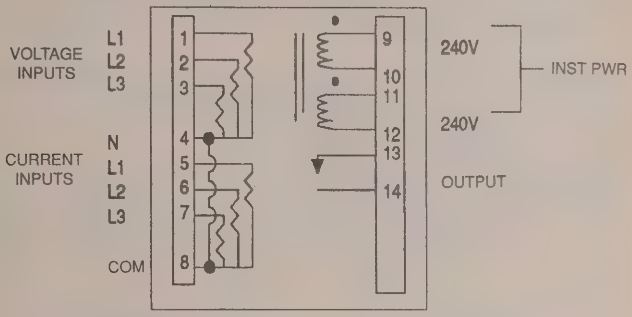
OUTPUT CONTACT CLOSURE RATE

The WL watthour transducer is calibrated to provide a contact closure for 5 watthours of energy. A current transformer ratio of unity is used in calibration. In practice, each contact closure will represent 5 watthours times the current transformer ratio. For example, the use of 100:5 ampere current transformers would cause each contact closure to represent 100 watthours. With 200:5 transformers each closure would represent 200 watthours.

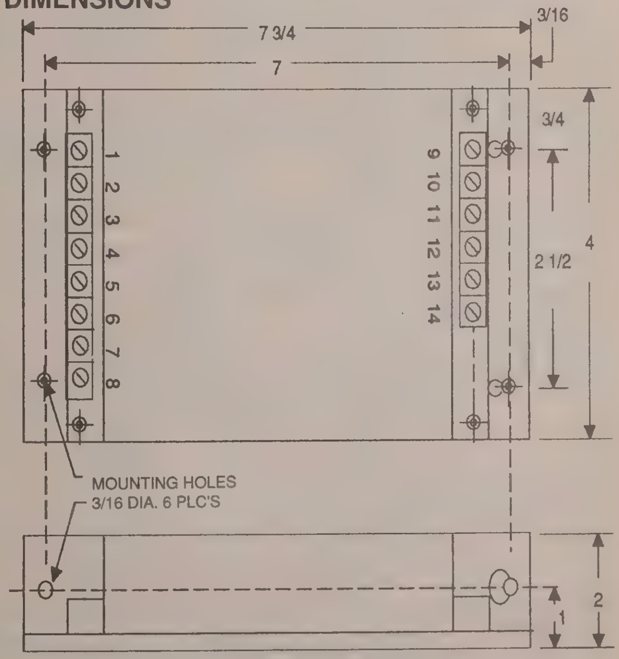
*CAUTION

To prevent damage to power lines and the watthour transducer NEVER connect the current inputs directly, **always use current transformers** rated for 600VAC at 5 ampere secondary current.

CONNECTIONS



DIMENSIONS



DIMENSIONS IN INCHES

SPLIT CORE AND SOLID CORE CURRENT TRANSFORMERS AVAILABLE - SEE EEM PAGE B•1991 FOR DETAILS.

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WATT/POWER TRANSDUCER

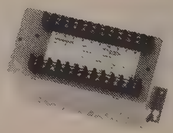
AC WATT/POWER FACTOR/VOLT-AMPERE TRANSDUCER *MODEL* PC20

FEATURES

- 0.25% Accuracy for true power measurement on sinusoidal or distorted waveforms.
- 0.25% Accuracy for apparent power (volt-ampere). Separate rms values for voltage and current are computed and then the product is determined to insure high accuracy.
- 0.50% Accuracy for power factor is derived from the ratio of true power to apparent power. This provides accurate results for sinusoidal, distorted or SCR controlled wave forms.
- Three separate outputs are provided -- one each for true power (watts), apparent power (volt-amperes) and power factor. The minimum output, zero or 4mA, occurs at zero input for watts or VA and zero power factor. Maximum output listed occurs at full scale watts or VA and at unity power factor. The scale is linear between these end points.

APPLICATIONS

- Building monitoring to attain efficient use of electrical energy.
- Process monitoring to maintain consistent product quality.
- Equipment monitoring to determine and/or maintain operating efficiency.
- Where SCR controlled, chopped, or otherwise distorted waveforms causes sinusoidal-based instrumentation to provide erroneous information.
- Wide frequency range --- 50 to 400Hz.



SINGLE PHASE - TWO WIRE (ONE ELEMENT)

INPUTS		F.S. W, VA	STANDARD OUTPUTS (W, PF, VA) PC20-						
VOLTAGE	CURRENT		0-1mA*	0-1mA	0-10V*	0-10V	0-5V*	0-5V	4-20mA
0 to 150	0 to 1A	100	103A	103B	103C	103D	103CX5	103X5	103E
	0 to 5A	500	001A	001B	001C	001D	001CX5	001X5	001E
	0 to 10A	1000	010A	010B	010C	010D	010CX5	010X5	010E
	0 to 20A	2000	117A	117B	117C	117D	117CX5	117X5	117E
0 to 300	0 to 1A	200	104A	104B	104C	104D	104CX5	104X5	104E
	0 to 5A	1000	002A	002B	002C	002D	002CX5	002X5	002E
	0 to 10A	2000	011A	011B	011C	011D	011CX5	011X5	011E
	0 to 20A	4000	110A	110B	110C	110D	110CX5	110X5	110E
0 to 600	0 to 1A	400	105A	105B	105C	105D	105CX5	105X5	105E
	0 to 5A	2000	003A	003B	003C	003D	003CX5	003X5	003E
	0 to 10A	4000	012A	012B	012C	012D	012CX5	012X5	012E
	0 to 20A	8000	111A	111B	111C	111D	111CX5	111X5	111E

THREE PHASE - THREE WIRE (TWO ELEMENT)

INPUTS		F.S. W, VA	STANDARD OUTPUTS (W, PF, VA) PC20-						
VOLTAGE	CURRENT		0-1mA*	0-1mA	0-10V*	0-10V	0-5V*	0-5V	4-20mA
0 to 150	0 to 1A	200	118A	118B	118C	118D	118CX5	118X5	118E
	0 to 5A	1000	004A	004B	004C	004D	004CX5	004X5	004E
	0 to 10A	2000	013A	013B	013C	013D	013CX5	013X5	013E
	0 to 20A	4000	112A	112B	112C	112D	112CX5	112X5	112E
0 to 300	0 to 1A	400	119A	119B	119C	119D	119CX5	119X5	119E
	0 to 5A	2000	005A	005B	005C	005D	005CX5	005X5	005E
	0 to 10A	4000	014A	014B	014C	014D	014CX5	014X5	014E
	0 to 20A	8000	113A	113B	113C	113D	113CX5	113X5	113E
0 to 600	0 to 1A	800	120A	120B	120C	120D	120CX5	120X5	120E
	0 to 5A	4000	006A	006B	006C	006D	006CX5	006X5	006E
	0 to 10A	8000	015A	015B	015C	015D	015CX5	015X5	015E
	0 to 20A	16000	114A	114B	114C	114D	114CX5	114X5	114E

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WATT/POWER TRANSDUCER

AC WATT/POWER FACTOR/VOLT-AMPERE TRANSDUCER MODEL PC20

THREE PHASE - FOUR WIRE (THREE ELEMENT)

INPUTS		F.S. W, VA	STANDARD OUTPUTS (W, PF, VA) PC20-						
VOLTAGE	CURRENT		0-1mA*	0-1mA	0-10V*	0-10V	0-5V*	0-5V	4-20mA
0 to 150	0 to 1.0	300	124A	124B	124C	124D	124CX5	124X5	124E
	0 to 5.0	1500	007A	007B	007C	007D	007CX5	007X5	007E
	0 to 10.0	3000	016A	016B	016C	016D	016CX5	016X5	016E
	0 to 20.0	6000	115A	115B	115C	115D	115CX5	115X5	115E
0 to 300	0 to 1.0	600	125A	125B	125C	125D	125CX5	125X5	125E
	0 to 5.0	3000	008A	008B	008C	008D	008CX5	008X5	008E
	0 to 10.0	6000	017A	017B	017C	017D	017CX5	017X5	017E
	0 to 20.0	12000	116A	116B	116C	116D	116CX5	116X5	116E

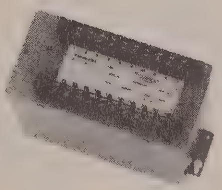
Highlighted 0 to 5.0A models can be used with customer's existing current transformers, or **OSI** current transformers shown on EEM page **B**•1991.

Voltage specification for three phase four wire are "Line To Neutral".

***Denotes Self-powered Model - Input Voltage ranges limited as follows:**

85V to 135V for 150V Models
200V to 280V for 300V Models
380V to 550V for 600V Models

All others require a separate 120VAC (85 to 135V) instrument power.



ORDERING INFORMATION

Example: Three-phase, three-wire, 240V 5A,
0 to 10V output, proportional to 0 to 2000W (VA),
with separate 120VAC instrument power.
PC20 - 005D

MODEL PC20 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 50 to 400 Hz.
POWER FACTOR: Any
RESPONSE (90%): 1 milliSecond
BURDEN:
  Voltage: 0.1VA per element
  Current: 0.28VA per element
OVERRANGE (W/O DAMAGE):
  Voltage (cont): 150V range: 175V
  300V range: 350V
  600V range: 600V
  Current: (cont.): 1A, 5A, 10A range: 2 X rated
  20A range: 20A
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

RIPPLE: 1% full scale
OUTPUT LOADING (OHMS): 0 to 1mA: 0-10K
  0 to 10V: 2K Min
  0 to 5V: 2K Min
  4 to 20mA: 0-500
RESPONSE TIME (90%): 250 milliSeconds

ACCURACY

W/VA 50 to 60 Hz: ±0.25% F.S.
POWER FACTOR (10% to 100% VA) 50 to 60 Hz: ±0.005 PF
W/VA 50 to 400Hz: ±0.5% F.S.
POWER FACTOR (10% TO 100% VA) 50-400Hz: 0.01 PF
TEMPERATURE EFFECT (–10°C to 60°C): ±1.0% RDG., ±0.1% F.S.
INSTRUMENT POWER: 85-135VAC, 50-400 Hz, 2.5VA

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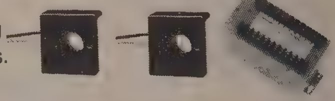
WATT TRANSDUCERS

OSI VARIABLE FREQUENCY WATT TRANSDUCER *MODEL* P

VARIABLE FREQUENCY (5 TO 500 HERTZ)

FEATURES
- Accurate from 5 to 500 Hz., **Factory calibrated.**
- Available in both single phase and three phase configurations.
- Available with split-core current sensors.

APPLICATIONS
- Accurate monitoring of power that contains dc and non-sinusoidal AC components.
- Ideal for use in phase angle firing circuits or frequency synthesizers.
- Bi-directional output..



SINGLE PHASE (ONE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	STANDARD OUTPUTS MODEL NUMBER P-					
VOLTAGE	CURRENT			+/-1mA	+/-10Vdc	4-20mA	4-12-20mA	0-20mA	+/-5Vdc
0 to 150	0 to 100	20K	C	121B	121D	121E	121EM	121EA	121X5
	0 to 200	40K	D	124B	124D	124E	124EM	124EA	124X5
	0 to 400	80K	D	127B	127D	127E	127EM	127EA	127X5
	0 to 600	120K	E	130B	130D	130E	130EM	130EA	130X5
	0 to 1000	200K	E	133B	133D	133E	133EM	133EA	133X5
	0 to 2000	400K	E	136B	136D	136E	136EM	136EA	136X5
0 to 300	0 to 100	40K	C	122B	122D	122E	122EM	122EA	122X5
	0 to 200	80K	D	125B	125D	125E	125EM	125EA	125X5
	0 to 400	160K	D	128B	128D	128E	128EM	128EA	128X5
	0 to 600	240K	E	131B	131D	131E	131EM	131EA	131X5
	0 to 1000	400K	E	134B	134D	134E	134EM	134EA	134X5
	0 to 2000	800K	E	137B	137D	137E	137EM	137EA	137X5
0 to 600	0 to 100	80K	C	123B	123D	123E	123EM	123EA	123X5
	0 to 200	160K	D	126B	126D	126E	126EM	126EA	126X5
	0 to 400	320K	D	129B	129D	129E	129EM	129EA	129X5
	0 to 600	480K	E	132B	132D	132E	132EM	132EA	132X5
	0 to 1000	800K	E	135B	135D	135E	135EM	135EA	135X5
	0 to 2000	1600K	E	138B	138D	138E	138EM	138EA	138X5

THREE PHASE (TWO ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE		STANDARD OUTPUTS MODEL NUMBER P-				
VOLTAGE	CURRENT			+/-1mA	+/-10Vdc	4-20mA	4-12-20mA	0-20mA	+/-5Vdc
0 to 150	0 to 100	20K	C	142B	142D	142E	142EM	142EA	142X5
	0 to 200	40K	D	145B	145D	145E	145EM	145EA	145X5
	0 to 400	80K	D	148B	148D	148E	148EM	148EA	148X5
	0 to 600	120K	E	151B	151D	151E	151EM	151EA	151X5
	0 to 1000	200K	E	154B	154D	154E	154EM	154EA	154X5
	0 to 2000	400K	E	157B	157D	157E	157EM	157EA	157X5
0 to 300	0 to 100	40K	C	143B	143D	143E	143EM	143EA	143X5
	0 to 200	80K	D	146B	146D	146E	146EM	146EA	146X5
	0 to 400	160K	D	148B	148D	148E	148EM	148EA	148X5
	0 to 600	240K	E	152B	152D	152E	152EM	152EA	152X5
	0 to 1000	400K	E	155B	155D	155E	155EM	155EA	155X5
	0 to 2000	800K	E	158B	158D	158E	158EM	158EA	158X5
0 to 600	0 to 100	80K	C	144B	144D	144E	144EM	144EA	144X5
	0 to 200	160K	D	147B	147D	147E	147EM	147EA	147X5
	0 to 400	320K	D	150B	150D	150E	150EM	150EA	150X5
	0 to 600	480K	E	153B	153D	153E	153EM	153EA	531X5
	0 to 1000	800K	E	156B	156D	156E	156EM	156EA	156X5
	0 to 2000	1600K	E	159B	159D	159E	159EM	159EA	159X5

All units require 85-135VAC instrument power, (50,400Hz.).
ADDITIONAL CURRENT RANGES AVAILABLE - CONSULT FACTORY
OPTIONAL SPLIT-CORE CURRENT SENSOR AVAILABLE-ADD SUFFIX "S" TO PART NUMBER

ORDERING INFORMATION

Example: Three phase, 120V, 100A input, split-core sensor, with 0-5Vdc output, proportional to 0-20kW.

P-142X5S

MODEL P SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 5 to 500 Hz.
RESPONSE (Trans. 90%): 50 microSeconds
POWER FACTOR: Any
BURDEN:
  Voltage: Less than 0.1VA.
  Current: Less than 0.1VA.
  dc insertion loss: None
OVERLOAD:
  Voltage: 600VAC maximum.
  Current: 50 times full scale.
DIELECTRIC TEST (Input/Output/Case): 1500VAC
SURGE: Withstands IEEE SWC test.

OUTPUT

OUTPUT RIPPLE: Less than 1.0% F.S. at 60 Hz.
OUTPUT LOADING (OHMS):
  +/-1mA: 0-10K
  +/-10Vdc: 2K min.
  4-20mA, 4-12-20mA, 0-20mA: 0-500
  +/-5Vdc: 2K min.
RESPONSE TIME (90%): 500 milliSeconds
FIELD ADJUSTABLE CAL.: +/-10%
ACCURACY +/-1.0% F.S.
  Includes combined effects of linearity, repeatability, and frequency.
TEMPERATURE EFFECT (0°C TO 40°C): +/- 1.0% of reading, +/-0.1% F.S. output
INSTRUMENT POWER: 85-135VAC, 50-400 Hz.

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WATT TRANSDUCERS

OSI VARIABLE FREQUENCY WATT TRANSDUCER MODEL PC8

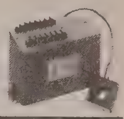
SINGLE PHASE DC TO 400 HERTZ

FEATURES

- **Calibrated with standards traceable to NIST.**
- Input/output isolation.
- Real-time indication of power, response time **less than 50 microseconds.**

APPLICATIONS

- Accurate monitoring of power that contains dc and non-sinusoidal AC components.
- Ideal for use in SCR and other AC or dc switching circuitry.
- Bi-directional output.



SINGLE PHASE-VARIABLE FREQUENCY (SINGLE ELEMENT)

INPUT VOLTAGE RANGE	INPUT VOLTAGE DESIGNATION
0- 25	001
0- 50	002
0-150	003
0-300	004
0-400	005
0-500	006
0-600	007

INPUT CURRENT RANGE	INPUT CURRENT DESIGNATION	SENSOR SIZE
0- 5	08	INTEGRAL
0- 100	01	C
0- 200	02	D
0- 300	03	D
0- 400	04	D
0- 600	05	E
0-1000	06	E
0-2000	07	E

MODEL PC8 STANDARD OUTPUTS				
+/-1mA	+/-10Vdc	4-20mA	4-12-20mA	+/-5Vdc
ADD SUFFIX "B" TO PART NUMBER	ADD SUFFIX "D" TO PART NUMBER	ADD SUFFIX "E" TO PART NUMBER	ADD SUFFIX "EM" TO PART NUMBER	ADD SUFFIX "X5" TO PART NUMBER

Highlighted models, (5A), can be used with customer's existing current transformers.

All units require 85-135VAC instrument power.

Full scale power (Watts) can be determined by the product of full scale input voltage and full scale input current.

OPTIONAL SPLIT-CORE CURRENT SENSOR AVAILABLE WITH UNITS OF 100 AMPS OR GREATER-ADD SUFFIX "S".
LOWER CURRENT RANGES AVAILABLE-CONSULT FACTORY

ORDERING INFORMATION

Example: 120V, 100A input with split-core sensor and +/-5Vdc output.
PC8-003-01-X5-S

MODEL PC8 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: dc to 400 Hz.
POWER FACTOR: Any
RESPONSE (Transient 90%): Less than 50 microSeconds
BURDEN (OHMS):
  Voltage:
    Less than 50V: Greater than 100K.
    Greater than 50V: Greater than 1M.
OVERLOAD:
  Voltage: 2 times full scale.
  Current:
    Using integral sensor: 2 times full scale.
    Using sensors C, D, E: 50 times full scale.
DIELECTRIC TEST (Input/Output/Case): 1000Vdc
SURGE: Withstands IEEE SWC test

OUTPUT

OUTPUT RIPPLE: Less than 1.0% at 60 Hz.
OUTPUT LOADING (OHMS):
  Option: B: 0-10K
    D: Greater than 2K
    E-Em: 0-500
    X5: Greater than 2K
RESPONSE TIME (90%):
  Less than 250 mS.
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 1.0% F.S.
  Includes combined effects of voltage, current, load and power factor.
TEMPERATURE EFFECT (0°C to 40°C):
  +/- 0.1% F.S.
  +/- 1.0% RDG.
INSTRUMENT POWER:
  85-135VAC, (50 to 400 Hz.)

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WATT OR VAR TRANSDUCERS

OSI PRECISION AC WATT TRANSDUCER MODEL GW5

ACCURATE TO 0.2% OF READING

FEATURES

- Accurate regardless of variations in voltage,current, power factor, or load.
- Available with 1, 2, 2½, or 3 element configurations. Provides bi-directional operation.
- Accuracy maintained over wide temperature range, **factory calibration traceable to NIST.**

APPLICATIONS

- Equipment monitoring for process control.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current tranformers, or potential transformers.

AC WATT TRANSDUCER-INTEGRAL CURRENT SENSOR

INPUTS		F.S. IN (WATTS)	PHASE CONFIG.	MODEL NUMBER GW5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	500	1 Ph.-2W	001A	†001B	001C	†001D	†001E	001E2	001CX5	001X5
		1000	3 Ph.-3W	004A	†004B	004C	†004D	†004E	004E2	004CX5	004X5
		1500	3 Ph.-4W	007A	†007B	007C	†007D	†007E	007E2	007CX5	007X5
		1500	3 Ph.-4W	7.5A	†7.5B	7.5C	†7.5D	†7.5E	7.5E2	7.5CX5	7.5X5
	0 to 10	1000	1 Ph.-2W	010A	010B	010C	010D	010E	010E2	010CX5	010X5
		2000	3 Ph.-3W	013A	013B	013C	013D	013E	013E2	013CX5	013X5
		3000	3 Ph.-4W	016A	016B	016C	016D	016E	016E2	016CX5	016X5
	0 to 20	2000	1Ph.-2W	019A	019B	019C	019D	019E	019E2	019CX5	019X5
		4000	3 Ph.-3W	022A	022B	022C	022D	022E	022E2	022CX5	022X5
		6000	3 Ph.-4W	025A	025B	025C	025D	025E	025E2	025CX5	025X5
0 to 300	0 to 5	1000	1 Ph.-2W	002A	†002B	002C	†002D	†002E	002E2	002CX5	002X5
		2000	3 Ph.-3W	005A	†005B	005C	†005D	†005E	005E2	005CX5	005X5
		3000	3 Ph.-4W	008A	†008B	008C	†008D	†008E	008E2	008CX5	008X5
	0 to 10	2000	1 Ph.-2W	011A	011B	011C	011D	011E	011E2	011CX5	011X5
		4000	3 Ph.-3W	014A	014B	014C	014D	014E	014E2	014CX5	014X5
		6000	3 Ph.-4W	017A	017B	017C	017D	017E	017E2	017CX5	017X5
	0 to 20	4000	1 Ph.-2W	020A	020B	020C	020D	020E	020E2	020CX5	020X5
		8000	3 Ph.-3W	023A	023B	023C	023D	023E	023E2	023CX5	023X5
		12000	3 Ph.-4W	026A	026B	026C	026D	026E	026E2	026CX5	026X5
0 to 600	0 to 5	2000	1 Ph.-2W	003A	†003B	003C	†003D	†003E	003E2	003CX5	003X5
		4000	3 Ph.-3W	006A	†006B	006C	†006D	†006E	006E2	006CX5	006X5
	0 to 10	4000	1 Ph.-2W	012A	012B	012C	012D	012E	012E2	012CX5	012X5
		8000	3 Ph.-3W	015A	015B	015C	015D	015E	015E2	015CX5	015X5
	0 to 20	8000	1 Ph.-2W	021A	021B	021C	021D	021E	021E2	021CX5	021X5
		16000	3 Ph.-3W	024A	024B	024C	024D	024E	024E2	024CX5	024X5

† UL Listed Units Are Available.

Highlighted models, (6.25A), can be used with customer's existing current transformers.

*Denotes self-powered unit, limiting input voltage ranges to:

85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit, (15-40Vdc).
All others require 85-135VAC instrument power.

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
GW5-001CX5

OPTIONAL 50 Hz. OPERATION- CONSULT FACTORY

MODEL GW5 SPECIFICATIONS

INPUT

SEE TABLE FOR VOLTAGE AND CURRENT RANGES
FREQUENCY RANGE: 58 to 62 Hz.
POWER FACTOR: Any
BURDEN:
 Voltage: Less than 0.1VA
 Current: Less than 0.28VA per element
OVERLOAD:
 Voltage (cont.): Consult factory
 Current (cont.): Consult factory
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 0.5%
OUTPUT LOADING (OHMS):
 Option: A-B: 0-10K
 C-D: Greater than 2K
 E-E2: 0-500
 CX5-X5: Greater than 2K
RESPONSE TIME (99%): Less than 400 mS
COMPLIANCE VOLTAGE: 12Vdc min.
OPEN CIRCUIT VOLTAGE: +/- 15Vdc
ACCURACY +/- 0.2% RDG. +/- 0.05% F.S.
TEMPERATURE EFFECT (-20° to 60°C): +/- 0.005%/°C

FOR VAR TRANSDUCERS CONTACT FACTORY
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TO PLACE AN ORDER: 1-800-537-6732

CURRENT TRANSFORMERS

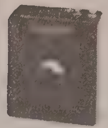
METERING CLASS CURRENT TRANSFORMERS

ACCURATE TO 0.3%

- Meets ANSI specifications for sub-metering applications.

CURRENT RATIO	PART NUMBER	WEIGHT (LBS)	ANSI METERING CLASS ACCURACY (60 Hz.)					RELAY CLASS
			B 0.1	B 0.2	B 0.5	B 0.9	B 1.8	
100:5	12973	5.5	0.3	1.2				
200:5	12975	5.5	0.3	0.3	0.6	1.2	2.4	C10
400:5	12978	5.5	0.3	0.3	0.3	0.3	0.6	C20
600:5	13481	3.5	0.3	0.3	0.3	0.6	0.6	C10
800:5	13483	3.5	0.3	0.3	0.3	0.3	0.3	C20
1000:5	13484	3.5	0.3	0.3	0.3	0.3	0.3	C10
2000:5	13488	3.5	0.3	0.3	0.3	0.3	0.3	C20

OTHER CURRENT RATIOS AVAILABLE - CONSULT FACTORY



TRANSFORMER SPECIFICATIONS

FREQUENCY: 25 to 400 Hz.
INSULATION CLASS: 600 Volts
IMPULSE LEVEL: 10KV, full wave

CONTINUOUS THERMAL CURRENT RATING FACTOR: 1.33 at 30°C ambient, 1.0 at 55°C ambient
TERMINALS: #8-32

LOW COST CURRENT TRANSFORMERS

50 TO 400 HERTZ FREQUENCY RANGE

FEATURES

- Manufactured to meet requirements of UL1244 and revisions.
- Flexible leads are UL1015 105°C CSA approved.

TRANSFORMER SPECIFICATIONS

FREQUENCY: 50 to 400 Hz.
INSULATION CLASS: 0.6KV BIL 10KV full wave
LEADS: UL1015 105°C CSA APPROVED, #16 AWG, 24 In. length.
TERMINALS: No. 8 ring terminal

50 TO 400 HERTZ CURRENT TRANSFORMER

CURRENT RATIO	ACCURACY AT 60 HZ.	BURDEN AT 60HZ.	PART NUMBER	WEIGHT (LBS)
100:5	1.5	5.0	10424	1.28
200:5	1.0	12.5	10425	1.27
400:5	1.0	15.0	10420	1.47
600:5	1.0	30.0	10422	1.59
800:5	1.0	35.0	12280	1.61
1000:5	1.0	20.0	10423	0.65
2000:5	1.0	40.0	12284	1.10

FLEXIBLE SPLIT-CORE CURRENT TRANSFORMERS

CIRCULAR MODELS PROVIDE SAFE, CONVENIENT INSTALLATION
RECTANGULAR WINDOW (BUS BAR) MODELS

FEATURES

- Flexible split-core configuration provides for easy installatin on large conductors.
- Unit is encapsulated in silicon rubber to protect against moisture, dirt, oil, and corona.
- Secondary open circuit voltage limited to 40VAC.

CURRENT RATIO	ACCURACY AT 60 HZ.(%)	BURDEN AT 60HZ.(VA)	THERMAL FACTOR	PART NUMBER
400:5	4.0	2.0	1.25	12512
	4.0	2.0	1.25	12521
600:5	3.0	3.0	1.25	12514
	3.0	3.0	1.25	12523
800:5	2.0	5.0	1.50	12515
	2.0	5.0	1.50	12524
1000:5	2.0	10.0	2.00	12516
	2.0	10.0	2.00	12525
2000:5	2.0	10.0	2.00	12519
	2.0	10.0	2.00	12528
	2.0	10.0	2.00	12535
5000:5	2.0	10.0	1.25	12533
	2.0	10.0	1.25	12540
	2.0	10.0	1.25	12546

TRANSFORMER SPECIFICATIONS

FREQUENCY: 50-60 Hz.
INSULATION: 600VAC
LEADS: 12 Ft. length.
TERMINALS: Spade terminal.
CONSTRUCTION:
Core: Directional silicon steel
Secondary: Copper
Casing: Silicon rubber, flexibility maintained over -45°Cto 200°C temperature range.

50 TO 400 HERTZ CURRENT TRANSFORMER

CURRENT RATIO	ACCURACY AT 60 HZ.(%)	BURDEN AT 60HZ.(VA)	THERMAL FACTOR	PART NUMBER
600:5	2.0	3.0	1.25	12600
800:5	2.0	5.0	1.50	12601
1000:5	2.0	10.0	2.00	12602
2000:5	2.0	10.0	2.00	12605
5000:5	2.0	10.0	1.25	12610

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CURRENT TRANSDUCERS

AC CURRENT TRANSDUCER MODEL CT5

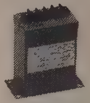
LOW COST AC CURRENT TRANSDUCER

FEATURES

- Accurate, reliable current measurement over a wide frequency range.

APPLICATIONS

- Designed for use in OEM applications which require inexpensive current measurement.



MODELS WITH INTEGRAL CURRENT SENSOR

INPUT AC CURRENT	SENSOR SIZE	MODEL CT5- OPTIONAL OUTPUTS				
		0-1mA	4-20mA	4-20mA*	0-10Vdc	0-5Vdc
0 to 1.0	N/A	001A	001E	001E2	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 5.0		005A	005E	005E2		
0 to 10.0		010A	010E	010E2		
0 to 20.0		020A	020E	020E2		

Highlighted modes, (5A), can be used with customer's current transformers.

Units with 0-1mA output are self-powered from measured line.

Units with standard 4-20mA output require 85-135VAC instrument power.

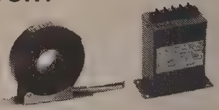
*4-20mA loop-powered unit, (15-40Vdc).

NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION

Example: 20Amp AC input with
4-20mA output.
CT5-020E

AVAILABLE WITH UP TO THREE UNITS IN A SINGLE ENCLOSURE CONSULT FACTORY



MODELS SUPPLIED WITH EXTERNAL CURRENT SENSOR

INPUT AC CURRENT	SENSOR SIZE	MODEL CT5- OPTIONAL OUTPUTS				
		0-1mA	4-20mA	4-20mA*	0-10Vdc	0-5Vdc
0 to 50	W	050A	050E	050E2	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 100	W	100A	100E	100E2		
0 to 200	W	200A	200E	200E2		
0 to 300	W	300A	300E	300E2		
0 to 400	X	400A	400E	400E2		
0 to 600	X	600A	600E	600E2		
0 to 1000	Y	1000A	1000E	1000E2		

MODEL CT5 SPECIFICATIONS

INPUT

CURRENT: See tables
FREQUENCY RANGE: 50 to 400 Hz.
BURDEN:
  Voltage: 2.8VA F.S.
  Current: 1.0VA F.S.
CURRENT OVERLOAD:
  2 times full scale rating (continuous), except 20A model.
  20A model: 1.25 times full scale rating.
  50 times full scale (1 Sec. transient).
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
  Option: A: 0-10K
    E-E2: 0-1.5K
RESPONSE: 400mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5% F.S. (at 25°C)
  Includes effects of linearity.
TEMPERATURE EFFECT (-20°C to 60°C):
  +/- 1.0% RDG.

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CURRENT TRANSDUCERS

RMS CURRENT TRANSDUCER MODEL CTR

ACCURATE TO 0.25% FULL SCALE

FEATURES

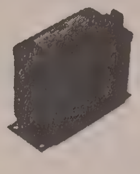
- Accurate measurement of the true RMS value of input signals over a wide frequency range.

APPLICATIONS

- For use in applications where measurement of non-siunsoidal waveforms is required.

INPUT	MODEL NUMBER CTR-OPTIONAL OUTPUTS			
CURRENT (AMPS)	0 - 1mA	4-20mA	0 to 10V	0- 5Vdc
0 to 1.0	001B	001E	001D	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 5.0	005B	005E	005D	
0 to 10.0	010B	010E	010D	
0 to 15.0	015B	015E	015D	
0 to 20.0	020B	020E	020D	

Highlighted 5 Amp models are **non-isolated** (input/output).



ORDERING INFORMATION

Example: 15 Amp Ac input with 0-10 Vdc output
CTR-015D

MODEL CTR SPECIFICATIONS

INPUT
CURRENT: See tables
FREQUENCY RANGE: 48 to 420 Hz.
BURDEN:
Voltage: 0.12VA F.S
Current: 0.28VA F.S.
OVERLOAD:
Current: 50A (10 Sec. transient)
250A (1 Sec. transient), isolated models only.
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER: 85-135VAC (50-400Hz.).

OUTPUT
OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: B: 0-10K
D-X5: Greater than 2.0K
E: 0-500
RESPONSE: 100 mS
FIELD ADJUSTABLE CAL.: +/-10%
ACCURACY +/-0.25% F.S. (at 60Hz.)
Includes effects of linearity.
+/- 0.5% over entire frequency range
TEMPERATURE EFFECT (-20°C TO 60°C): +/- 1.0%RDG.

AC CURRENT TRANSDUCER MODEL CTD

DESCRIPTION

The CTD series of AC Current Transducers provide a dc output which is proportional to the AC current. The output is derived from the average absolute value of the input and calibrated as the RMS value of the sine wave.

Standard outputs of 0 to 1 mAdc or 4-20mAdc "loop power" are available, with full scale current ranges of 25 through 1000 amperes.

INSTALLATION

All transducers have a 1.56 inch window and are equipped with a mounting foot. Polarity of the current carrying cable is not required. Output terminals are #8-32 studs, with X1 the positive terminal.

Loop power 4-20mA models require an external power supply nominal 24 Vdc, although the unit will be operated over the range of 15V to 40Vdc.

STANDARD MODELS

AC INPUT AMPERES	0-1 mA	OUTPUT * 4-20 mA
25	CTD-025A	CTD-025E2
50	CTD-050A	CTD-050E2
100	CTD-100A	CTD-100E2
200	CTD-200A	CTD-200E2
300	CTD-300A	CTD-300E2
400	CTD-400A	CTD-400E2
500	CTD-500A	CTD-500E2
600	CTD-600A	CTD-600E2
800	CTD-800A	CTD-800E2
1000	CTD-1000A	CTD-1000E2

* REQUIRES 150-40 VDC INPUT (LOOP POWERED)

INPUT
CURRENT RANGE: See table of standard models
Overrange: 5 Times Rating For 10 Sec/Hr
Burden: .5 VA
FREQUENCY: Nominal: 60 Hz
Range: 50 to 400 Hz
DIELECTRIC TEST (Input/Output/Case): 1800VAC
INSTRUMENT POWER:
(1mA Models): Self Powered
(4-20 mA Models): Required 15 to 40 Vdc

OUTPUT: See Table of Standard Models
LOAD ON OUTPUT:
(1mA Models): 0 to 10K Ω
(4-20 mA Models at 24V): 0 to 500 Ω
RIPPLE: <±.5% F.S.
RESPONSE TIME 90%: 300m Sec
ACCURACY: ±0.5% F.S.
Includes linearity, nominal frequency and set point.

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CURRENT TRANSDUCERS

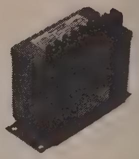
OSI DC CURRENT TRANSDUCER MODEL CT7

DC TO 500 HERTZ FREQUENCY RANGE

FEATURES
- Provides output which is directly proportional to DC input signal.
- Input/output isolation.

APPLICATIONS
- Accurate measurement of dc current.
- Low current measurement.

INPUT CURRENT (AMPS)	MODEL NUMBER CT7-OPTIONAL OUTPUTS +/- 1mA	4-20mA	+/- 10Vdc	+/- 5Vdc
0 to 0.1	002B	002E	002D	002X5
0 to 0.5	004B	004E	004D	004X5
0 to 1.0	006B	006E	006D	006X5
0 to 1.5	007B	007E	007D	007X5
0 to 2.0	008B	008E	008D	008X5
0 to 5.0	014B	014E	014D	014X5
0 to 10.0	015B	015E	015D	015X5
0 to 15.0	016B	016E	016D	016X5
0 to 20.0	017B	017E	017D	017X5



**OTHER CURRENT RANGES AVAILABLE-
CONSULT FACTORY**
All units require 85-135VAC instrument power, (50-400 Hz.).
Optional 220VAC instrument power-Add suffix "-22".

ORDERING INFORMATION
Example: 0-500mA dc input with 4-20mA output.
CT7-004E

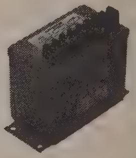
VARIABLE FREQ. CURRENT TRANSDUCER MODEL CT8

DC TO 500 HERTZ FREQUENCY RANGE

FEATURES
- Provides output which is directly proportional to RMS value of AC and/or dc input signal.
- Input/output isolation.

APPLICATIONS
- Accurate measurement of current waveforms containing dc and non-sinusoidal AC components.
- Low current measurement.

INPUT CURRENT (AMPS)	MODEL NUMBER CT8-STANDARD OUTPUTS 0 - 1mA	4-20mA	0 - 10Vdc	0- 5Vdc
0 to 0.1	002B	002E	002D	002X5
0 to 0.5	004B	004E	004D	004X5
0 to 1.0	006B	006E	006D	006X5
0 to 1.5	007B	007E	007D	007X5
0 to 2.0	008B	008E	008D	008X5
0 to 5.0	014B	014E	014D	014X5
0 to 10.0	015B	015E	015D	015X5
0 to 15.0	016B	016E	016D	016X5
0 to 20.0	017B	017E	017D	017X5



**OTHER CURRENT RANGES AVAILABLE-
CONSULT FACTORY**
All units require 85-135VAC instrument power, (50-70 Hz.).
Optional 220VAC instrument power-Add suffix "-22".

ORDERING INFORMATION
Example: 500mA dc input with 4-20mA output.
CT8-004E

MODEL CT7, CT8 SPECIFICATIONS

INPUT
CURRENT: See tables
FREQUENCY RANGE: dc to 500 Hz.
BURDEN (OHMS):
  0.1 to 5 Amp models: 0.1
  10 to 20 Amp models: Less than 0.005
OVERLOAD:
  CT7: 1.2 times full scale rating
  CT8: Full scale rating
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT
RESPONSE (90%):
  CT7: 1 milliSecond CT8: 100 milliSeconds
OUTPUT LOADING (OHMS):
  0-1mA: 0-10K
  0-10Vdc, 0-5Vdc: 2K min.
  4-20mA: 0-500
FIELD ADJUSTABLE CAL.: +/-10%
ACCURACY +/-0.5% F.S
  Includes effects of linearity and repeatability.
TEMPERATURE EFFECT (-10°C TO 60°C): +/- 1.0%RDG.
INSTRUMENT POWER (STD): 85-135VAC, 50-400 Hz (CT7).
85-135VAC, 50-70Hz.(CT8).

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CURRENT TRANSDUCER

OSI AC, DC, PULSE CURRENT TRANSDUCER *MODELS* CTF & CTFB

0.1% LINEARITY **100KHZ BANDWIDTH**

FEATURES

- High linearity.
- Module or circuit board mount.
- Bi-directional current output.
- 100KHz bandwidth
- Closed loop.

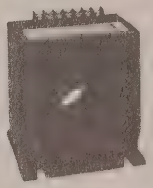
APPLICATIONS

- Variable frequency drives.
  ASD (adjustable speed drives)
- UPS
- Inverters (PWM)
- Feedback control.

NEW PRODUCT

NOMINAL INPUT CURRENT RMS	PEAK INPUT CURRENT	TURNS RATIO	OUTPUT		MODEL NO.
			CURRENT	LOAD IN OHMS	
100A	150A	1:1000	100mA=100A	0 TO 75	CTFB-100TT
200A	300A	1:2000	100mA=200A	0 TO 75	CTFB-200TT
300A	500A	1:2000	150mA=300A	0 TO 50	CTFB-300TT
300A	500A	1:3000	100mA=300A	0 TO 75	CTF-300TT
500A	750A	1:5000	100mA=500A	0 TO 50	CTF-500TT

FOR –40°C TO +80°C TEMPERATURE RANGE, DELETE ONE "T"



DESCRIPTION

The CTF series transducer is a sensor for AC, DC and pulse currents. Input and output are physically isolated but magnetically coupled by a high permeability core. The sensor uses a hall effect generator to control the secondary winding current in a feedback configuration to exactly cancel the flux due to the primary current.

With the core flux controlled to zero, then $I_pN_p=I_sN_s$ where the subscripts P & S refer to primary and secondary ampere (I) turns (N). If a single turn is used in the primary $I_s=I_p/N_s$ so the secondary current is directly related to the primary window current.

In application a resistor can be inserted in the secondary current circuit to provide an output voltage proportional to primary window current. The resistance can be any value within the load range specified. The output voltage is an exact replica of the input current waveform.

This technique provides impressive performance specifications as indicated below for todays challenging applications such as PWM inverters for adjustable speed drives and electric vehicles.

SPECIFICATIONS

INPUT

CURRENT: See tables
RESPONSE TIME: 1µSec
di/dt 50A/µSec
BANDWIDTH: (Small Signal) 100KHz
ISOLATION: (Input to Output) 2500VAC

OUTPUT

SIGNAL: See table
LOAD RESISTANCE: See table
For current ranges above peak value listed, reduce the load resistance proportionally.

POWER REQUIREMENTS

VOLTAGE: ±14 To ±18VDC
CURRENT: Approx. 35mA + Output current

ACCURACY ±0.3% F.S.
(Includes effects of linearity, setpoint and offset at 25°C)
LINEARITY: ±0.1% F.S.
OFFSET: (0-70°C) ±0.25% F.S.
"T" Model (–40°C To +80°C) ±0.5% F.S.

DIMENSIONS Inches (mm)
CTFB SERIES: "Printed circuit board mount (FR4)"
2.60 (66) x 3.54 (90) x 1.340 (34) WLH
WINDOW: 1 (25) DIA.

CTF SERIES: "Plastic Enclosure"
3.94 (100) x 4.05 (103) x 3.31 (84) WLH
WINDOW: 1.62 (41, 25) DIA.

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CURRENT TRANSDUCERS

OSI CURRENT TRANSDUCERS MODEL CTL

FREQUENCY RANGE DC TO 1000 HERTZ

FEATURES AND APPLICATIONS

- 5000 Volt line-to-output isolation.
- DC to 5000 Hertz response.
- Bi-directional operation.
- Available in split-core configurations.
- Response time less than 50 microSeconds.
- Output is proportional in **direction and magnitude** to the current flow through the window.
- Overload capability to **50 times rating** (at 60 Hz.).
- Stability maintained during severe vibration.
- Easy installation.
- Replaces shunts.
- No insertion loss.
- For use with **OSI** model CTA signal conditioners.
- Ideal for use on AC systems with dc components and/or chopped waveforms.

CIRCULAR WINDOW MODELS (0.5% LINEARITY)

RMS CURRENT (A)	EXCITATION (mA)	OUTPUT (mV)	TEMPERATURE EFFECTS	TEMPERATURE RANGE (°C)	RESISTANCE (OHMS) INPUT	RESISTANCE (OHMS) OUTPUT	SENSOR SIZE	PART NUMBER
50	100	30	-0.15% /°C	-40 to 65	4.0	3.0	A	CTL-50
	100	20	+/- 1.0%	0 to 40	4.0	25.0	A	CTL-50TT
	100	20	+/- 1.0%	-40 to 65	4.0	25.0	A	CTL-50T
100	100	50	-0.15% /°C	-40 to 65	4.0	3.0	C	CTL-100
	100	50	+/- 1.0%	0 to 40	4.0	25.0	C	CTL-100TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	C	CTL-100T
200	100	75	-0.15% /°C	-40 to 65	4.0	3.0	D	CTL-200
	100	50	+/- 1.0%	0 to 40	4.0	25.0	D	CTL-200TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	D	CTL-200T
400	100	50	-0.15% /°C	-40 to 65	4.0	3.0	D	CTL-400
	100	50	+/- 1.0%	0 to 40	4.0	25.0	D	CTL-400TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	D	CTL-400T
600	100	75	-0.15% /°C	-40 to 65	25.0	6.0	E	CTL-600
	100	50	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-600TT
	100	50	+/- 1.0%	-40 to 65	25.0	25.0	E	CTL-600T
1000	200	75	-0.15% /°C	-40 to 65	25.0	6.0	E	CTL-1000
	200	50	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-1000TT
	200	50	+/- 1.0%	-40 to 65	25.0	25.0	E	CTL-1000T
2000	200	150	-0.15% /°C	-40 to 65	25.0	6.0	E	CTL-2000
	200	100	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-2000TT
	200	100	+/- 1.0%	-40 to 65	25.0	25.0	E	CTL-2000T

OPTIONAL SPLIT-CORE-ADD SUFFIX "S" TO PART NUMBER (50 Amp models not available in split-core configuration)

RECTANGULAR WINDOW (BUS BAR) MODELS (1.0% LINEARITY)

PEAK CURRENT (A)	EXCITATION (mA)	OUTPUT (mV)	TEMPERATURE EFFECTS	TEMPERATURE RANGE (°C)	RESISTANCE (OHMS) INPUT	RESISTANCE (OHMS) OUTPUT	SENSOR SIZE	PART NUMBER
1000	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-1000HT
1200	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-1200HT
2000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-2000HT
2200	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-2200HT
3000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-3000HT
4000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-4000HT
	200	150	+/- 1.0%	-40 to 65	25.0	25.0	G	CTL-4000T
5000	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-5000HT
	200	150	+/- 1.0%	-40 to 65	25.0	25.0	G	CTL-5000T
8000	200	75	+/- 1.0%	-40 to 65	12.0	25.0	H	CTL-8000T

ORDERING INFORMATION

EXAMPLE: 200 Amp split-core current transducer requiring 100mA excitation, with output of 75mV.

CTL-200-S

TO ORDER WITH OSI MODEL CTA SIGNAL CONDITIONER

Locate transducer model number in first column of table on following page. Specify model CTA signal conditioner model number based on required analog output. **The transducer and signal conditioner must be ordered as separate items although supplied as a calibrated set.**

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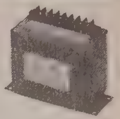
PHONE: (614) 486-9561 FAX: (614) 486-0743
TO PLACE AN ORDER: 1-800-537-6732

SIGNAL CONDITIONERS

SIGNAL CONDITIONER MODEL CTA

FOR USE WITH OSI MODEL CTL CURRENT TRANSDUCERS



DIRECT MEASUREMENT MODELS

- Provide output which is directly proportional to **amplitude of AC and/or dc** input waveform.

RMS MODELS

- Provide output which is proportional to **RMS value of AC and/or dc** input waveform.

MODEL CTL CURRENT TRANSDUCER (FROM PG. 46)	TRANSDUCER INPUT CURRENT RANGE	DIRECT MODELS OUTPUT PROPORTIONAL TO AC/DC INPUT			RMS MODELS OUTPUT PROPORTIONAL TO RMS OF AC/DC INPUT			
		STANDARD AC/DC OUTPUTS			STANDARD DC OUTPUTS			
		+/-5V	+/-10V	4-20mA	0-5Vdc	0-10Vdc	4-20mA	0-1mA
CTL-50	0 to 50	CTA101	CTA201	CTA212	CTA113	CTA213	CTA215	CTA214
CTL-50TT		CTA101	CTA201	CTA212	CTA113	CTA213	CTA215	CTA214
CTL-50T		CTA101	CTA201	CTA212	CTA113	CTA213	CTA215	CTA214
CTL-100	0 to 100		CTA101	CTA112		CTA113	CTA115	CTA114
CTL-100TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-100T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-200	0 to 200		CTA101H	CTA112H		CTA113H	CTA115H	CTA114H
CTL-200TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-200T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-400	0 to 400		CTA101	CTA112		CTA113	CTA115	CTA114
CTL-400TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-400T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-600	0 to 600		CTA101H	CTA112H		CTA113H	CTA115H	CTA114H
CTL-600TT			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-600T			CTA101	CTA112		CTA113	CTA115	CTA114
CTL-1000	0 to 1000		CTA201H	CTA212H		CTA213H	CTA215H	CTA214H
CTL-1000TT			CTA201	CTA212		CTA213	CTA215	CTA214
CTL-1000T			CTA201	CTA212		CTA213	CTA215	CTA214
CTL-1000HT			CTA101H	CTA112H				
CTL-1200HT	0 to 1200		CTA101H	CTA112H				
CTL-2000	0 to 2000		CTA201K	CTA212K		CTA213K	CTA215K	CTA214K
CTL-2000TT			CTA201P	CTA212P		CTA213P	CTA215P	CTA214P
CTL-2000T			CTA201P	CTA212P		CTA213P	CTA215P	CTA214P
CTL-2000HT			CTA101P	CTA112P				
CTL-2200HT	0 to 2200		CTA101P	CTA112P				
CTL-3000HT	0 to 3000		CTA101P	CTA112P				
CTL-4000TT	0 to 4000		CTA201K	CTA212K				
CTL-4000T			CTA201K	CTA212K				
CTL-4000HT			CTA101P	CTA112P				
CTL-5000TT	0 to 5000		CTA201K	CTA212K				
CTL-5000T			CTA201K	CTA212K				
CTL-5000HT			CTA101H	CTA112H				
CTL-8000TT	0 to 8000		CTA201H	CTA212H				
CTL-8000T			CTA201H	CTA212H				

ORDERING INFORMATION

Locate model CTL part number in first column. Determine type of output required, (direct or RMS). Locate model CTA signal conditioner part number in corresponding output column. **Order as separate items.**

EXAMPLE: 200 Amp split-core current transducer. Output from signal conditioner of 0-10Vdc proportional to 0-200A.

ITEM 1: CTL-200-S ITEM 2: CTA113H

MODEL CTA SPECIFICATIONS

INPUT

VOLTAGE: See tables
FREQUENCY RANGE: dc to 5000 Hz.
INSTRUMENT POWER: 115VAC (+/-10%) 50-400 Hz.

OUTPUT

OUTPUT RIPPLE: Less than 0.25% F.S.
FIELD ADJUSTABLE GAIN: 25%

OUTPUT LOADING (OHMS):
1mA: 0-10K
10V, 5V: 2K min.
4-20mA: 0-500
RESPONSE (90%): Direct models: 40 microSeconds
RMS Models: 200 milliSeconds
LINEARITY +/- 0.1% F.S.
TEMPERATURE EFFECT (0°C to 70°C): +/- 0.005%/°C

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TO PLACE AN ORDER: 1-800-537-6732

VOLTAGE TRANSDUCERS

AC VOLTAGE TRANSDUCER MODEL VT

LOW COST AC VOLTAGE TRANSDUCER

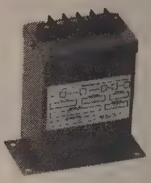
FEATURES

- Accuracy reliable voltage measurement over a wide frequency range.
- Input/output isolation.

APPLICATIONS

- Designed for use in OEM applications where inexpensive voltage measurement is required.
- Line voltage monitoring.

INPUT	MODEL NUMBER VT-		OPTIONAL OUTPUTS	
AC VOLTAGE	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 150	120A	120E	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 300	240A	240E		
0 to 600	3940A	3940E		



Units with 0-1mA output are self-powered from measured voltage line.
Units with 4-20mA output require 85-135VAC instrument power.
Models VT480A and VT480E include **OSI** 226-145 potential transformer.
NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION
Example: Single phase120VAC input
with 4-20mA output.
VT-120E

RMS VOLTAGE TRANSDUCER MODEL VTR

ACCURATE TO 0.25% FULL SCALE

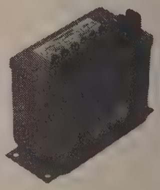
FEATURES

- Accurate measurement of the true RMS value of input signals over a wide frequency range.

APPLICATIONS

- For use in applications where measurement of non-sinusoidal waveforms is required.

INPUT	MODEL NUMBER VTR-		OPTIONAL OUTPUTS	
AC VOLTAGE	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 150	001B	001E	001D	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 300	002B	002E	002D	
0 to 600	004B	004E	004D	



ORDERING INFORMATION
Example: Single phase120VAC input
with 0-10Vdc output.
VTR-001D

All units require 85-135VAC instrument power, (50-400Hz.).
NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

MODEL VT, VTR SPECIFICATIONS

INPUT
VOLTAGE: See tables
FREQUENCY RANGE: 50 to 400 Hz.
BURDEN:
Voltage: 2.8VA F.S.
Current: 1.0VA F.S.
OVERLOAD:
Voltage: Full scale rating.
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER: 85-135VAC (50-400Hz.).

OUTPUT
OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: A: 0-10K
E: 0-1.5K
RESPONSE: 400mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5% F.S. (at 25°C)
Includes effects of linearity.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 1.0% RDG.

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VOLTAGE TRANSDUCERS

OSI AC/DC VOLTAGE TRANSDUCER AND SHUNT ISOLATOR MODEL VT7

DC TO 5000 HERTZ FREQUENCY RESPONSE

FEATURES

- Provides instantaneous output which is directly proportional to AC or dc input signal.
- Amplifies mV shunt output to standard analog signal level.
- Input/output isolation.

APPLICATIONS

- Designed for use in applications which require directly analogous voltage measurement..
- Shunt isolation.
- Bi-directional circuits.

INPUT	MODEL NUMBER VT7 AND VT8-STANDARD OUTPUTS			
DC VOLTAGE	1 to 1mA	4-20mA	10 to 10V	5 to 5V
0 to 0.050	015B	015E	015D	015X5
0 to 0.100	016B	016E	016D	016X5
0 to 10	001B	001E	001D	001X5
0 to 25	002B	002E	002D	002X5
0 to 50	003B	003E	003D	003X5
-0 to 50 mV	015B	015E	015D	015X5
0 to 100	004B	004E	004D	004X5
-0 to 100mV	016B	016E	016D	016X5
0 to 150	005B	005E	005D	005X5
0 to 200mV	017B	017E	017D	017X5
0 to 250mV	018B	018E	018D	018X5
0 to 250	006B	006E	006D	006X5
0 to 300	007B	007E	007D	007X5
0 to 400	008B	008E	008D	008X5
0 to 500	009B	009E	009D	009X5
0 to 600	010B	010E	010D	010X5
0 to 700	011B	011E	011D	011X5
0 to 800	012B	012E	012D	012X5
0 to 900	013B	013E	013D	013X5
0 to 1000	014B	014E	014D	014X5

Highlighted models will be supplied with an externally mounted resistance box.
All units require 85-135VAC instrument power, (50,70Hz.).
Optional 220VAC instrument power-Add suffix **"-22"**.

ORDERING INFORMATION

Example: 120VAC/dc input with 0-10Voutput
VT7-005D
Example: 0-50mV input with 4-20mA output
VT7-015E

RMS VOLTAGE TRANSDUCER MODEL VT8

DC TO 5000 HERTZ FREQUENCY RESPONSE

FEATURES

- Provides DC output which is directly proportional to RMS value of AC and/or dc input signal.
- Input/output isolation.

APPLICATIONS

- Accurate measurement of voltage that contains dc and non-sinusoidal AC components.
- Monitoring of RMS voltage.

ORDERING INFORMATION

Select input voltage range and output required from table shown above, (model VT7).
Example: 120VAC/dc input with
4-20mA output proportional to RMS value of input.
VT8-005E

MODEL VT7, VT8 SPECIFICATIONS

INPUT
VOLTAGE: See tables
FREQUENCY RANGE: 5 to 5000 Hz.
BURDEN: Greater than 100K
OVERLOAD:
.05 -700V:2 times full scale rating.
800-100V: 1500V
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT
OUTPUT LOADING (OHMS):
Option: B: 0-10K
D-X5: Greater than 2.0K
E: 0-1.5K
RESPONSE TIME (90%): 1 milliSecond
FIELD ADJUSTABLE CAL.: +/-10%
ACCURACY +/-0.5% F.S.
Includes effects of linearity and repeatability.
TEMPERATURE EFFECT (-10°C TO 60°C): +/- 1.0%RDG.
INSTRUMENT POWER: 85-135VAC, (50-70 Hz.).

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VOLTAGE, CURRENT TRANSDUCERS

OSI AC VOLTAGE, AC CURRENT TRANSDUCERS MODELS MVT, MCT5

DIN RAIL MOUNTED AC VOLTAGE, AC CURRENT TRANSDUCERS

FEATURES

- Ruggedized Polyamide DIN mount case.
- Standard OSI five year warranty.
- Slim profile allows maximum use of available space.
- Field selectable analog outputs.
- Recessed terminals provide increased safety.

APPLICATIONS

- Ideal for use in enclosures wioth dimensional constraints.
- Designed for industrial environments.
- OEM measurement systems.
- Designed for use with potential transformers.
- Easily integrated into control systems.

INPUT	MODEL MVT-STANDARD OUTPUTS	
AC VOLTAGE	0 - 1mA*	4-20mA**
0 to 150	150A	150E2
0 to 300	300A	300E2
0 to 600	600A	600E2

INPUT	MODEL MCT5-STANDARD OUTPUTS	
AC CURRENT (AMPS)	0 - 1mA*	4-20mA**
0 to 0.1	001A	001E2
0 to 5.0	005A	005E2

*Models are self-powered from measured AC input line with DIP switch selectable 0-5Vdc, or 0-10 Vdc output.

**Denotes 4-20mA loop-powered unit, (15-35Vdc). Note: 600V models supplied with OSI potential transformer.

Note: 600V models supplied with **OSI** potential transformer.

Transducer output is derived from the average absolute value of the input and calibrated as the RMS value of a sine wave input.

MODEL MVT, MCT5 SPECIFICATIONS

INPUT
CURRENT: See table
FREQUENCY RANGE: 48 to 65 Hz., 60 Hz. Nom.
BURDEN: 150V models: 1.0VA
300V, 600V models: 2.0VA
1 Amp models: 0.05VA
5 Amp models: 0.175VA
VOLTAGE OVERLOAD: Full scale rating
CURRENT OVERLOAD:
2 times full scale rating (continuous)
10 times full scale rating (10 Sec./Hr.)
DIELECTRIC TEST (Input/Output): 1500VAC
OUTPUT
OUTPUT RIPPLE: Less than +/- 1.0% F.S.

RESPONSE TIME (99%): 400 milliSeconds
OUTPUT LOADING (OHMS):
4-20mA (24V LOOP PWR.): 0-600
Field selectable:
0-1mA: 0-10k
0-5Vdc: Greater than 5M
0-10Vdc: Greater than 10M
FIELD ADJUSTABLE SPAN: +/- 10%
ACCURACY (@ 60Hz.) +/-0.25% F.S.
Includes effects of linearity (10% to 100% F.S.) and setpoint.
TEMPERATURE EFFECT (-20°C TO 65°C): +/- 1.0%.
INSTRUMENT POWER (LOOP POWERED):
Nominal: 24Vdc
Range: 15-35Vdc

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UL LISTED TRANSDUCERS

WATT / WATTHOUR TRANSDUCER MODEL AGH

UL LISTED, ACCURATE TO 0.2% OF READING

FEATURES

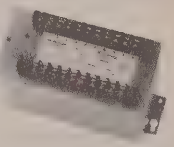
- Accurate regardless of variations in voltage,current, power factor, or load.
- Dual outputs. 0-1mA proportional to instantaneous Watts, relay closure proportional to Watthours.

APPLICATIONS

- Designed for applications which require UL listed devices.
- Integration into energy management systems, or a variety of sub-metering applications.

5 YEAR WARRANTY

LISTED 87 X 9
Energy Management
Equipment Accessory
E134941



INPUTS		PHASE CONNECTION	NO. OF ELEMENTS	WATTS		WATTHOUR		PART NUMBER
VOLTAGE	CURRENT			F.S. INPUT	OUTPUT	OUTPUT	COUNTS/HR.	
0 to 150	0 to 5	1 phase, 2 wire	1	500	0 to 1mA dc	NORMALLY OPEN SPST RELAY CONTACT CLOSURE	500	AGH-001B
0 to 150	0 to 5	3 phase, 3 wire	2	1000	0 to 1mA dc		1000	AGH-004B
0 to 150	0 to 5	3 phase,4 wire	3	1500	0 to 1mA dc		1500	AGH-007B

4-20mA OR 0-10Vdc ANALOG WATT OUTPUTS AVAILABLE-CONSULT FACTORY

AC CURRENT TRANSDUCER MODEL ACT5

UL LISTED AC CURRENT TRANSDUCER

FEATURES

- Accurate, reliable current measurement over a wide frequency range.

APPLICATIONS

- Can be used with **OSI** line of **UL listed** current transformers.

5 YEAR WARRANTY

AC CURRENT INPUT (AMPERES)		MODEL ACT5-001A OUTPUT
RANGE	NOMINAL	
0 to 5	5	0 to 1mA dc

Unit is self-powered from measured AC input line.

LISTED 87 X 9
Energy Management
Equipment Accessory
E134941

AC VOLTAGE TRANSDUCER MODEL AVT

UL LISTED AC VOLTAGE TRANSDUCER

FEATURES

- Accurate, reliable voltage measurement over a wide frequency range.

APPLICATIONS

- Can be used with potential transformers.

5 YEAR WARRANTY

AC VOLTAGE INPUT		MODEL AVT-120A OUTPUT
RANGE	NOMINAL	
0 to 150	85-135	0 to 1mA dc

Unit is self-powered from measured AC input line.

LISTED 87 X 9
Energy Management
Equipment Accessory
E134941

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PRECISION SENSOR

PRECISION HALL EFFECT SENSOR MODELS HR, HS

HALLTRON MAGNETIC FIELD SENSOR

FEATURES

- High linearity, low noise.

APPLICATIONS

- Magnetic field sensing applications.

HALL OUTPUT* MILLIVOLTS (+/-25%)	NOMINAL CONTROL CURRENT Ic, (mA)	OHMIC RESIDUAL, (mV) FIELD=0 Ic=10mA	OHMIC RESIDUAL, (mV) FIELD=0 Ic=100mA	NOMINAL INPUT RESISTANCE (OHMS)	NOMINAL OUTPUT RESISTANCE (OHMS)	DIMENSIONS (INCHES) L	DIMENSIONS (INCHES) W	DIMENSIONS (INCHES) T	LEAD INSUL. MAT'L	TEMP. COEFF. % OUTPUT PER °C	MODEL NUMBER
350	350		0.15	1.5	1.5	0.625	0.375	0.028	PVC	–0.10	HR36
200	25	0.2		8.0	8.0	0.625	0.375	0.028	PVC	–0.25	HR38
500	200		0.50	5.0	4.0	0.200	0.250	0.028	Enamel	–0.15	HR66
340	200		0.50	2.0	2.0	0.200	0.250	0.028	PVC	–0.10	HR70
700	100	0.2		9.0	6.0	0.200	0.250	0.028	Enamel	–0.25	HR72
550	100		1.00	10.0	10.0	0.200	0.250	0.030	Enamel	–0.25	HR77
100	100		0.50	2.5	2.0	0.200	0.250	0.028	Enamel	–0.05	HR125A
250	100		0.50	1.2	1.0	0.500	0.375	0.025	PVC	-----	HS55

*OUTPUT SPECIFIED WITH FIELD OF 10KG, AND CONTROL CURRENT AS LISTED IN TABLE.
OPERATING TEMPERATURE RANGE: –65 TO 85°C

PROCESS SIGNAL CONDITIONERS MODEL SG

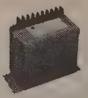
CUSTOM PROCESS SIGNAL CONDITIONERS

FEATURES

- Isolated linear output from a standard or non standard input process signal.
- Factory calibrated for selected input and output ranges.
- Easy-mount metal enclosure.
- Zero and Cal "Span" adjustments.

APPLICATIONS

- Process Control
- Signal Isolation
- Signal Conversion



ORDERING INFORMATION

Example: 4-20 mA input and a 0-1mA output, 115VAC instrument power, with 50% span adjustment. **SG-6-01-H1**

MODEL SG SELECTION CHART

RATED INPUT	RATED OUTPUT	INSTRUMENT POWER	OPTION
(1)0-1mAdc (2)0-10Vdc (3)0-5Vdc (4)1-5Vdc (5)0-20mA dc (6)4-20mA dc (7)20-4mA dc (8)10-50mA dc	(01)0-1mA dc (02)0-10Vdc (03)0-5Vdc (04)1-5Vdc (05)0-20mA (06)4-20mA (07)0-5mA (08)4-20mA loop powered (09)4-12-20mA	(H) 115VAC (G) 220 VAC	(Blank) ±10%, Output Span ADJ, ±5% Zero ADJ (1) 50% Output Span ADJ (2) ±10% Span ADJ, 50% Zero Output ADJ (3) 50% Output Zero ADJ and Span ADJ

MODEL SG SPECIFICATIONS

INPUT

CURRENT: See tables
FREQUENCY: dc
BURDEN: 1mA; 1KΩ 20mA; 250Ω
10V, 1-5V; >100KΩ 50mA; 100Ω
OVERRANGE: 2 times rated input.
RESPONSE TIME: 1 millisecond
ISOLATION (Input to Output): 1000Vdc
(Input/Output to Inst. Pwr.): 1500Vdc
INSTRUMENT POWER: 90 to 135 VAC, 50-400Hz
Optional: 220VAC, 50-400Hz

OUTPUT

LOAD ON OUTPUT: 1mA; 0 to 10K Ω
10V, 1-5V; 2K Ω to infinity
20mA; 0 to 600 Ω
RESPONSE TIME: 10 milliseconds
RIPPLE: Less than ±0.5% RO
LINEARITY: ±0.1% RO
ACCURACY (Set Point): ±0.25% RO
TEMPERATURE EFFECT (–20°C to +65): ±0.01%/°C

CONTACT FACTORY FOR FREE COPY OF COMPLETE PRODUCT CATALOG

OHIO SEMITRONICS, INC.

1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-2287
PHONE: (614) 486-9561 FAX: (614) 486-0743
TO PLACE AN ORDER: 1-800-537-6732

FREQUENCY TRANSDUCERS

OSI FREQUENCY TRANSDUCER MODEL FT

ACCURATE TO 0.2% OF FULL SCALE

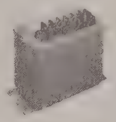
FEATURES

- Provides analog output which is proportional to the instantaneous frequency of the input signal.

APPLICATIONS

- For use on any application that requires indication or collection of frequency variations.

INPUT FREQUENCY (Hz)	MODEL NUMBER FT-STANDARD OUTPUTS 0 - 1mA	0-10Vdc	0-5Vdc
45 to 55	050B	050D	050X5
55 to 65	060B	060D	060X5
375 to 400	400B	400D	400X5



**ADDITIONAL FREQUENCY RANGES AVAILABLE-
CONSULT FACTORY**

ORDERING INFORMATION

Example: 55-65Hz. input, with 0-5Vdc output

FT-060X5

MODEL FT SPECIFICATIONS

INPUT

FREQUENCY RANGE: See table
VOLTAGE RANGE: 95-135V
BURDEN: 4.0VA
OVERLOAD: 150V
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT LOADING (Ohms): 0-10K
RESPONSE TIME: 400MS
ACCURACY +/-0.2% F.S
Includes effects of linearityand repeatability.
TEMPERATURE EFFECT (-20°C TO 60°C): +/- 0.005%/°C

WIDE RANGE FREQUENCY TRANSDUCER MODEL FTA

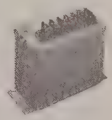
ACCURATE TO 0.5% OF SPAN

FEATURES

- Provides analog output which is proportional to the input frequency range.

APPLICATIONS

- For use on any application that requires measurement over a wide frequency range.



INPUT FREQUENCY RANGE (Hz)	DESIGNATION
0 to 10	001
0 to 55	005
0 to 65	004
0 to 100	002
0 to 425	006
0 to 1000	003

INPUT VOLTAGE RANGE (V)	DESIGNATION
1 to 10	01
5 to 55	02
10 to 65	03
80 to 100	04
150 to 425	05
300 to 1000	06

STANDARD OUTPUTS MODEL FTA 0-1mA	0-10Vdc	4-20mA	0-20mA	0-5Vdc
ADD SUFFIX "B" TO PART NUMBER	ADD SUFFIX "D" TO PART NUMBER	ADD SUFFIX "E" TO PART NUMBER	ADD SUFFIX "E1" TO PART NUMBER	ADD SUFFIX "X5" TO PART NUMBER

Alstandard models require 85-135VAC instrument power,
Optional 220VAC instrument power-Add suffix "**-22**".

**ADDITIONAL FREQUENCY RANGES AVAILABLE-
CONSULT FACTORY**

ORDERING INFORMATION

Example:0-100 Hz., 10-100V input, 0-5Vdc output proportional to 0-100 Hz.

FTA-002-04X5

MODEL FTA SPECIFICATIONS

INPUT

FREQUENCY RANGE: See table
VOLTAGE RANGE: See table
AC WAVEFORMS: Sine, square, or triangle
OVERLOAD: 2 times rated, or a max. of 700V
IMPEDANCE (OHMS): LESS THAN 500K
ISOLATION(Input/Output./Case): 700VAC/1000V PK
(Instrument power to Input/Ouput/Case): 1500VAC
ACCURACY +/-0.5% of span
Includes effects of linearityand repeatability.
TEMPERATURE EFFECT (-20°C TO 60°C): +/- 0.005%/°C
INSTRUMENT POWER (STD.): 85-135VAC, 50-400 HZ.

OUTPUT

OUTPUT RIPPLE: +/- 1.0% F.S.
OUTPUT LOADING (OHMS):
0-1mA: 0-10K
0-10Vdc, 0-5Vdc: 2K min.
4-20mA, 0-20mA: 0-500
RESPONSE TIME:
0-10Hz.: 1.0 Second
0-100 Hz.: 400 milliSeconds
0-1000 Hz.: 200 milliSeconds

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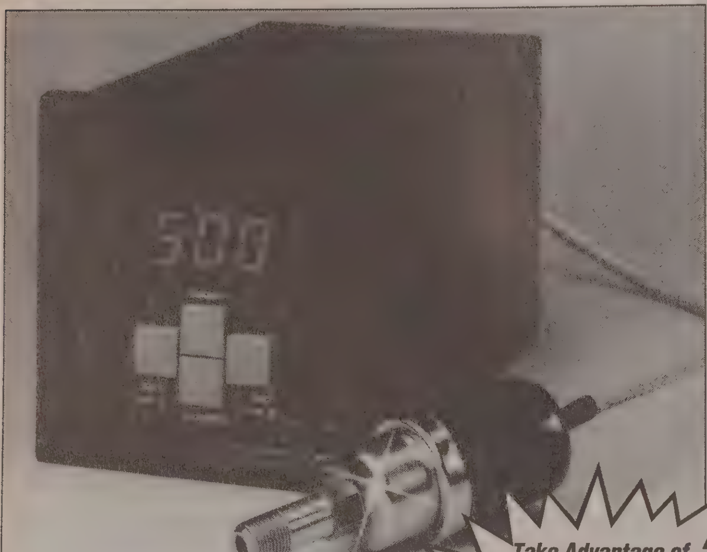
OMEGA...TRANSDUCERS AND SENSORS FOR TEMPERATURE, PRESSURE, STRAIN, FLOW, pH



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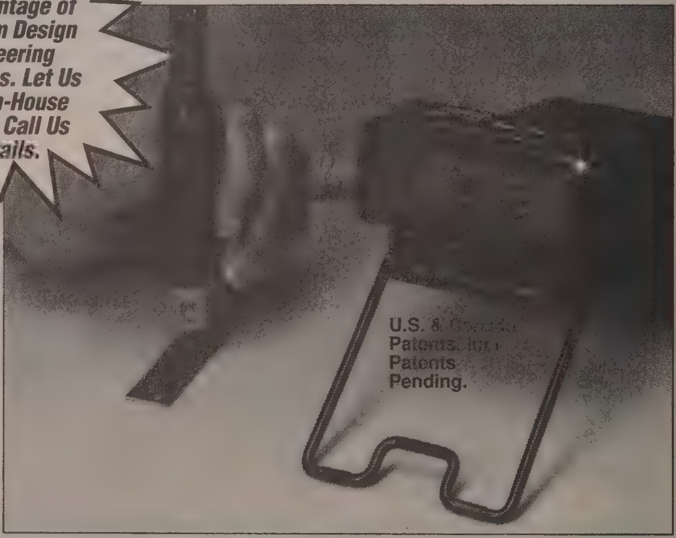

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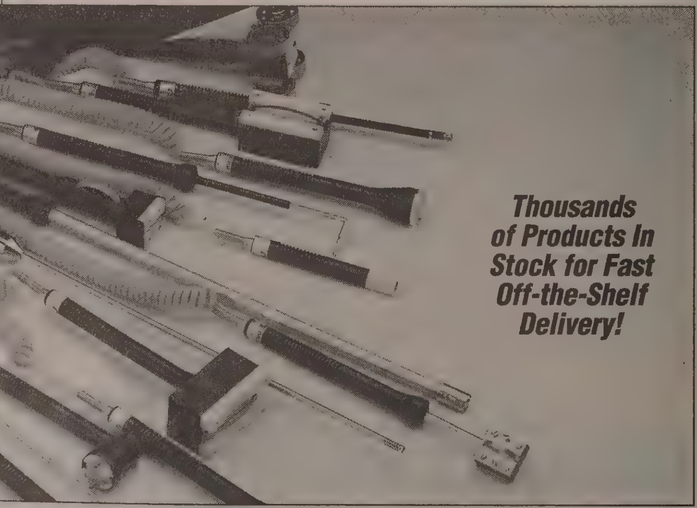

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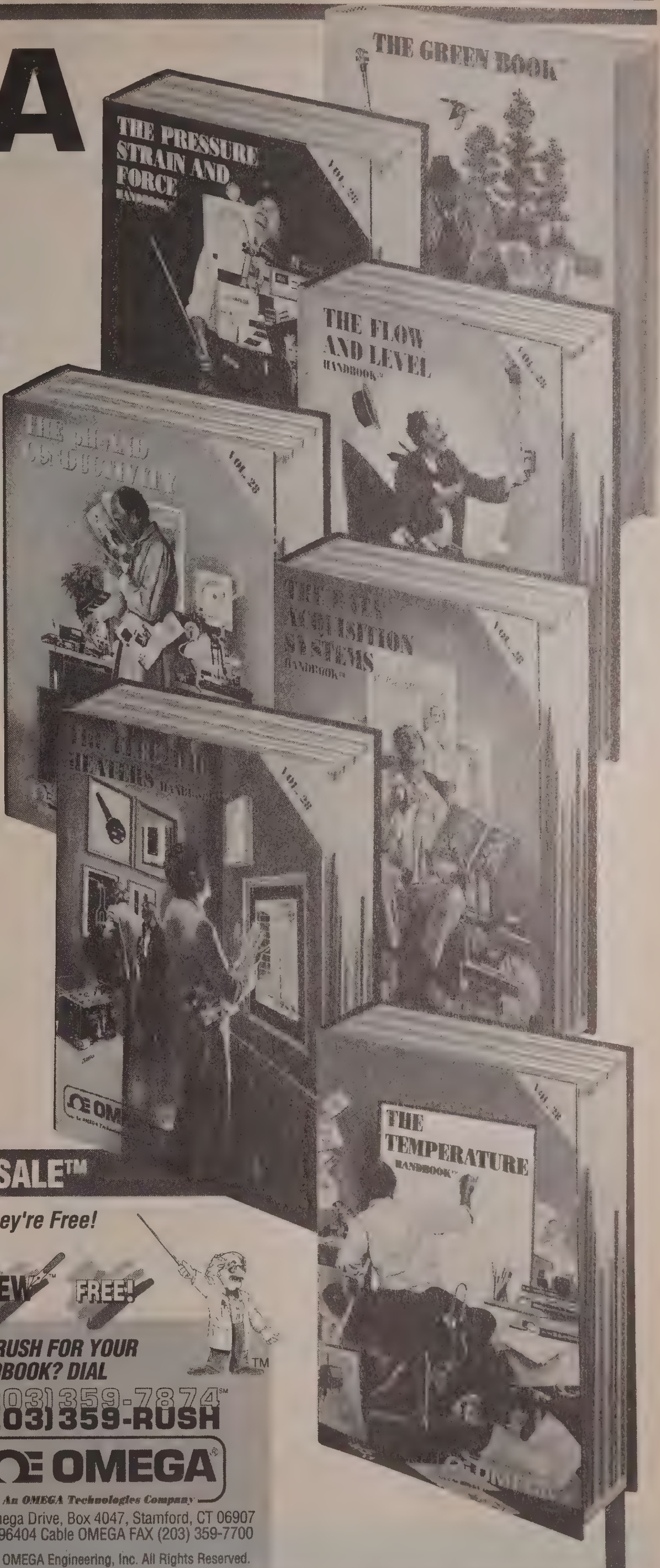
THE GREEN BOOK
THE PRESSURE STRAIN AND FORCE HANDBOOK
VOL. 28
THE FLOW AND LEVEL HANDBOOK
THE pH AND CONDUCTIVITY
THE DATA ACQUISITION SYSTEMS HANDBOOK
THE ELECTRIC HEATERS HANDBOOK
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Reed Switch Developments Company, Inc.

1405-16th Street • P.O. Box 085297 • Racine, WI 53408
414-637-8848 • FAX: 414-637-8861

Reed Switch Developments Co. Inc. offers a complete line of magnetic proximity reed sensors and actuators. All are sealed against contamination from foreign materials, extremes in temperature, shock and vibration for millions of exact operations. Simple, inexpensive sensors can help bring cost effectiveness to every level of your operation. We provide complete custom capability for applications which may not be covered by our standard product line. Skilled applications engineers are available to assist you.

- 18 to 26 gauge wire or cable capabilities.
- Series F, FL, V-6" leads standard.
- Series T, TL-18" leads standard.
- Various lead lengths available upon request.
- Cable available upon request.
- Lead connector capabilities.

Switch/Sensor Specifications

	F-100	F-110	F-115	F-200	FL-100	FL-200	H-110	H-130	H-200	T-100	T-110	T-115	T-200	TL-100	TL-200	VT-100	VT-200	VW-100	VW-110	VW-115	VW-200
Housing	CX	CX	CX	CX	CX	CX	CL	CL	CL	AA	AA	AA	AA	AA	AA	CX	CX	CX	CX	CX	CX
Contact Form	SPST	SPST	SPST	SPDT	SPST	SPDT	SPST	SPST	SPDT	SPST	SPST	SPST	SPDT	SPST	SPDT	SPST	SPDT	SPST	SPST	SPST	SPDT
Wattage	10	20	50	3	100	100	20	100	100	10	20	50	3	100	100	10	3	10	20	50	3
Switching Amps†	.75	1.0	1.5	.25	3.0	3.0	1.0	3.0	3.0	.75	1.0	1.5	.25	3.0	3.0	.75	.25	.75	1.0	1.5	.25
Switching Voltage†	200	200	200	175	120VAC 50VDC	120VAC 50VDC	200	120VAC 50VDC	120VAC 50VDC	200	200	200	175	120VAC 50VDC	120VAC 50VDC	200	175	200	200	200	175
Make Minimum*	5/8"	5/16"	7/16"	1/2"	1/2"	3/4"	1"	7/8"	7/8"	3/8"	3/16"	5/16"	3/8"	1/4"	1/4"	5/16"	5/16"	5/16"	1/8"	1/4"	5/16"
Break Maximum*	3/4"	7/16"	3/4"	3/4"	7/8"	1"	1-1/2"	1"	1-1/8"	1/2"	5/16"	9/16"	5/8"	3/8"	3/8"	7/16"	1/2"	7/16"	1/4"	7/16"	1/2"
Magnet Actuator	F/A	F/A	F/A	F/A	FL/A	FL/A	H/A	H/A	H/A	T/A	T/A	T/A	T/A	TL/A	TL/A	V/A	V/A	V/A	V/A	V/A	V/A

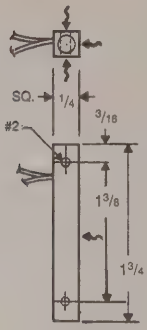
AA = Anodized Aluminum
CX = Celanex Plastic
CL = Celcon Plastic

* Operating distances
† Product of amps and voltage not to exceed Wattage rating.
Specifications subject to change. Specifications deemed to be correct at time of printing.

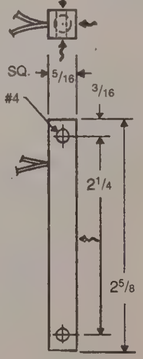
Other models available not shown or specified

Dimensions

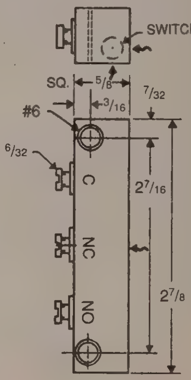
F-Series


SQ.
1/4
3/16
#2
1 3/8
1 3/4

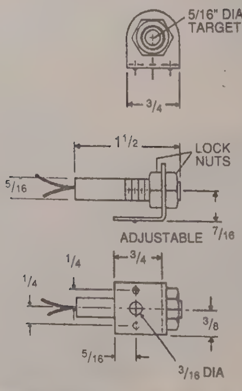
FL-Series


SQ.
5/16
3/16
#4
2 1/4
2 5/8

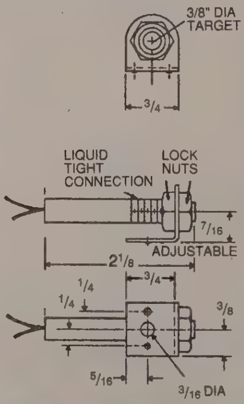
H-Series


SWITCH
SQ.
5/8
7/32
3/16
#6
6/32
C
NC
NO
2 7/16
2 7/8

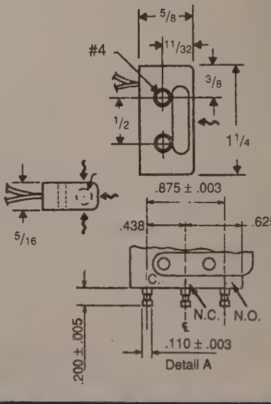
T-Series


5/16" DIA
TARGET
3/4
1 1/2
LOCK
NUTS
5/16
ADJUSTABLE
7/16
1/4
3/4
1/4
3/8
5/16
3/16 DIA

TL-Series


3/8" DIA
TARGET
3/4
LIQUID
TIGHT
CONNECTION
LOCK
NUTS
7/16
ADJUSTABLE
2 1/8
1/4
3/4
1/4
3/8
5/16
3/16 DIA

V-Series


5/8
11/32
#4
3/8
1/2
1 1/4
5/16
.875 ± .003
.438
.625
C.
N.C.
N.O.
.200 ± .005
.110 ± .003
Detail A

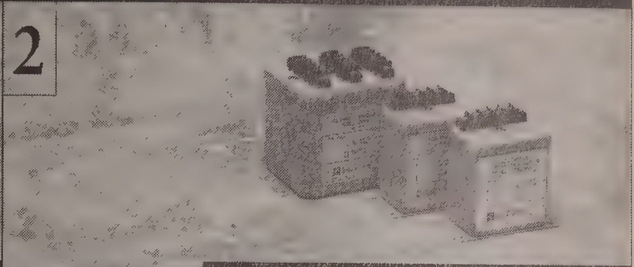
Call Today And Let Us Put Over 25 Years Of Experience To Work For You

SCIENTIFIC COLUMBUS TRANSDUCERS

1

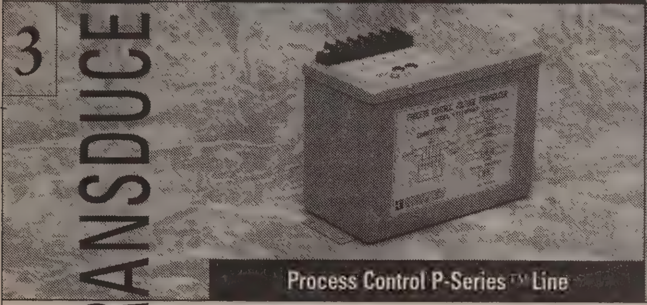
Digilogic™ Line

2



Exceltronic™ Line

3



Process Control P-Series™ Line

4

XLP™ Modular Plug-in Line

Only Scientific Columbus offers 4 separate lines of transducers—and the expertise to match the right transducer to *your* application.

You can spend hours trying to determine your precise transducer requirements, or simply call the world's leading supplier of transducers—Scientific Columbus.

No one offers more types of transducers.

Only Scientific Columbus offers four different lines of transducers, so you can match your specific application requirements for measurement, accuracy and budget—without compromise.

1. ***Digilogic Line** offers accuracy to ±0.1% of reading.*
2. ***Exceltronic Line** offers accuracy to ±0.2% of reading.*
3. ***Process Control P-Series Line** offers accuracy to ±0.25% of reading with a variety of process control outputs: 4-20/4-12-20 mAdc, 1-5/1-3-5 mAdc, 10-50/10-30-50 mAdc.*
4. ***XLP Modular Plug-in Line** offers rack-mount housing for limited space environments or applications requiring large numbers of transducers.*

Functions Available

- ***Watt***
- ***Var***
- ***Watt/Var***
- ***Watt/Watthour***
- ***Var/Varhour***
- ***Volt-Amp***
- ***Volt-Amp/ Volt-Amphour***
- ***Current***
- ***Voltage***
- ***Phase Angle (Power Factor)***
- ***Voltage Angle***
- ***Frequency***
- ***Temperature***
- ***DC Isolation***
- ***Signal Conditioning and Transmission***

There's no need to compromise with "the closest thing" when you deal with Scientific Columbus. Our broad line of transducers means you can get an exact match to your transducer needs—and always get the "most" transducer for your money.

You're working with the world's leading supplier of transducers.

Scientific Columbus introduced its first power measurement transducers in 1962. In the years since, Scientific Columbus transducers have earned a reputation for exceptional reliability and performance.

All Scientific Columbus transducers are produced with a painstaking concern for quality, using rugged steel cans for magnetic shielding and high-quality components throughout.

No one makes specifying the right transducer easier for you.

Scientific Columbus' streamlined ordering process makes specifying the right transducer fast and easy. It's as simple as completing the Easy Order Checklist on the fourth page of this section. Within minutes, you'll have all the information you need to order the exact transducer for your application—even if you've never specified a transducer before.

FOR TECHNICAL ASSISTANCE OR THE NUMBER OF YOUR LOCAL SALES REPRESENTATIVE, CALL:

1-800-274-5368

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Columbus, OH 43228
Phone: 614/274-0400
Fax: 614/272-2288

TRANSDUCER SPECIFICATION MATRIX

Scientific Columbus offers the broadest selection of electrical transducers—4 different lines to meet your exact application requirements.

This matrix provides an overview of Scientific Columbus' complete transducer line, including operating specifications, dimensions, power input, output options and input connections. Other specifications, as well as information on special options, are available in our complete Electrical Transducer Catalog.

A Scientific Columbus transducer specialist is available to discuss your applications and to help you select the right transducer for your requirements—even if you've never specified a transducer before.

Transducer Types	Specifications												Interface				
Features	Input Quantity				Accuracy								Input Connections				
Functions	Power	Energy	Combined Functions	Process Parameters	0.1% of Reading	0.2% of Reading	Temperature Effect on Accuracy (%/°C)	Operating Temperature	Any Power Factor	Stability Per Year Non-Accumulative	High Dielectric Withstand	ANSI/IEEE Surge Withstand	1 Element/1 Phase	1 1/2 Element/3 Phase/3 Wire	2 Element/3 Phase/3 Wire	2 1/2 Element/3 Phase/4 Wire	3 Element/3 Phase/4 Wire
WATT	•			•	•	•	.005	-20°C to +70°C	•	0.05%	•	•	•	•	•	•	•
VAR	•			•	•	•	.009	-20°C to +60°C	•	0.1%	•	•	•	•	•	•	•
COMBINED WATT/VAR	•		•	•		•	.005 .009	-20°C to +60°C	•	0.1% 0.2%	•	•	•	•	•	•	•
COMBINED WATT/WATTHOUR	•	•	•	•	•	•	.005	-20°C to +70°C	•	0.05%	•	•	•	•	•	•	•
COMBINED VAR/VARHOUR	•	•	•	•	•	•	.009	-20°C to +60°C	•	0.1%	•	•	•	•	•	•	•
VOLT-AMP	•			•		0.3%	.01	-20°C to +70°C	•	0.2%	•	•	•	•	•	•	•
COMBINED VOLT-AMP/ VOLT-AMPHOUR	•	•	•	•		0.3%	.01	-20°C to +70°C	•	0.2%	•	•	•	•	•	•	•
CURRENT (Avg. and RMS) (Single or Triple)			•	•		•	.01	-20°C to +60°C		0.1%	•	•	•		•		•
VOLTAGE (Avg. and RMS) (Single or Triple)			•	•		•	.01	-20°C to +60°C		0.1%	•	•	•		•		•
PHASE ANGLE (Power Factor)				•		1°	.01	-20°C to +60°C	•	1°	•	•	•		•		•
VOLTAGE ANGLE				•		1°	.01	-20°C to +60°C	•	1°	•	•	•				
FREQUENCY				•	•		.0025	-20°C to +60°C		0.1%	•	•	•				
TEMPERATURE				•		1°F Typ.	.025	-20°C to +60°C		0.3%	•	•	•				
DC VOLTAGE ISOLATION AMPLIFIER				•		0.5% RO	.04	-10°C to +70°C		0.25%	•	•	•				

Esterline SCIENTIFIC COLUMBUS

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TRANSDUCER SPECIFICATION MATRIX

FOR A COMPLETE CATALOG DETAILING ALL SCIENTIFIC COLUMBUS TRANSDUCER SPECIFICATIONS, OR FOR TECHNICAL ASSISTANCE, CALL **1-800-274-5368.**

Transducer Types	Aux. Power		Interface		Customer-Specified Features									
					Output									
Functions / **Features**	Internal	External	Approximate Dimensions (Inches W x D x H) Excluding Mounting Plate	Available as Modular Plug-In Rack-Mount	0-1 mAdc 10 V Compliance	Any Voltage up to 10 Vdc	1-5 mAdc 40 V Compliance	1-3-5 mAdc 40 V Compliance	4-20 mAdc 40 V Compliance	4-12-20 mAdc 40 V Compliance	10-50 mAdc 30 V Compliance	10-30-50 mAdc 30 V Compliance	Measurement Frequency 24-450 Hz	Response Time 50 ms - 1 Second
WATT	•	•	(DL) 6.9 x 3.5 x 5.6 (XL) 4.4 x 3.8 x 4.7	•	±	±	•	•	•	•	•	•	•	•
VAR	•	•	(DL) 6.9 x 3.5 x 5.6 (XL) 4.4 x 3.8 x 4.7	•	±	±	•	•	•	•	•	•	•	•
COMBINED WATT/VAR	•	•	4.4 x 3.8 x 6.3	•	±	±	20V Comp	20V Comp	20V Comp	20V Comp			•	•
COMBINED WATT/WATTHOUR	•	•	6.9 x 3.5 x 5.6	•	±	±	•	•	•	•	•	•	•	•
COMBINED VAR/VARHOUR	•	•	6.9 x 3.5 x 5.6	•	±	±	•	•	•	•	•	•	•	•
VOLT-AMP	•	•	7.2 x 5.2 x 5.8		+	+	•		•		•		•	•
COMBINED VOLT-AMP/ VOLT-AMPHOUR	•	•	7.2 x 5.2 x 5.8		+	+	•		•		•		•	•
CURRENT (Avg. and RMS) (Single or Triple)	•	•	(S) 3.1 x 2.0 x 4.1 (T) 4.4 x 3.8 x 4.7	•	+	+	•		•		•		•	•
VOLTAGE (Avg. and RMS) (Single or Triple)	•	•	(S) 3.1 x 2.0 x 4.1 (T) 4.4 x 3.8 x 4.7	•	+	+	•		•		•		•	•
PHASE ANGLE (Power Factor)	•	•	4.4 x 3.8 x 4.7	•	±	±			•				•	•
VOLTAGE ANGLE	•	•	4.4 x 3.8 x 4.7	•	±	±			•				•	•
FREQUENCY	•	•	4.4 x 3.8 x 4.7	•	±	±	•		•		•		•	•
TEMPERATURE		•	(N) 3.1 x 2.0 x 4.1 (P/C) 4.4 x 3.8 x 4.7	•	+	+	•		•		•			•
DC VOLTAGE ISOLATION AMPLIFIER		•	4.4 x 3.8 x 4.7		±	±	•	•	•	•	•	•		•

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1900 Arlingate Lane
Columbus, OH 43228
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Scientific Columbus Easy Order Checklist – Transducers

Scientific Columbus' Easy Order Checklist simplifies the painstaking process of ordering and specifying electrical transducers. This form systematically walks you through the specification process and helps to insure you receive the most appropriate transducer for your specific application.

We have included space on this form for special options or other special requirements. Refer to the specifications for specific models in this catalog or discuss availability with your Scientific Columbus Application Specialist.

1. Accuracy	☐ Normal Precision (0.2%) ☐ Very High Precision (0.1%)
2. Type	☐ Universal Mount (Metal Case) ☐ Rack Mount (XLP Modular Plug-In)
3. System	☐ AC ☐ DC
4. Function	☐ Watt ☐ Var ☐ Watt/Var ☐ Watt/Watthour ☐ Var/Varhour
	☐ Volt-Amp ☐ Volt-Amp/Volt-Amphour ☐ Frequency ☐ Temperature
	☐ Average Current* ☐ Average Triple Current* ☐ True RMS Current
	☐ Average Voltage* ☐ Average Triple Voltage* ☐ True RMS Voltage
	☐ Phase Angle (Power Factor) ☐ Voltage Angle ☐ DC Isolation
5. Input	Current: (Nominal) ☐ Standard 5A ☐ 1A ☐ 2.5A ☐ 7.5A ☐ 10A ☐ 15A ☐ 25A ☐ Special ____
	Voltage: (Nominal) ☐ Standard 120V ☐ 69V ☐ 240V ☐ 277V ☐ 480V ☐ Special ____
	Frequency: (Nominal) ☐ Standard 60 Hz ☐ 50 Hz ☐ 400 Hz ☐ 25 Hz ☐ Special ____
	Temperature – RTD: ☐ Nickel-Iron ☐ Platinum ☐ Copper
	– Thermocouple: ☐ J ☐ K ☐ T ☐ R ☐ S ☐ E
	Other ____
6. Input Connection	☐ 1 Element/1 Phase ☐ 1 1/2 Element/3 Phase/3 Wire ☐ 2 Element/3 Phase/3 Wire
	☐ 2 1/2 Element/3 Phase/4 Wire ☐ 3 Element/3 Phase/4 Wire
7. Aux. Power	☐ Internal Power External Power: ☐ Standard 120 Vac ☐ Special ____
8. Output	Unidirectional: ☐ 0-1 mAdc ☐ 1-5 mAdc ☐ 4-20 mAdc ☐ 10-50 mAdc
	Bidirectional: ☐ 0 to ±1 mAdc ☐ 1-3-5 mAdc ☐ 4-12-20 mAdc ☐ 10-30-50 mAdc
	Calibration: ☐ Standard ☐ Special ____

* Calibrated in RMS.

9. Special Options ____

10. Other Requirements ____

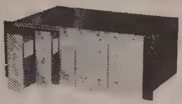
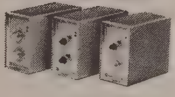
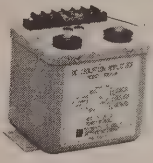
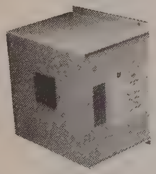
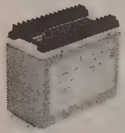
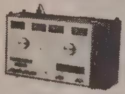
Name Mr./Ms./Mrs. ____ **Title** ____
Company ____
Address ____
City ____ **State** ____ **Zip** ____
Country ____ **Phone** ____ **Fax** ____

FOR TECHNICAL ASSISTANCE CALL 1-800-274-5368 OR FAX FORM TO 614/272-2288.

Esterline SCIENTIFIC COLUMBUS

Scientific Columbus Co.
Instrumentation Group, Esterline Technologies
1900 Arlingate Lane
Columbus, OH 43228
Phone: 614/274-0400
Fax: 614/272-2288

INSTRUMENTATION

PRODUCT		DESCRIPTION
XLP MODULAR PLUG-IN RACK-MOUNT		*XLP modular plug-in transducers are an economical solution where large quantities of transducers are required and space is limited. They are ideal for SCADA systems, generation plants, substations or limited-space industrial environments. Offered in a complete line of functions, XLP modules can contain up to 6 transducers and are available in housings containing 2, 4 or 8 modules.*
SIGNAL CONDITIONERS AND ALARMS		*Scientific Columbus offers a complete line of fully isolated, plug-in signal conditioners and alarms for all process control applications. Models include dc current, dc voltage, dc millivolt, thermocouple, resistance (RTD, slidewire), ac voltage, ac current and frequency, and are available as transmitters, combined transmitters/alarms and alarms.*
DC AMPLIFIERS (Isolated and Non-Isolated)		*Scientific Columbus' Model 6271A DC Voltage Isolation Amplifier amplifies dc shunted millivolt signals or dc voltages ranging from 50 mV to 1000 V, and provides complete isolation of the input signal. Safe for use with shunts operating at high voltage levels above ground. Load resistance variations from 0-10,000Ω have less than 0.1% effect on the output current, making the amplifier ideal for telemetering, scaling, recording applications or matching to tone transmitters or A/D converters. The Model 6181A DC Instrument Amplifier is a non-isolated unit with unmatched stability and provides a direct interface to low level signals.*
DC WATT TRANSDUCER		*The Model 6268 DC Watt Transducer adapts Scientific Columbus' Digilogic transducer design to accept direct currents. Current input can be direct from a 50 mVdc or 100 mVdc external (customer supplied) shunt. The line-to-line voltage connection can be made directly for voltages from 100 Vdc to 600 Vdc. For line-to-line voltages from 600 Vdc to 1800 Vdc, an external multiplier resistance box is supplied.*
DC WATTHOUR METERS		*The Model 6260 DC Watt/Watthour Meter combines the Model 6268 DC Watt Transducer's 0-1 mAdc analog output with an analog-to-pulse converter to provide pulses proportional to dc watthours. The current input can be either 50 mVdc or 100 mVdc from an external (customer supplied) current shunt. Line-to-line voltages may be from 400 Vdc to 1250 Vdc. The dc watthour output is displayed on a 7-digit nonresettable register. An optional Form C relay output is available for remote monitoring of dc watthours. The Model 6406 DC Watthour Meter is an economical, highly accurate meter which accepts 1- or 2-element inputs and has 120 Vdc or 240 Vdc auxiliary power as a standard feature. It provides a readout with nonvolatile memory, and the watthour output is field selectable*
ANALOG-TO-PULSE CONVERTER		*Scientific Columbus high accuracy analog-to-pulse converters are crystal-referenced devices for converting an analog signal into an integrated pulse output. Inputs may be from a watt, var, current, voltage, temperature or other type of transducer for which integrated output information is required. Choose from unidirectional, bidirectional or multichannel (1, 2 or 3) models. The outputs may be either mercury-wetted relay or solid-state, and can be fed to Scientific Columbus registers, pulse recorders or other 2- or 3-wire receiving devices.*
6152/6153 SERIES REGISTERS		*Scientific Columbus registers are designed for use with all Scientific Columbus transducers with pulse outputs, analog-to-pulse converters and can be used as remote registers for JEM® meters. Unidirectional and bidirectional models are available with a choice of 6-digit resettable or 7-digit nonresettable displays.*
TRANSDUCER CALIBRATOR		*Scientific Columbus' digitally programmable multifunction calibrator permits easy field checking and calibration of watt, var, voltage and current transducers. This rugged unit is completely self-contained and mounted in a portable carrying case. It needs no external loads or accessory equipment, and can be easily operated by one person.*
CATALOG/TECHNICAL DATA SHEETS		*Scientific Columbus' complete transducer and instrumentation catalog provides detailed descriptions, specifications, options, operating conditions and wiring diagrams for all four lines of electrical transducers. To receive your copy, call 1-800-274-5368. If you need information on a specific unit only, ask for the applicable technical data sheet.*

FOR TECHNICAL ASSISTANCE CALL **1-800-274-5368**

Esterline SCIENTIFIC COLUMBUS

Scientific Columbus Co.	Instrumentation Group, Esterline Technologies	1900 Arlingate Lane Columbus, OH 43228	Phone: 614/274-0400 Fax: 614/272-2288

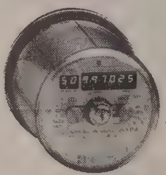
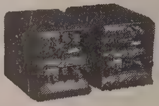
ELECTRONIC ENERGY METERS AND CALIBRATION STANDARDS

Solutions in energy measurement from the leader in technological innovations and field-proven reliability.

Scientific Columbus introduced the first multifunction, electronic energy meter in 1976 with its first JEM® Meter. Since that time, we have installed more electronic multifunction meters and introduced more technological innovations in metering than any other manufacturer. Today, Scientific Columbus offers the industry's broadest product selection with the JEM®1, JEM®2 and JEM®3 Meters.

This broad range of metering products enables Scientific Columbus to recommend an energy measurement solution based on specific customer needs — not the limited capabilities of one meter. Our applications specialists have been extremely successful at helping customers select and configure meters that match their specific energy measurement, communication and budget requirements—without compromise.

Scientific Columbus meters can be configured for revenue, cogeneration, substation or load survey metering. For more information, or technical assistance in determining the best energy measurement solution for your application, call Scientific Columbus at 1-800-274-5368.

PRODUCT		DESCRIPTION	
JEM1 ELECTRONIC ENERGY METER		• Economical solution for measurement of up to 4 different quantities • All solid-state meters • Accuracy to 0.1% of reading • Proven long-term stability • Provides analog outputs (0-1 mA) • Solid-state KYZ outputs	• Electronic registers available • Potential indication on each phase • KVA calculated and displayed • Used for revenue, interchange, power plant and transmission metering
JEM2 ELECTRONIC ENERGY METER		• Time of Use (measures consumptions and demands) • Accuracy to 0.1% of reading • 4-quadrant metering • All data is displayable and stored in nonvolatile memory • Mass memory — 8 data channels • Transformer/line loss compensation • EPROM configurable • Provides remote meter reading	• 10 active registers — with 10 corresponding storage registers • Demand (measures 12 different demand quantities) • Power Factor • Used for larger commercial and industrial sites, cogeneration applications, industrial plant load centers and others
JEM3 ELECTRONIC ENERGY METER		• Most capability of all JEM Meters • Accuracy to 0.1% of reading • Displays per-phase quantities • 100 registers • Measures polyphase, per-phase and demand quantities • 5 communication choices: Optical Port, RS232, 20 mA, Modem and JEMLINK™ • 128K mass memory option	• Fiber optic data communication option • Time of Use option • Programmable multifunction meter that is field-configurable to meet exact requirements for all types of large commercial and industrial metering including revenue, cogeneration, substation and load survey applications
LABORATORY STANDARDS		Scientific Columbus offers a complete line of high-precision electrical measurement laboratory standards for the calibration of electronic energy meters and other measurement devices. Also, peripheral equipment such as the MicroJoule®II digital pulse comparator with RS323 and GPIB interface.	
SC-30 PORTABLE FIELD STANDARD		• The SC-30™ and SC-30CT™ Portable Field Standards provide all the performance and convenience features required for field calibration. • Autoranging voltage, current and auxiliary power • Accuracy better than 0.05% of reading • Backlit, 8-digit display for easy reading in all lighting environments • Display diagnostics immediately indicate hookup errors	

FOR APPLICATION ASSISTANCE OR MORE INFORMATION CALL **1-800-274-5368**

Esterline SCIENTIFIC COLUMBUS

Scientific Columbus Co.
Instrumentation Group, Esterline Technologies
1900 Arlingate Lane
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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	**D•2221**
Batteries, Product Selection Guide	**D•1419**
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	**C•1003**
Capacitors, Product Selection Guide	**A•1003**
Coils, Chokes, Inductors, Product Selection Guide	**A•1179**
Connectors, Terminals & Sockets, Product Selection Guide	**C•1139**
Cores, Magnets & Ferrites	**A•1317**
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**A•1326**
DC-DC Converters	**D•2049**
DC Power Supplies, Product Selection Guide	**D•1488**
Delay Lines, Product Selection Guide	**A•1513**
Discrete Semiconductors, Product Selection Guide	**A•2130**
Displays, Readouts, & CRTs, Product Selection Guide	**B•1017**
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**C•1557**
Fiber Optics, Product Selection Guide	**B•1200**
Filters, Power, Product Selection Guide	**A•1584**
Filters, Signal, Product Selection Guide	**A•1617**
Instruments, Test & Measuring, Product Selection Guide	**D•1215**
Interconnection Systems, Product Selection Guide	**C•1670**
Keyboards & Keypads, Product Selection Guide	**B•1818**
Lamps, Lights, & Indicators, Product Selection Guide	**B•1131**
Microwave Components, Product Selection Guide	**A•1719**
Military Qualified Products List	**B•1002**
Motors, Drives, & Rotating Components, Product Selection Guide	**B•1231**
Oscilloscopes, Product Selection Guide	**D•1402**
Panel Hardware, Product Selection Guide	**C•1522**
Panel Meters, Analog & Digital, Product Selection Guide	**D•1336**
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**A•2053**
Power Supplies, AC, Product Selection Guide	**D•2221**
Power Supplies, DC, Product Selection Guide	**D•1488**
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**B•1341**
Relays, Product Selection Guide	**B•1401**
Resistors, Product Selection Guide	**A•1859**
Solenoids, Product Selection Guide	**B•1626**
Switches, Product Selection Guide	**B•1658**
Thermal Components, Product Selection Guide	**B•1857**
Transducers & Encoders, Product Selection Guide	**B•1911**
Transformers, Product Selection Guide	**A•2229**
Wire & Cable, Product Selection Guide	**C•1701**

Setra Systems, Inc.

Product Line Summary

Gage - Absolute - Vacuum Transducers

Model	Applications	Type of Measurement (Pressure)	Pressure Ranges	Accuracy (RSS Method) ± % FS	Thermal Effect ± % FS/100°F	Media Compatability	Output
204	R & D Laboratories Vacuum Systems Hazardous Environments	Absolute Gage Vacuum	25 to 5000 psia 25 to 10000 psig 0 to 14.7 psiv	0.11	0.4 max Zero 0.3 max Span	Gas or liquid compatible with stainless steel	**204** 0-5 VDC **C-204** 4-20 mA
206/207	Equipment Automation Compressor Control Chillers Paper Converting Hydraulics & Pneumatics	Gage	25 to 5000 psig	0.13	1.0 max Zero 1.5 max Span	Gas or liquid compatible with stainless steel	**206/207** 0.1-5.1 VDC **C-206/C-207** 4-20 mA
208 OEM	Off Road Equipment Hydraulic Systems Compressor Control HVAC/R Equipment Industrial Engines	Gage	50 to 5000 psig Option 30,10000 psig	0.25 Option 0.15	2.0 max Zero 1.5 max Span Option 1.5 max Zero 1.0 max Span	Gas or liquid compatible with stainless steel	1.0-6.0 VDC 4-20 mA Options 0.2-5.2 VDC 0.5-4.5 VDC 1.0-5.0 VDC
280E	Hydraulics & Pneumatics Process Control P/I Range Level Measurement	Absolute Gage Compound P/I	25 to 5000 psia 15 to 10000 psig 3 to 15 psig -14.7 to 35, 50, 100 psig	0.11	0.75 (Typ.) 1.5 (Typ.) 2.0 max Zero 2.0 max Span	Gas or liquid compatible with stainless steel	**280E** 0-5 VDC **C-280E** 4-20 mA
270	Weather Data Systems Laser Interferometers Altimeter Setting Indicators Transfer Pressure Standard	Barometric Gage Absolute	600-1100 mb 800-1100 mb 5 to 100 psig 10 to 100 psia	0.05 Option 0.03	0.1 max Zero (0.2 Barometric) 0.1 max Span	Wet or dry air	0-5 VDC

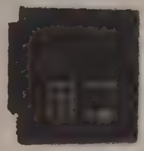
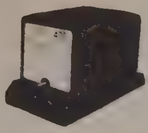
Differential Pressure Transducers

Model	Applications	Type of Measurement (Pressure)	Pressure Ranges	Accuracy (RSS Method) ± % FS	Thermal Effect ± % FS/100°F	Media Compatability	Output
204D	General Purpose Engine Test Cells Hazardous Environments	Differential	25 to 10000 psid ±10 to ±500 psid	0.11	1.0 max Zero 1.0 max Span	Gas or liquid compatible with stainless steel	0-5 VDC Bidirectional ±2.5 VDC
228-1	Process Control Filter Condition Monitoring Refrigeration Equipment Pump Speed Control HVAC Equipment	Differential (can be wet both sides)	1 to 100 psid ±0.5 to ±50 psid	Low Ranges 0.15 High Ranges 0.21	2.0 max Zero 2.0 max Span	Gas or liquid compatible with stainless steel (both pressure & reference sides)	**228-1** 0-5 VDC Bidirectional ±2.5 VDC **C-228-1** 4-20 mA
239	HVAC Control Leak Detection Environmental Testing R & D Scientific Fume Hood Control	Differential	0.5" to 30" WC ±0.25" to ±15" WC 5 to 10 psid ±2.5 to ±5 psid	0.14	1.0 max Zero 1.0 max Span	High Pressure Port Gas compatible with stainless steel & aluminum Low Pressure Port Clean Dry Air	**239** 0-5 VDC Bidirectional ±2.5 VDC **C-239** 4-20 mA
264	HVAC and VAV Control Energy Management Systems Clean Room Control Medical Instrumentation Filter Condition Monitoring	Very low Differential	0.1" to 25" WC ±0.1" to ±5" WC	1.00 Option 0.4	3.3 Zero & Span Combined	Air or Inert gases	**264** 0-5 VDC **C-264** 4-20 mA

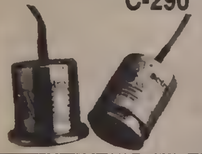
setra

45 Nagog Park, Acton, MA 01720
1-800-257-3872, In MA (508) 263-1400
Telefax: (508) 264-0292

Digital Displays and Systems

Model	Applications	Type of Measurement (Pressure)	Pressure Ranges	Accuracy (RSS Method) ± % FS	Analog Output
300	Panel Mountable Digital Indicators for use with Setra transducers and transmitters	Gage Absolute Differential Barometric Vacuum	All Pressure Ranges (4-1/2 digits)	Transducer Accuracy	0 to 5V or 0 to ±2.5V (from transducer) or 4-20 mA (from transmitter)
304-1/339-1/350-1	Bench Top Digital Pressure - Manometers, R & D Scientific, Temporary Field Pressure - Monitoring, Pressure Transfer Standards	Gage Absolute Differential Barometric Vacuum	5 to 1000 psig 10 to 1000 psia 0.5" to 30" WC ±0.25" to ±15"WC 5 to 100 psid ±2.5 to ±100 psid 600-1100 mbar 800-1100 mbar 0-14.7 psiv	±0.11 (304-1) ±0.14 (339-1) ±0.05 (350-1)	0 to 5V or 0 to ±2.5V 6 to 11V (baro) 8 to 11V (baro) (from transducer)
 **370**	Barometric Pressure Monitoring Altimeter Calibration Pressure Switch Setting Laser Interferometers Min/Max Tracking Hi/Lo Alarming Pressure Transfer Standard	Absolute Barometric	600-1100 mbar 800-1100 mbar 0 to 100 psia	±0.02	EIA-232
 **470**	Automatic Weather Reporting Systems, Barometric Pressure Compensation, High Accuracy Altimeter Altimeter Calibration Weather Data Buoy Pressure Transfer Standard	Absolute Barometric	600-1100 mbar 800-1100 mbar 10 to 100 psia	±0.02	EIA-232

Specialty Application Products

Model	Applications	Type of Measurement (Pressure)	Pressure Ranges	Accuracy (RSS Method) ± % FS	Thermal Effect ± % FS/100°F	Media Compatability	Output
212/212FT	Specialty Gas Handling Systems Semiconductor Process Gas Bottle Filling Equipment Pharmaceutical & Biotechnology HPLC (High Pressure Liquid Chromatography)	Gage Compound Absolute (M-212 only)	100 to 3000 psig -14.7 to 3000 psig 100 to 3000 psia (M-212 only)	0.14 (M-212FT) 0.22 (M-212)	1.5 max Zero 1.0 max Span	Corrosive liquids or gases (Ultra-High Purity Gas & Liquid Compatible)	**212/212FT** 0.2-5.2 VDC **C212/C212FT** 4-20 mA
280E - XP FM Approved	Explosionproof/Weatherproof Process Instrument Signals Natural Gas Lines Chemical Processing Off-Shore Drilling	Gage Absolute Compound P/I	15 to 10000 psig 25 to 5000 psia -14.7 to 100 psig 3 to 15 psig	0.11	0.75 Zero (Typ.) 1.5 Span (Typ.) 2.0 max Zero 2.0 max Span	Gas or liquid compatible with stainless steel	**280E** 0-5 VDC **C-280E** 4-20 mA
C-290 	Sanitary Pressure Lines Food & Beverage Processing Tank Level Measurement Pharmaceutical Processing Sanitary Filtration Systems	Gage	1 to 1000 psig	0.20	2.0 max Zero 2.0 max Span	Gas or liquid compatible with stainless steel	4-20 mA
141	Transportation Equipment Position Sensing Robotics Shock & Vibration Testing	G Ranges (Full Scale Ranges ±G)	DC to ±2, ±4, ±8, ±15, ±30, ±60, ±150, ±600g	1.00	2.0 max Zero 2.0 max Span	N/A	**141A** ±500 millivolts (nominal) **141B** ±1000 millivolts (nominal)

setra 1-800-257-3872

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Spectrol®

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Swindon Wiltshire SN3 3HY England
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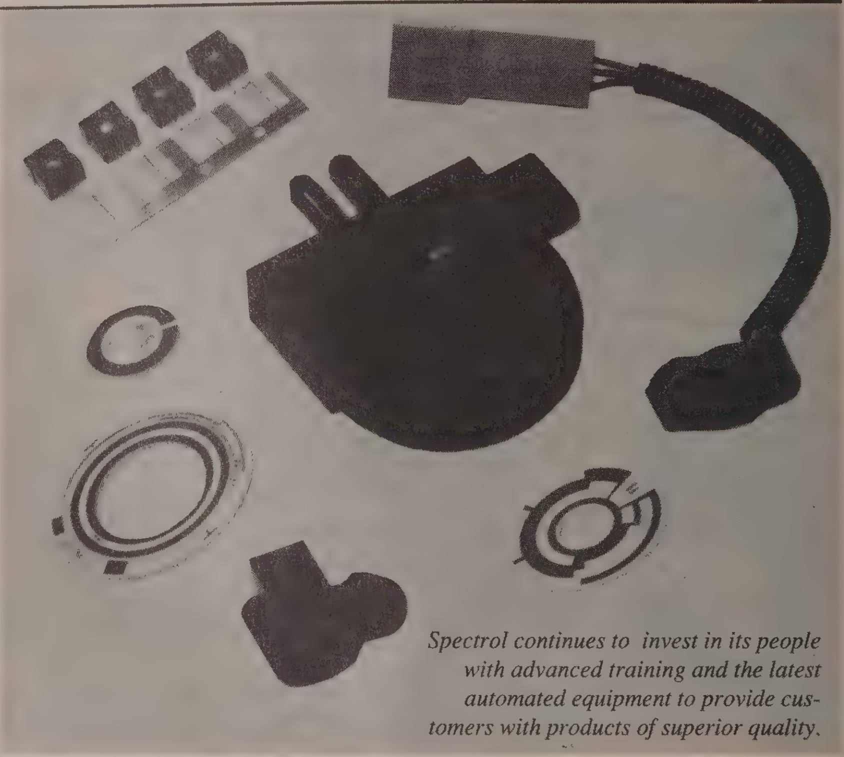
Fax: 011-44-793-539-255

Sense of Commitment

World Class Manufacturing

Spectrol's modern automated facilities in North America and Europe employ the latest total quality management (TQM) techniques to produce millions of sensors annually.

Statistical Process Control, continuous improvement, just-in-time delivery and flexible manufacturing are all utilized by Spectrol. Among the many supplier and quality awards received by Spectrol is the prestigious Q1 Quality Award presented by Ford Motor Company. For tight process control and to ensure outstanding quality at low cost, Spectrol is a vertically integrated company within its core technologies. Spectrol, for example, produces its own resistive inks and lubricants.

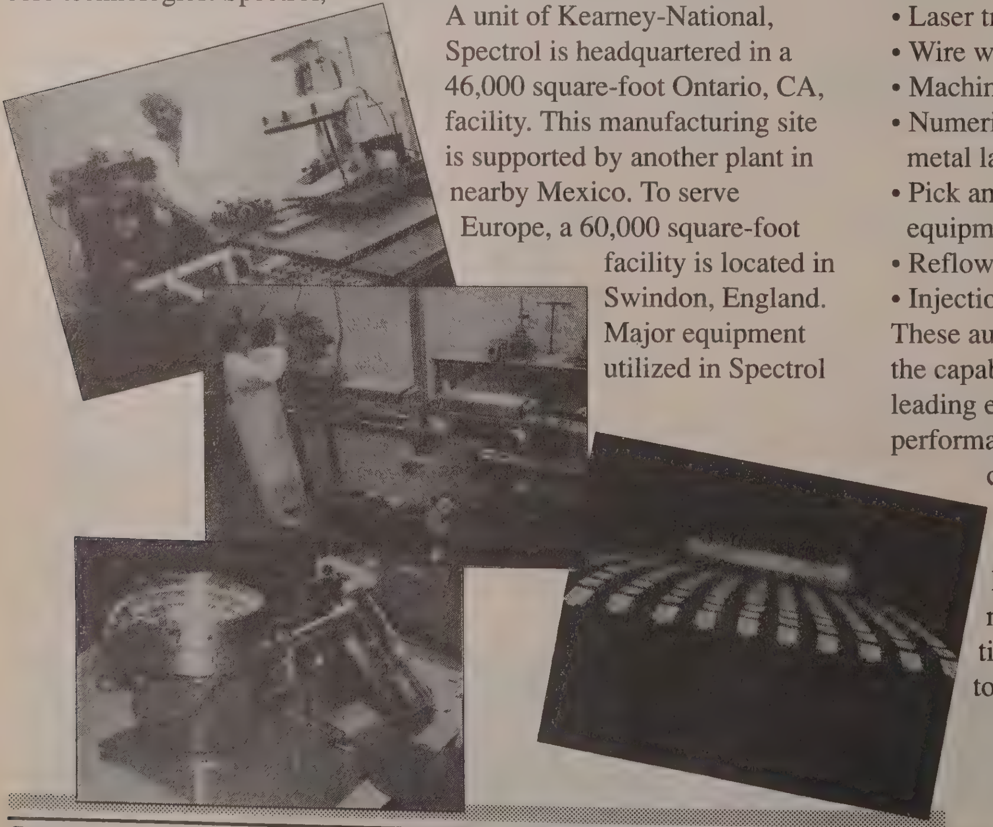


Spectrol continues to invest in its people with advanced training and the latest automated equipment to provide customers with products of superior quality.

A unit of Kearney-National, Spectrol is headquartered in a 46,000 square-foot Ontario, CA, facility. This manufacturing site is supported by another plant in nearby Mexico. To serve Europe, a 60,000 square-foot facility is located in Swindon, England. Major equipment utilized in Spectrol plants includes:

- Thick film screen printers
- Laser trimmers
- Wire winding machines
- Machine vision inspection
- Numerical control precision metal lathes
- Pick and place assembly equipment
- Reflow solder ovens
- Injection mold machines

These automated processes have the capability to produce both leading edge one-of-a-kind high performance sensors and commercial grade sensors by the million. Let the manufacturing know-how at Spectrol make your next generation sensor a reality today.



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Spectrol®

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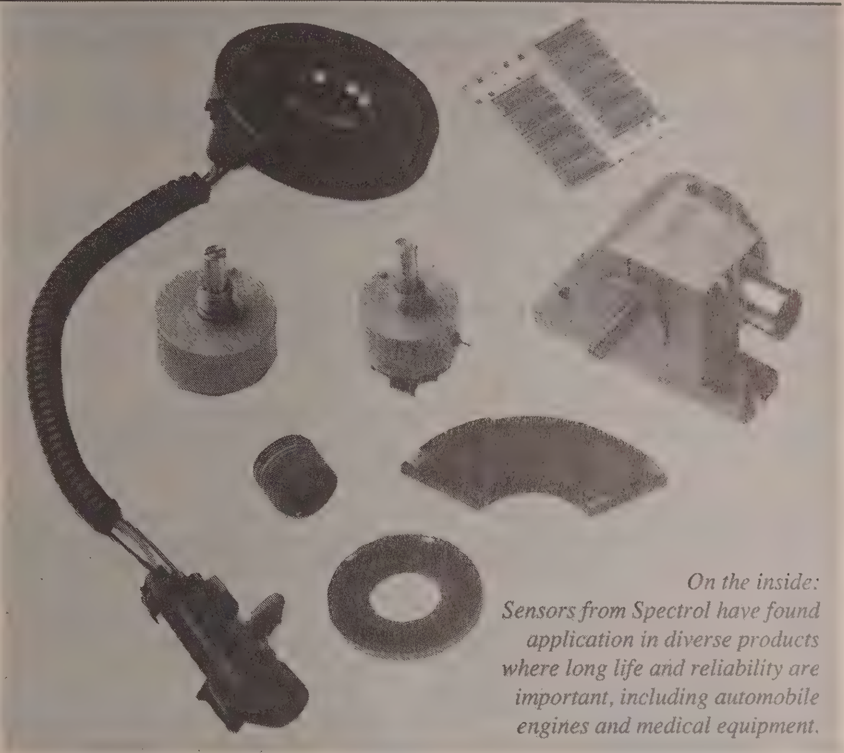
Sense of Purpose

Serving Our Customers

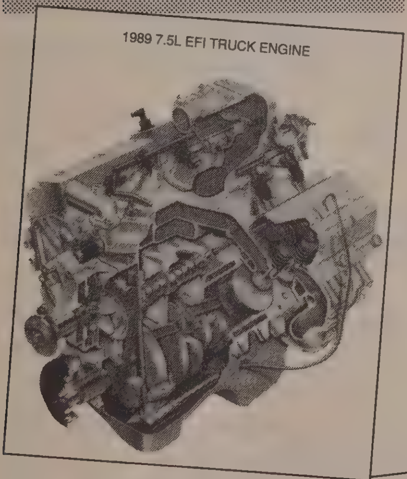
Sensors have become a critical design element in many of today's newest products featuring sophisticated electronics. They often play a key role in enhancing product performance, reliability and life.

At Spectrol, the importance of achieving a competitive advantage with electronic sensors is well understood. We've evolved as a leading edge sensor partner with diverse customers over the last four decades.

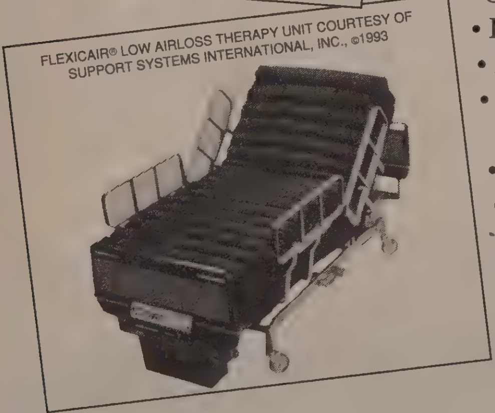
Accuracy, linearity, vibration, humidity, temperature, life and reliability are all essential design considerations in which Spectrol excels. Our objective is to help customers meet their design requirements with sensors of the highest value at the lowest installed cost.



On the inside:
Sensors from Spectrol have found application in diverse products where long life and reliability are important, including automobile engines and medical equipment.



1989 7.5L EFI TRUCK ENGINE



FLEXICAIR® LOW AIRLOSS THERAPY UNIT COURTESY OF SUPPORT SYSTEMS INTERNATIONAL, INC., ©1993

With design and manufacturing expertise in precision analog resistive and encoder position sensors, as well as custom packaging capabilities, Spectrol has made significant contributions to products such as:

- Automobiles
- Offroad vehicles
- Industrial Equipment
- Aircraft and spacecraft
- Automated assembly equipment
- Robotics
- Medical equipment
- Appliances

Spectrol is adept at assessing customer requirements and responding rapidly with its resistive sensor assemblies, potentiometers and encoders from concept to design to prototype to manufacture. Examples of sensors and controls now in production include applications for:

- Exhaust gas circulation
- Throttle position
- Transmission gear position
- Fuel level measurement
- Hydraulics
- Navigation and guidance
- X-Y positioning
- Temperature control
- Instrumentation

We're ready with both custom sensor design capabilities and standard design solutions to meet your needs. Whether you require one or a million sensors, let Spectrol put its creative talents to work for you.

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

ABNT **Brazil (ABNT)** Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

TGL **Germany, Democratic Republic of (East) (ASMW)** Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

ELOT **Greece (ELOT)** The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

SII **Indonesia** Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

SII **Israel (SII)** Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

STAS **Romania** Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

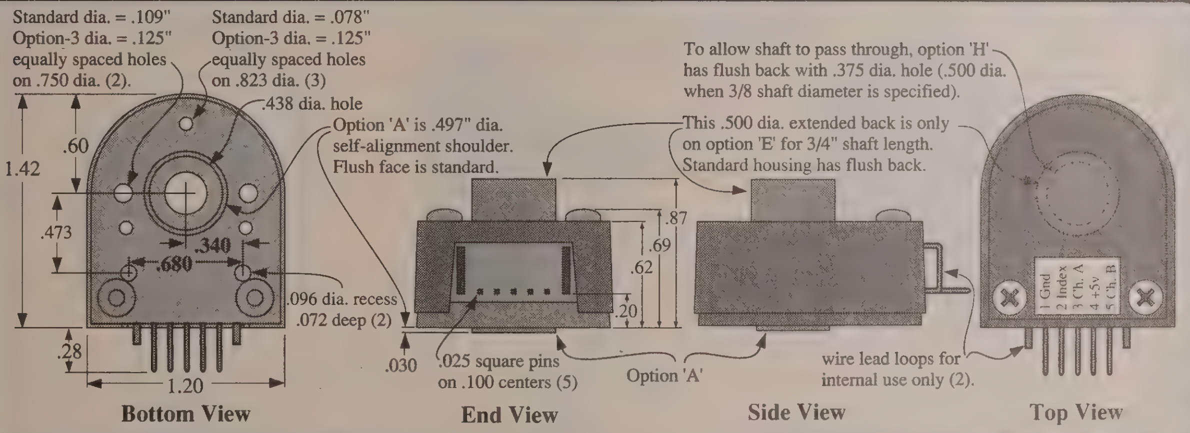
US DIGITAL

E2 Quick Assembly Optical Encoder

The E2 optical incremental shaft encoder is a noncontacting rotory to digital position feedback device designed to easily mount to an existing shaft. The internal monolithic module converts realtime shaft angle, speed and direction into TTL-compatible outputs. Simplicity and low cost make the E2 ideal for both high and low volume motion control applications.

Features

- Quick and simple assembly
- Rugged screw-together housing
- Low cost
- Small size
- 96 to 1024 cycles/rev.
- 384 to 4096 codes/rev.
- 0 to 35000 RPM
- Tracks from 0 to 100,000 cycles/sec
- 2-channel quadrature TTL squarewave outputs
- 3rd channel **index** option
- -40 to +100°C operating temperature
- Accepts ±.010" axial shaft play
- Compatible with HP HEDS-5500
- Fits .750", .823" or 1.812" bolt circles
- Fits 12 shaft diameters (2mm to 3/8")
- Single +5v supply @ 17ma typical, 40ma max.
- **RS-422** differential driver option available
- Flush back, through shaft hole, or extended back
- Flat or self-aligning base
- Custom mounting adapters available
- Special resolutions & diameters available


Standard dia. = .109"
Option-3 dia. = .125"
equally spaced holes
on .750 dia. (2).
Standard dia. = .078"
Option-3 dia. = .125"
equally spaced holes
on .823 dia. (3)
.438 dia. hole
Option 'A' is .497" dia.
self-alignment shoulder.
Flush face is standard.
1.42
.60
.473
.340
.680
.096 dia. recess
.072 deep (2)
.28
1.20
.030
.025 square pins
on .100 centers (5)
.87
.69
.62
.20
Option 'A'
To allow shaft to pass through, option 'H'
has flush back with .375 dia. hole (.500 dia.
when 3/8 shaft diameter is specified).
This .500 dia. extended back is only
on option 'E' for 3/4" shaft length.
Standard housing has flush back.
wire lead loops for
internal use only (2).
1 Gnd
2 Index
3 Ch. A
4 +5v
5 Ch. B
Bottom View
End View
Side View
Top View

Ordering Information

Part Number

E2–☐–☐–☐

Resolution Cycles/Rev.

96	400
100	500
200	512
250	540
256	1000
360	1024

Shaft Diameter in thousandths of an inch

Code	Size
079	2mm
118	3mm
125	1/8"
156	5/32"
157	4mm
187	3/16"
197	5mm
237	6mm
250	1/4"
312	5/16"
315	8mm
375	3/8"

Options

I = index (3rd-channel)
A adds self-alignings houlder to base.
H adds hole in housing to allow the shaft to pass through.
E adds an extension to the housing back to allow for a longer shaft.
3 changes the diameter of all five base mounting holes to .125".

Use our E3 series for larger shaft diameters.

Pricing

$14.00/20,000's
$15.00/10,000's
$16.00/5,000's
$17.00/1,000's
$18.00/500's
$20.00/100's
$22.00/50's
$25.00/10's
$29.00/1's
Add 10% for index or resolutions =>1000 CPR.

- 2 year warranty.
- Next day shipment.
- No minimum

(206) 260-7451 **(800) 736-0194** **Fax (206) 260-7452**

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US DIGITAL

S1 & S2 Series Softpot Optical Shaft Encoder

The Softpot optical shaft encoder is a noncontacting rotory to digital converter. Useful for position feedback or manual interface, the Softpot converts realtime shaft angle, speed and direction into TTL-compatible outputs. It is a practical solution to the wear, contact bounce and digit bobble problems associated with pots and A/D converters.

The Softpot utilizes an unbreakable disk, metal shaft and bushing, LED light source, monolithic electronics and operates from a single +5 volt supply.

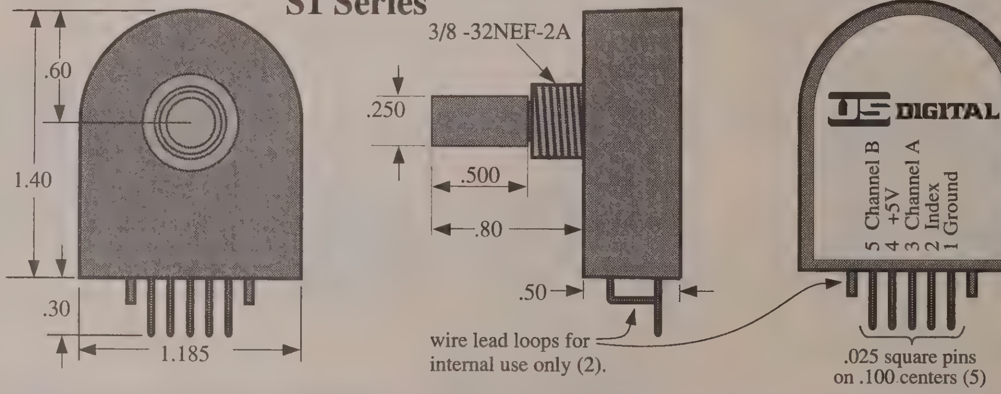
Available with ball bearings for motion control applications or torque-loaded to feel like a potentiometer for front-panel manual interface.

Features
- Small size
- Low cost
- 2-channel quadrature, TTL squarewave outputs
- 3rd channel **index** option
- Tracks from 0 to 100,000 cycles/sec
- Ball bearing option tracks to 10,000 RPM
- -40 to +100°C operating temperature
- Single +5v supply @ 17ma typical, 40ma max.

S1 Series
- 96 to 1024 cycles/rev.
- 384 to 4096 codes/rev.

S2 Series (2.2" diameter package)
- 1000 to 2048 cycles/rev., 4000 to 8192 codes/rev.

S1 Series



Ordering Information

Part Number

S1 – ☐ – ☐

Resolution Cycles/Rev.

96	400
100	500
200	512
250	540
256	1000
360	1024

Options
I = Index (3-channel)
B = Ball Bearings
NT = No added Torque

S2 Series **Resolution** Cycles/Rev.
1000
1024
2000
2048

S1 Pricing
$17.00 / 20,000's
$19.00 / 10,000's
$21.00 / 5,000's
$23.00 / 1,000's
$25.00 / 500's
$27.00 / 100's
$30.00 / 50's
$33.00 / 10's
$39.00 / 1's

Sales Policy
- 2 year warranty
- Next day shipment is normal.
- We have no minimum orders.
- Scheduled shipments are ok.
- We can build to your specification.
- Engineering orders (including special shafts) normally **ship within 24 hours**.

Add $7.00 for ball bearing option.
On S1 Series, add 10% for index or resolutions =>1000 CPR.
On S2 Series, add $1.00 and 10% for index or resolutions =>2000 CPR

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US DIGITAL

Absolute Encoder & Custom Disks

Smart Absolute Encoder

- True absolute encoder reports position even after power-off position change.
- $80 to $200 price range.
- Operates from -25 to +85°C.
- Programmable single turn resolution from 2 to 65536 CPR with 12-bit linearity.
- Programmable zero position.
- Multiple versions:
  - Sleeve bushing
  - Ball bearing
  - Quick assembly kit
  - Digital absolute inclinometer
- 12-bit analog output option.
- Parallel output option.
- Simple RJ11-6 cable adapter plugs into IBM PC compatible RS-232 port.
- RS-485 serial multi-drop cable connects 1 to 15 encoders.
- Cable length up to 1000 feet.
- Ready-to-go IBM PC software with source code in assembly and C languages.
- Operates from 5.5 to 20 volts at <15mA.
- Sleep mode for battery operation <.5mA.
- Accepts ±.025" radial or axial shaft misalignment.
- IBM PC daughter boards available.
- Special versions available

Custom Encoder Disks

U.S. Digital has been designing and manufacturing our own optical encoder disks in-house for years.

We can design and manufacture to your spec:
- Any pattern (incremental, absolute or other).
- Any number of tracks.
- Any inside hole diameter.
- Any outside diameter.
- Any resolution up to 400 line pairs per linear inch (up to 1200 CPR for a 1" diameter disk) proportionally higher for larger diameters.
- Any quantity, small or large.
- Typical lead time is 1 to 2 weeks.
- Typical NRE charge is $250.
- Typical unit cost is well under $1.00.

We can also manufacture and assemble the hub built to your spec.

Our disks are made from 7-mil mylar film which is unbreakable, can be is easily handled and cleaned without damage, is stable over temperature (-60°C to 110°C), is machinable and low cost.

We will help you with the details and quote price and lead time.

New Product Updates

Call or fax us to receive new product updates on absolute, variable resolution, multi-index, inclinometer, brushless motor feedback components, and heavy duty encoder products.

No lead time!

We can normally ship orders for our standard encoder products from stock, usually on the same day.

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US DIGITAL

T2 Tilt sensor Incremental Inclinometer

The T2 inclinometer is a low cost digital tilt transducer used to report the angle of an object with respect to gravity.

Optical shaft encoder technology provides unlimited range and virtually eliminates linearity errors.

Internally, an optical encoder disk is suspended between two micro-ball bearings. A weight placed on one side of the wheel assembly causes it to follow the source of gravity.

A beam of collimated light generated by a lensed LED projects the codewheel image onto an array of photodiode detectors on a monolithic chip. As the housing moves relative to the codewheel, the moving image of radial lines is converted to realtime TTL outputs.

Features

- Low cost
- Fast response
- Rugged and simple
- 2-channel quadrature outputs
- 3rd channel index option
- TTL compatible
- -40 to +100°C operating temperature
- Single +5v supply
- 360 degree range
- 1440 codes/rev. = 0.25° resolution
- 3600 codes/rev. = 0.1° resolution
- 7200 codes/rev. = 0.05° resolution
- 2 year warranty

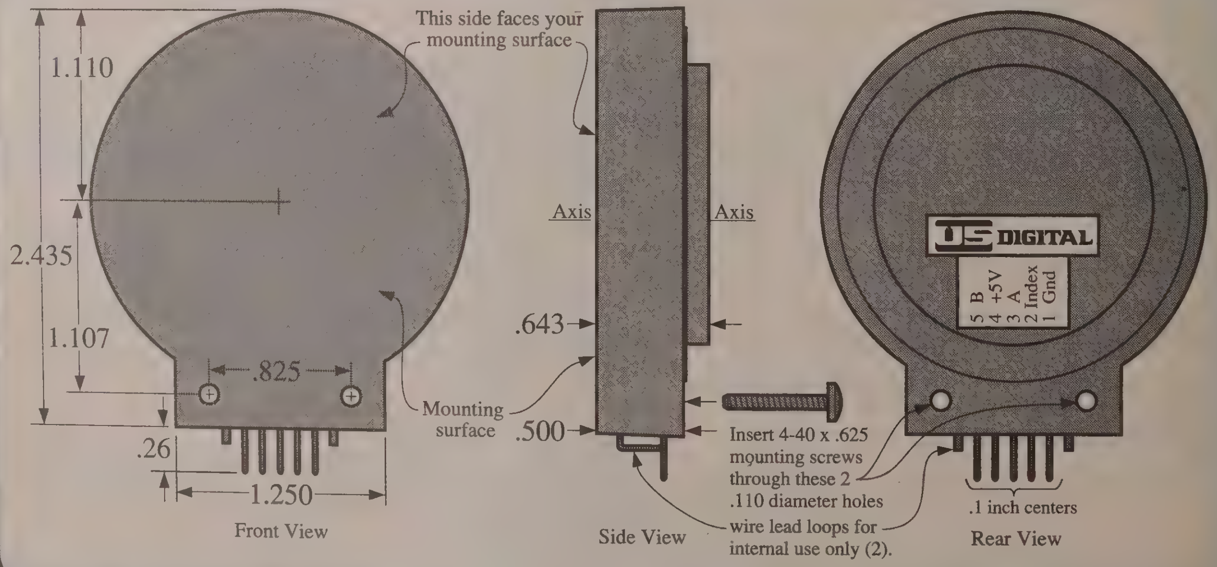
Damping:
Internal magnetic damping is a balance between response time and ringing. The standard damping will fit many applications. Typical settling time for standard damping appears to be less than 200 milli-seconds. Double damping slows the settling time by several hundred milli-seconds, not by ringing, but by more slowly approaching the final position. Some applications may not require any damping, such as motion detectors. Others may require double damping to average out cyclic motion such as found in moving vehicles. Damping options can be specified when ordering.

Index:
The optional index can serve as an absolute reference to reset an external counter. For standard orientation, the index will go high when the connector pins point toward gravity. Other orientations can be specified.

Digital displays:
Several digital counters with LCD displays are available which will connect directly to these inclinometers. Check with us about models, price and availability.

Absolute Inclinometer:
Ask about our true absolute digital inclinometer.

Price	Cost Modifiers
$41.00 / 100's	Add $4.00 for 7200 codes/rev. or index.
$44.00 / 50's	Deduct $4.00 for no damping (N-option).
$48.00 / 10's	Add $4.00 for double damping (D-option).
$55.00 / 1's	Add $2.00 for transfer adhesive (T-option).


1.110
2.435
1.107
.825
.26
1.250
Front View
This side faces your mounting surface
Axis
Axis
.643
Mounting surface
.500
Side View
Insert 4-40 x .625 mounting screws through these 2 .110 diameter holes
wire lead loops for internal use only (2).
US DIGITAL
5 B
4 +5V
3 A
2 Index
1 Gnd
.1 inch centers
Rear View

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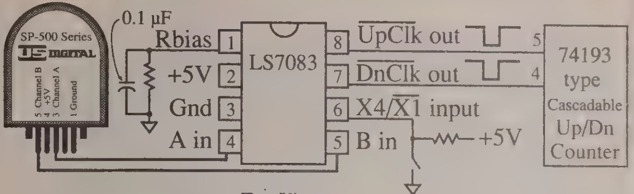
US DIGITAL

Encoder Interface Chips

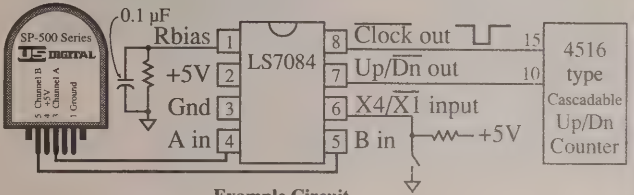
Encoder to Counter Interface Chips: LS7083 & LS7084

Features:
- Provides 1 or 4 clocks per cycle
- TTL and CMOS compatible
- Low power (micro-amps)
- 8-pin DIP package
- Surface Mount Available
- No external clocks required
- Drive standard Up/Dn counters
- Monolithic CMOS

Price:
$1.02/10k
$1.20/5K
$1.40/1K
$1.65/500
$1.95/100
$2.45/25-99
$3.05/1-24


SP-500 Series
US DIGITAL
5 Channel B
4 +5V
3 Channel A
1 Ground
0.1 µF
Rbias 1
+5V 2
Gnd 3
A in 4
LS7083
8 UpClk out
7 DnClk out
6 X4/X1 input
5 B in
+5V
5
4
74193 type Cascadable Up/Dn Counter

Top View


SP-500 Series
US DIGITAL
5 Channel B
4 +5V
3 Channel A
1 Ground
0.1 µF
Rbias 1
+5V 2
Gnd 3
A in 4
LS7084
8 Clock out
7 Up/Dn out
6 X4/X1 input
5 B in
+5V
15
10
4516 type Cascadable Up/Dn Counter

Example Circuit

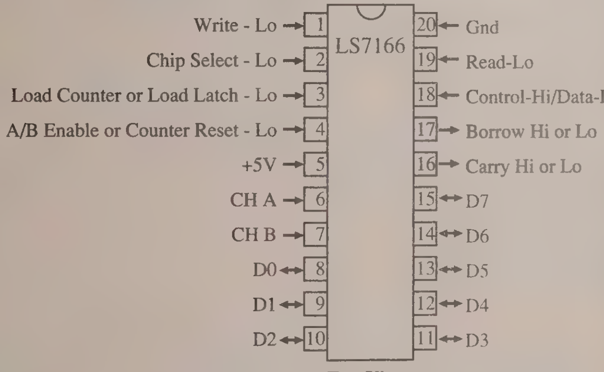
Description:
These devices allow incremental shaft encoders to drive standard up/down counters. Connect the encoder quadrature outputs to the A & B inputs. The LS7083 outputs can connect directly to the up and down clock inputs of counters such as 74193 or 40193. The LS7084 outputs can connect directly to the Clock and Up/Dn inputs of counters such as 4516 or 74169.

Now the 14-pin LS7082 is also available from stock which provides 1, 2 or 4 clocks per cycle and simultaneous UpClock, DnClock, Direction and Index outputs.

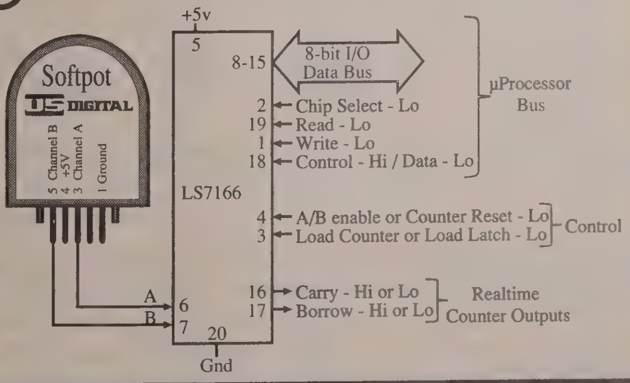
Encoder to Microprocessor Interface Chip: LS7166

Features:
- Preloadable 24-bit Up/Down Counter
- 20 pin DIP or Surface Mount Package
- 1, 2 or 4 counts per cycle
- Binary or BCD
- 24-Bit Comparitor Register
- 4 Control Registers
- Readable Status Register
- 8-Bit Tri-state I/O Bus
- DC to 10 MHz
- Latched Counter Outputs
- TTL & CMOS Compatible
- 5 Volt Operation
- 200 Micro-amp Supply Current
- No External Clock Required

Price:
$3.90/10K
$4.59/5K
$5.40/1K
$6.35/500
$7.45/100
$9.35/25-99
$11.65/1-24


LS7166
Write - Lo 1
Chip Select - Lo 2
Load Counter or Load Latch - Lo 3
A/B Enable or Counter Reset - Lo 4
+5V 5
CH A 6
CH B 7
D0 8
D1 9
D2 10
20 Gnd
19 Read-Lo
18 Control-Hi/Data-Lo
17 Borrow Hi or Lo
16 Carry Hi or Lo
15 D7
14 D6
13 D5
12 D4
11 D3

Top View


Softpot
US DIGITAL
5 Channel B
4 +5V
3 Channel A
1 Ground
+5v
5
8-15
8-bit I/O Data Bus
µProcessor Bus
2 Chip Select - Lo
19 Read - Lo
1 Write - Lo
18 Control - Hi / Data - Lo
LS7166
4 A/B enable or Counter Reset - Lo
3 Load Counter or Load Latch - Lo
Control
16 Carry - Hi or Lo
17 Borrow - Hi or Lo
Realtime Counter Outputs
A
B
6
7
20
Gnd

Description
The LS7166 is an LSI monolithic CMOS building block useful in motion control applications. The 24-bit multi-mode counter, registers and logic enable a microprocessor to track the speed, direction and position of an optical incremental shaft encoder. In addition to an 8-bit data bus, programmable realtime inputs and outputs are provided for hardware based control functions and status indication.

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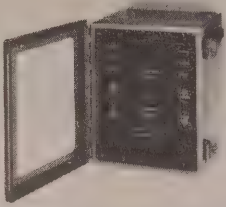
Vibra• Metrics INC.

FAX 203-288-4937

VIBRA • METRICS • 1014 SHERMAN AVENUE, HAMDEN, CT 06514 • (203) 288-6158 • **1-800-U-SENS-IT**

MACHINERY VIBRATION MONITORS



- **Monitoring Level:** 0-1 ips RMS
- **Frequency Range:** 5-3,000 Hz (3db)
- **Colored LED's:** Alert—Amber, Danger—Flashing Red, Channel Status—Green to Red—Auto Guard Transducer malfunction
- **Trip Accuracy:** 5% of setting
- **Two Trip Levels:** Alert, Danger; adjustable front panel set pots
- **Internally Adjustable Trip Delays:** 1-10 seconds—Factory set 8 secs.
- **Trip Level Calibration/Check via Level Meter**
- **Reset Button** (remote contacts available)
- **Digital RMS Velocity Level Indicating Meter**
- **Channel Selector Switch** for Level meter, Calibration & Velocity AC Output
- **115VAC Input Power (220V option)**
- **Fail-Safe Power Loss Protection** (disables Shutdown Relay)
- **Optional Filters:** Low, High or Band Pass
- **Inputs for (1-6) Accelerometer Signals;** rear panel BNC jacks
- **Outputs:** A. AC Signal: 5VAC/ips (peak) BNC jacks (rear), (1) BNC jack (front) B. DC signal: 4VDC/ips RMS (1-6) BNC jacks (rear) C. Two DP/DT relays per channel—3 amps D. Remote Reset (option)

M8D DIGITAL VIBRATION METER
[Battery Operated]

Metric scale optional

Functions: Velocity, Acceleration and displacement.

Ranges [Decade]: Velocity-Full scale .02 to 200 in/sec (PK)
Acceleration .002 to 20 g
Displacement to 2000 mils (PP)

Output: 2 Volts (Full scale) AC/DC Recorder option

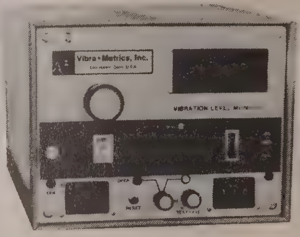
Frequency Range [3db]:
Accel. 2HZ - 15KHZ
Vel. 5HZ - 3KHZ
Disp. 5HZ - 1KHZ

Accelerometer Power: 2 ma, 15 Volts (DC) from input connector

Filters [Front Panel Selectable]: Plug in optional High pass, low pass or band pass

Accelerometer: 7 - 14 mv/g
70-140 mv/g

M9D VIBRATION METER/MONITOR



Specifications same as M-8D with the following additions

Accelerometer: 100 mv/g

Trip Alarms: One or two

Set Points: Digital 0-200% of Full scale selected.

Outputs: Relay contacts
NO/NC BCD (Option)
2 Volts (Full scale)
DC Recorder option

VM-350 PREDICTIVE MAINTENANCE VIBRATION METER

An accurate solid-state instrument for use in predictive maintenance and quality assurance

Velocity Ranges: 0.1 to 30 (I.P.S.)

Frequency Range: 3HZ-5 KHz

Input: Low impedance accelerometer included in vibration probe (VP 300) or individual sensor

Power: Battery

Size: 7" long x 2½" deep x 4" wide

SEISMIC VIBRATION METER SYSTEM

Consists of **M8DSP** Meter and 1030 Seismic Accelerometer

Most Sensitive Full Scale Range:
20 Micro g
200 Micro in/sec
20 Micro in (PP)

VIBRAMITE ACCELEROMETER WITH "BUILT-IN" ELECTRONICS

	MICROMITE	MINIATURE	TRIAXIAL	GENERAL PURPOSE	HIGH OUTPUT	INDUSTRIAL	5 VOLTS
LOW IMPEDANCE SPECIAL "OEM" DESIGNS							
	0.7 GRAM	1.8 GRAM	10 GRAM			RUGGED	SEISMIC
MODEL	9001	1000/1001	3000	1018/1019	1020/1021	6022	1030
Sensitivity mv/g	7	10	10	10	100	100	5 Volt
Frequency Range [±5%]	5-10K	3-10K	3-10K	3-10K	2-10K	3-5K	.01-200
Noise g(rms)	.004	.0015	.0015	.0015	.00015	.00015	5X 10-6
Iso Shield	NO	YES/NO	YES	YES/NO	YES/NO	YES	YES
Pre-filter Option	NO	NO	NO	NO	YES	YES	YES
Temperature [F]	250	250	250	250	250	250	250
Weight [gms]	0.7	2/1.8	10	15	50	60	485
Dimensions [in]	.25 H x .25D	.4H x .25D	.75H X .5D	.75H x .5D	1.2H x .75D	.2H x .8D	2.5H X 2.5D

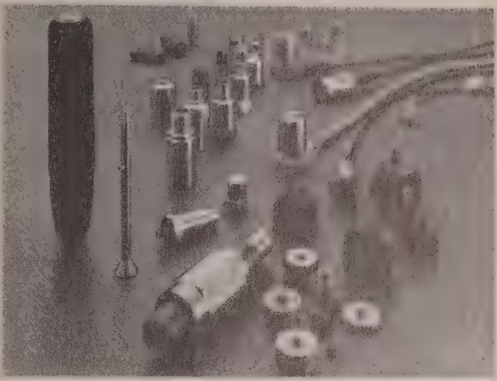
MORE THAN 30 MODELS AVAILABLE FROM STOCK. MODELS MEETING API 678 SPECIFICATIONS NOW AVAILABLE!

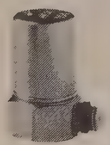
WR WILCOXON RESEARCH

PIEZOELECTRIC ACCELEROMETERS

Wilcoxon Research Accelerometers Offer You:

- High fidelity signals from internal Piezofet® amplifiers
- High output, low impedance circuits capable of driving long cables
- Rugged, hermetically sealed stainless steel housings available
- Base strain isolation and low thermal sensitivity
- Protection against mispowering, overloads & static discharge
- Wide dynamic ranges
- FMRC (Factory Mutual) & CSA approved for intrinsic safety
- Complete line of vibration sensors, instruments and accessories



Just a few of over 300 models available from Wilcoxon Research							
SPECIAL FEATURES	Miniature Triaxial	Low Mass High Sensitivity	Rugged Industrial	Industrial Low Frequency	Rugged Velocity Output	Industrial Triaxial	Handheld Probe
Model	**733**	**736**	**793**	**793L**	**793V**	**993A**	**HA8**
Sensitivity, mV/g	10	100	100	500	100 mV/in/sec	100	100
Frequency Range, Hz	2 - 4,000	4 - 20,000	2 - 9,000	0.4- 1,000	2.5 - 3,500	2 - 2,000	2 - 500
Ground Isolation	yes	no	yes	yes	yes	yes	yes
Temperature Limit, °C	120	120	120	120	120	120	NA
Weight, grams	24	13	110	135	140	90	150
Dimensions, inches(H x D)	0.75 x 1.35	0.9 x 0.5	2.4 x 1.0	2.4 x 1.0	2.4 x 1.0	1.3 x 2.0	6.5 L x 1.3 D

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SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol $^{-1}$	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	second^{-1}	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

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MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

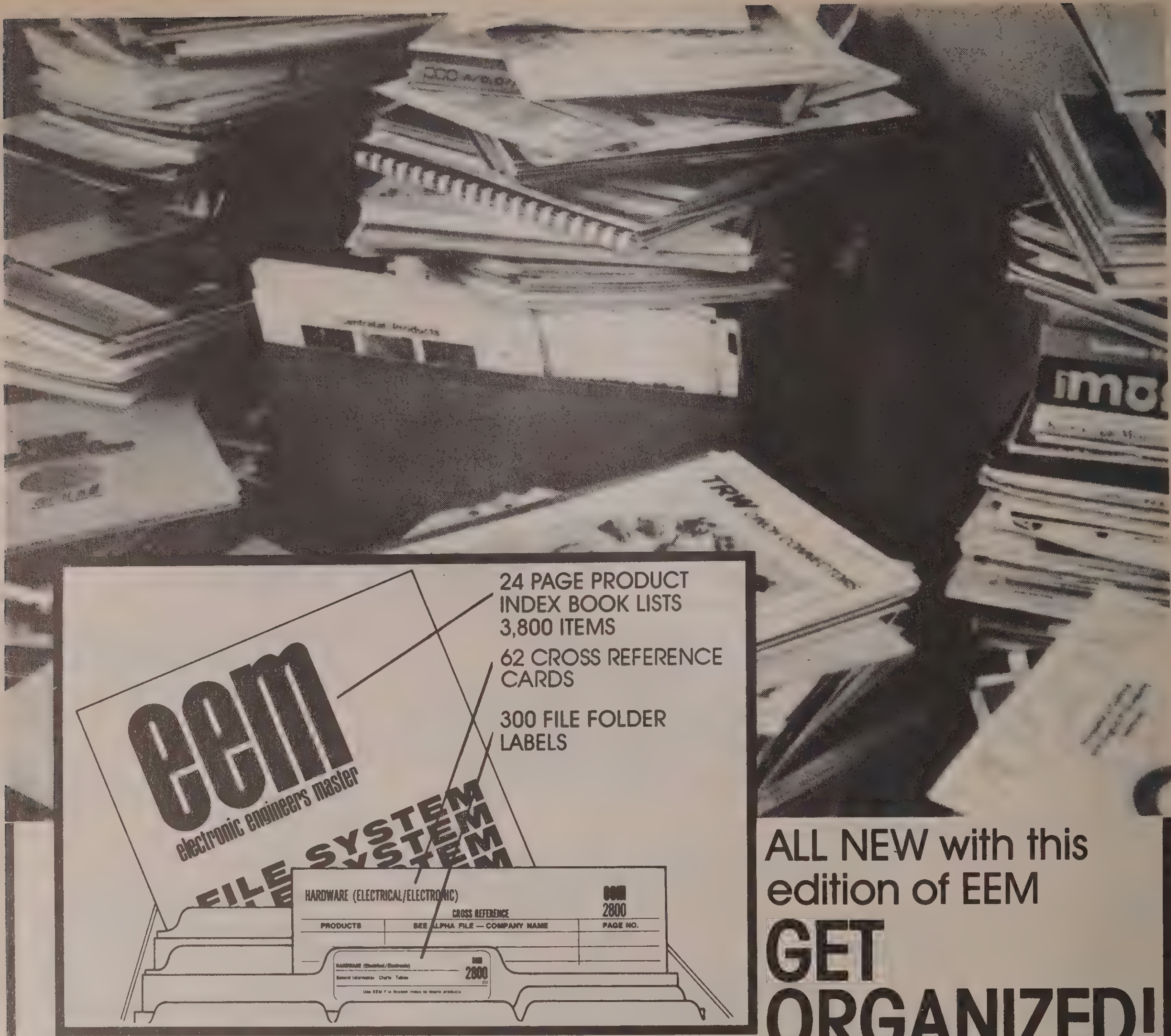
Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.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Capacitors, Product Selection Guide	**A•1003**
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Connectors, Terminals & Sockets, Product Selection Guide	**C•1139**
Cores, Magnets & Ferrites	**A•1317**
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**A•1326**
DC-DC Converters	**D•2049**
DC Power Supplies, Product Selection Guide	**D•1488**
Delay Lines, Product Selection Guide	**A•1513**
Discrete Semiconductors, Product Selection Guide	**A•2130**
Displays, Readouts, & CRTs, Product Selection Guide	**B•1017**
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Filters, Signal, Product Selection Guide	**A•1617**
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